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THE ROLE OF ORGANIC FARMING FOR THE DEVELOPMENT OF AGRICULTURAL SECTOR IN BULGARIA

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Abstract

Organic farming is a multifunctional set of activities that integrates economic and social issues with those related to environmental protection and is a suitable alternative for producers, processors and traders, helping to make the best decision for the organization, management and development of their farms. This production method contains both its organizational and economic features and all the characteristics of agriculture. The goal of the present scientific paper is to analyse and evaluate the important role of organic farming for the agricultural sector development in Bulgaria. The study is based on directly collected empirical information from 73 organic farms operating on the territory of Plovdiv District in Bulgaria. Our research reveals prerequisites, opportunities, strategic guidelines and recommendations for increasing the economic efficiency of the organic production, and country's agriculture respectively for the next Programming Period 2021-2027. After overcoming the organizational and economic problems that accompany it, we believe that organic farming is substantial practical way and sustainable approach to the future progress of contemporary agriculture in Bulgaria.

Key words**:** *organic farming, strategies, development, agricultural sector*

INTRODUCTION

Agriculture today is finding itself in increasing difficulties. It is being assailed on so many sides that it hardly knows which way to turn. There is one solution that cuts a totally different path. It addresses all the problems currently facing agriculture, and so far, it is performing well. It is organic agriculture [3].

The world faces one of the most serious challenges - to develop sustainably in a way that meets the needs of the current generation, without compromising the ability of future generations to meet their needs. Sustainability refers to three factors - environment, society and economy at the global and in particular at the regional level. Sustainable agriculture is organic, biodynamic, resource-saving, low-cost, etc. Definitely, organic production is the basis of the global concept of unified social responsibility, through which these conditions are linked [4].

Organic farming as a system takes into account environmental, economic and social aspects of agriculture at the local, national and global level. Therefore, the goal of organic agriculture is producing sufficient quantities of high-quality food to the rational use of natural resources and the environment [2].

Due to environmental problems of conventional agriculture in many countries, most agricultural policy makers are considered organic farming system as a new approach of environmental protection to achieve food security and sustainable agricultural development [9].

Agricultural sector that is differed by its own characteristics, arising from the natural, economic, social and other conditions of production. Organic farming has all its characteristics. At the same time, it is distinguished by a number of features that are determined by its place and role in the unified reproduction process. Organic agricultural production refers to the number of intensive agricultural productions. It requires the attraction of large labour and material resources on a small amount of land. The intensification of organic production is related to the limited nature of the land as a basic means and to the possibilities to increase its fertility with the help of scientific and technological progress. World experience shows that organic farms are generally smaller than conventional farms, where production is based on industrial, in terms of arable land, production

volume and income [6]. Organic agriculture is a widespread trend and has the opportunity to attract a higher return for a farmer in a saturated bulk market [8].

In the last three decades, modern conventional (intensive) agriculture is in a serious crisis due to the high degree of chemicalization and its negative impact on the environment, soil, landscape and biological balance in agroecosystems. This is followed by the constantly deteriorating socio-economic indicators of agricultural production [7]

Bulgaria is known with deep agricultural traditions. The growth rate of the output of the agricultural sector is 5% for the recent years [5]. Organic production is a priority in the program of the government. Prerequisites for this are the favourable soil and climatic conditions of Bulgaria for the production of agricultural products and organic products.

MATERIALS AND METHODS

The goal of the present scientific paper is to analyse and evaluate the important role of organic farming for the agricultural sector development in Bulgaria. The study is based on directly collected empirical information from 73 organic farms operating on the territory of Plovdiv District in Bulgaria. The empirical information was collected and analysed after direct interviews with farmers, volunteers practicing organic production methods in Plovdiv, specialists and proven experts in organic farming, representatives of national regulatory authorities, managers of non-governmental organizations defending organic production and supporting its development in the country, lecturers from the Agricultural University – Plovdiv and others.

Based on our theoretical, economic and empirical analysis, we found that the development, sustainability and economic efficiency of Bulgarian organic farming are affected by many factors.

Conclusions are made and strategic guidelines and management recommendations are proposed for the future solution of the identified problems and increase of the economic efficiency of the organic production and thus the agricultural sector for the next Programming Period 2021-2027.

There is an urgent need for a change in the thinking and driving philosophy of both the producers and the policy and national legislation in the subsector and agricultural sector respectively.

RESULTS AND DISCUSSIONS

Currently, the total area of organically managed areas in Bulgaria is 136,629 ha, as the seventy-three studied organic farms are with a total area of 944.8 ha, i.e., 0.7% of the total organic land. Most of the farm's area is less than 100 ha, and only one farm has a remarkable 4,600 ha. Table 1 presents our own view for size categorization.

Table 1. Distribution of the studied organic farms by area, (ha)

Category area, (ha)	Organic farms, (number)	Share of the total number of surveyed farms, (%)
< 1 ha	5	5.08
1.01 – 2	8	1.19
2.02 – 5	18	7.37
5.01 – 10	37	25.83
10.01 – 15	1	1.06
15.01 – 20	-	-
20.01 – 30	1	3.17
30.01 – 40	1	3.52
40.01 – 50	-	-
50.01 – 60	-	-
60.01 – 70	-	-
70.01 – 80	1	7.83
80.01 – 90	-	-
90.01 – 100	-	-
100.01 – 200	-	-
201.01 – 1,000	-	-
1,000.01 – 2,000	-	-
> 2,000 ha	1	48.68

Source: Own research and analysis.

The table shows that the majority of the farmers organize and manage relatively small sized farms. More than a third of the farms occupy less than 10 ha. Our study shows that the largest-sized organic farms are concentrated in the production of the following: cereals; raspberries; perennials; meadows and essential oilseeds. Where the smaller-sized farms are producing vegetables; organic vermicompost and honey.

We found that organizational and management strategies have key role for the development and increase of economic efficiency of organic farming, and hence of the agricultural sector in Bulgaria. The first step in our country is to raise consumer awareness about global natural and climate change and the importance of consuming organic food. This is a prerequisite for a conscious and increased interest in organic products, respectively increased demand. The study cites as a good strategy the example of a number of countries (Spain, etc.) that have achieved positive results through this model. An example of a positive effect for the sector is the construction and implementation of new business models such as independent stores for organic products, focused on the removal of plastic packaging, supporting the commercialization of bulk products. Organic zero-waste supermarkets such as Yesfuture in Barcelona and Unpacked in Madrid are examples of this new business model.

In addition to specialty stores with native organic products, a major impact at the national level is the emphasis on increasing retail trade. In this way better and safer conditions are created for the realization of the production of the small organic farms. In our opinion, municipalities can contribute by offering free and/or lower rent stands and/or buildings for the construction of local outlets and markets for the promotion and trade of organic products.

Our survey shows that in Germany, Poland, Romania and France, farmland areas are provided free of charge by the state and municipalities. More than 90% of Bulgarian organic farms are small and/or medium in size and carry out their business mainly in rural areas, which confirms their vital role in supporting the economic situation in rural areas and preventing a future population migration. This organizational and managerial direction is a real opportunity to increase the level of employment in the given regions and in the country as a whole.

Another strategic model, taking into account the low purchasing power of the population in rural areas and small municipalities, is the formation of social groups or cooperation for the purchase of organic products (weekly, monthly, etc.). This ensures access to high-quality organic food, reduction of waste and packaging and a choice to support ethical food production and local organic farmers. A real advantage is the possibility of price discounts of up to 40% of equivalent products in supermarkets. In our view, this alternative way of shopping is a real chance to improve the domestic market of agricultural products in Bulgaria. That way, by reducing the cost of food and products, transport costs are also reduced, the use of plastic packaging is reduced, and all this contributes to the well-being of us and our families, our community and the planet as a whole.

It is essential to include a high percentage of organic food in Bulgarian children's kitchens, nurseries and kindergartens, schools, hospitals and other institutions. According to the survey, in Austria and France, this percentage is almost 30%, and in Poland and Romania - 15%. Undoubtedly, in view of the eating habits of modern human and the established organizational and economic problems in organic and conventional production in the country, this is a highly effective organizational strategy to support the sector and maintain the health of the Bulgarian population.

The next step is in the widespread implementation of precision farming methods. Where a very high cost of manual labour is required, it is rational to introduce equipment and technology in order to compensate for the serious lack of motivated and qualified labour. This concept includes the use of advances in computer science, electronics and fine mechanics, chemistry and biotechnology. We share the opinion of Vodenicharov [10] that the implementation of technologies for precision agriculture would have the following positive effects: Precise control over crops due to minimizing the use of fertilizers and plant protection products; Clarifying control will in turn optimize farmers' costs; The widespread penetration of these technologies would lead to stimulating the development of the accompanying sectors of the Bulgarian economy; Precision farming

technologies are a key prerequisite for a successful mass transition to organic farming.

Fundamental moment for the formation of a complete qualitatively new image of Bulgarian agriculture is the transition to a complex organic orientation of the farms. Thus, they can offer solutions to the problems of climate change, the rational use of water resources and soil protection and can be a key factor in ensuring food security.

A significant problem for Bulgarian organic producers is the definition of a mission and development strategy. The main task for them is to build viable and competitive farms on European markets. The lack of vision and developed strategy has a negative impact. Strategies for development and increasing the economic efficiency of organic farming in Bulgaria in our opinion are the following: general strategy, business, financial, marketing, human resources strategy, information, research, investment, etc. They should be combined to obtain better economic results [1].

On the one hand, the study proves that specialized consulting services in the sector are vital for the implementation of the agricultural method and the development of organic farming in Bulgaria. The main purpose of consulting services in the field of organic farming is to support producers in the subsector. On the other hand, scientific and technical progress, accumulated theoretical knowledge and practical experience allow for the most rational organization of the technological process in the cultivation of crops and groups of animals, which will ensure maximum efficiency of the natural, material and labour resources used in sector.

We perceive precision agriculture as a set of technological operations for cultivation of different parts of the field, taking into account the conditions of plant development. A key role in this approach is played by the high degree of automation of labour and digitalization. Nowadays, agriculture is becoming more scientific, with remote sensing, GPS and data analytics being added to agricultural machinery. Precise agriculture is a modern agricultural innovation and a strategic tool for digitalization in agriculture.

In our opinion, the adaptation of new tools gaining popularity in agriculture, such as blockchain technology and digital hubs, are a chance to improve the organization and management of organic farms; increasing their flexibility to new technologies; contributes to the adequate solution of the accompanying organizational and economic problems. Apart from farmers, these technologies are a prerequisite for better control and organization of the official database for agricultural production in Bulgaria. Undoubtedly, the assessment of the added value and the correct implementation of the digital innovations are a reasonable investment for the contemporary Bulgarian farms.

Integrated production is now on the rise, as more and more farmers are realizing that they need to be economically efficient while increasing the contribution of agriculture to the environment and natural resources.

We found the following innovative environmentally friendly production agricultural practices: No-till technology; biodynamic agriculture; the use of green manure and vermicompost; possibilities for applying the mobile beekeeping as an alternative to the stationary one, etc.

Short-term, medium-term, long-term and research priorities have been developed in the study. Thus, the ways for increasing the economic efficiency of organic farming in the District of Plovdiv are indicated.

They are also systematized guidelines and recommendations proposed in the research outlining the direction of the organization and management of organic farming in Bulgaria, with a view to increasing its and the country's agricultural economic efficiency. Our main organizational and management strategies proposed in the scientific work are the following:

(1)Promoting agricultural production and increasing consumer confidence;

(2)Developing a functioning market strategy that minimizes the risk of the market factor;

(3)Creation and implementation of new technologies for precision agriculture;

(4)Development and implementation of technologies for integrated management of agricultural holdings;
(5)Applying production technologies in order to preserve and/or increase soil fertility;
(6)Establishment of local farmers' associations protecting the interests of organic farmers in a given subsector;
(7)The inclusion of a high percentage of organic foods in Bulgarian children's kitchens, nurseries and gardens, schools, hospitals and other institutions;
(8)Clear, transparent and fair subsidization of the sector;
(9)Practice oriented research, education, training and consultancy in the field of organic agriculture in Bulgaria.

CONCLUSIONS

Based on the research we found: **First**, organic farming in Bulgaria is an alternative family business model with great potential for economic benefit and a favourable agricultural production method for our stressed environment. Its economic, environmental, social and political influence is essential for the development of both local and national agriculture; **Second**, organic production is specific and has a wide range of organizational and economic problems and challenges. Contemporary organic farmers are interested in their quick and timely solution, which is a sure prerequisite for building environmentally friendly and profitable organic production. Undoubtedly, as with any successful business, good management of the organic farm is essential; **Third**, the knowledge and technologies of the 21st century allow Bulgarian organic producers to find better ways of living a healthy lifestyle and profitable farming business, applying best practices to optimize the available natural, climatic and production resources. The development and implementation in practice of proven, improved and/or new innovative goods and services, processes, marketing or organizational and management methods, leads to increasing the environmental, social and economic efficiency of organic farming in the country;

Fourth, the existence of a high natural and climatic potential for the creation and development of a stable and sustainable structure of Bulgarian organic farms has been proven, which is accompanied by many closely interrelated organizational and economic problems; **Fifth**, a clear policy, goals and management strategies are needed in the organic and agricultural sector in Bulgaria. More adequate support for the organic production of the production lines with emphasized high labour intensity. Minimizing the obstacles to the studied organic productions is a guarantee for achieving economic success in the agriculture as a whole; **Sixth**, the empirical results of the research show that the increased interest in organic production in recent years in Bulgaria makes it a strategically important segment for the development of agriculture and the economy;
Seventh, the study finds that impartial institutional recognition of the full potential of organic food and organic farming systems is vital for the future development and prosperity of organic production in Bulgaria, in order to ensure the standard and nutrition of current generations, without compromising the needs of future generations; **Eighth**, dealing with the main organizational and management strategies proposed in the scientific research, namely: transparent, effective and balanced legislation in the field of organic farming; search for common ways to increase the national educational qualification and the respective agrarian literacy of the employees in the sector; maximum use of scientific and technical achievements and the advantages of modern innovations; removing or easing administrative burdens and bureaucratic procedures for organic producers; establishment and support of local farmers' associations, protecting the interests and rights of farmers in the respective production areas; greater support for the organic livestock sector; the creation and maintenance of real feedback along the chain organic producer-farmers' associations-competent authority; generating trust between producer – end user; adequate market regulation and improvement

of the marketing mix; supporting and stimulating short chains for direct sales, in order to increase the efficiency of small and medium-sized organic farmers; improving the quality of life and work through economic and social motivation and stimulating labour resources; improving the condition of the road infrastructure in the small settlements/hard-to-reach places and rural areas; the construction of municipal stands and/or markets for fair sale of finished organic products; creating and developing a coherent relationship between organic farming and the sectors of agri-tourism and food industry. All this in order to achieve environmentally friendly, cost-effective and competitive organic farming and so thriving agricultural sector in Bulgaria for the next Programming Period 2021-2027.

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DIGITAL TRANSFORMATION OF AGRICULTURAL INDUSTRIAL COMPLEX IN THE IMPLEMENTATION OF ITS DEVELOPMENT STRATEGY

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Abstract

In modern conditions, the innovative development of agriculture has reached a high level and ensures a steady growth in agricultural production. In this regard, the identification of new reserves for the growth of agro-industrial production will give a new impetus to the development strategy of the agro-industrial complex, one of which is the digitalization of agriculture as the basis for the stable functioning and growth of its efficiency. The work of the agricultural sector directly affects the employment, quality and standard of living of millions of Russians, as well as the food and national security of the country. One of the goals of the implementation of the agro-industrial complex development strategy is its digital transformation, which correlates with the national policy to accelerate the introduction of digital technologies in the economy and social sphere. Digital technologies will significantly change the quality of technological process control and decision-making at all levels. The real prospects of the domestic agricultural sector in the direction of digital transformation include the transition to a qualitatively new level of use of agro-industrial technologies - "smart agriculture", including precision farming, smart farms and others using elements of artificial intelligence. The purpose of the publication is to define the concept of "Digital transformation of the agro-industrial complex", analyze the indicators and indicators of the program of digitalization in agriculture and determine the possibilities of using information and digital technologies in agriculture. The work used general and special research methods, including analysis and synthesis, generalization of scientific information, logical method and systematization. The result of the work is an analysis of the current state of agricultural development and systematization of indicators of the digitalization program for agriculture and determination of parameters for the use of digital technologies in crop and livestock production. The use of digital technologies in the agro-industrial complex would increase not only the volumes of production and exports, but also the competitiveness of Russian products. Reasonable use of information technologies could almost double the efficiency of the Russian agro-industrial complex.

Key words**:** *digital transformation, strategy, agro-industrial complex, agriculture, development*

INTRODUCTION

Information technologies implies digitalization of the agricultural companies in order to enable them to develop their business and economic efficiency [3, 5].

Digital transformation of the agro-industrial complex - the transformation of economic activity through the introduction of digital tools - technologies and platform solutions designed for the generation, processing, in-depth analysis and translation of its results in the form of numerical information about objects and subjects of the economy for subsequent adoption of informed management decisions and ensuring a technological breakthrough in the agro-industrial complex.

The main task of the digital transformation of the agro-industrial complex is the integration of objective data streams of commodity producers and government data into the digital production platform to ensure global planning and provide accurate recommendations to market participants, including using artificial intelligence; activation of innovative processes based on the modern apparatus of innovative management [14].

Digitalization has become a strategic vector for the development of the Russian agro-industrial complex. This was preceded by the following events:

- in the Federal Assembly (December 1, 2016) it was proposed to launch a large-scale

systemic program for the development of the economy;
- adoption of the program "Digital Economy" of the Russian Federation (2017). The Ministry of Telecom and Mass Communications was renamed into the Ministry of Digital Development, Communications and Mass Media of the Russian Federation;
- publication of the strategy for sustainable development of rural areas of the Russian Federation for the period up to 2030;
- Decree of the Government of the Russian Federation "On approval of the Federal Scientific and Technical Program for the Development of Agriculture for 2017 - 2025".
In the Federal Assembly (March 1, 2018) it it was told about the super-efficient use of the enormous technological potential accumulated in the world, which would make it possible to make a technological breakthrough and bring the economy to a new level.
In this context, the purpose of the publication is to define the concept of "Digital transformation of the agro-industrial complex", analyze the indicators and indicators of the program of digitalization in agriculture and determine the possibilities of using information and digital technologies in agriculture. The work used general and special research methods, including analysis and synthesis, generalization of scientific information, logical method and systematization. The result of the work is an analysis of the current state of agricultural development and systematization of indicators of the digitalization program for agriculture and determination of parameters for the use of digital technologies in crop and livestock production. The use of digital technologies in the agro-industrial complex would increase not only the volumes of production and exports, but also the competitiveness of Russian products.

MATERIALS AND METHODS

The authors used general and special research methods, including analysis and synthesis, generalization of scientific information, logical method and systematization. The materials were normative acts, the works of domestic scientists, statistical collections.

RESULTS AND DISCUSSIONS

Legal framework

By order of the Government of the Russian Federation of July 28, 2017 No. 1632-r, the State Program "Digital Economy of the Russian Federation" was approved, which states that digital data is a key factor in the production of all spheres of socio-economic activity, which makes it possible to increase the country's competitiveness and the quality of life of citizens, ensure economic growth and national sovereignty [2].

Digital panorama in the future

In turn, the number of strategic documents has increased, where such terms as “numbers” and agriculture are mentioned [4]. By all accounts, the digital panorama of tomorrow's agriculture has already taken shape. The development of a departmental project was also completed by the Ministry of Agriculture of the Russian Federation, the implementation period of which is 2019 - 2024 [6].
The goal of the project is the digital transformation of agriculture through the introduction of digital technologies and platform solutions.
Currently, the use of information technology in the agro-industrial complex is not only the use of computers [7]. Digital technologies allow you to control the full cycle of production - "smart" devices measure and transmit the parameters of soil, plants, microclimate and more. All this data from sensors, drones and other equipment is analyzed by special programs. Mobile or online applications come to the aid of business entities in the agro-industrial complex - to determine the favorable time for planting or harvesting, to draw up a fertilizer introduction scheme, to predict the harvest, and much more.
Roughly 70.0% of farms in the US, Canada and Europe are already using smart technologies for agriculture. Also, among domestic farmers, the demand for digital is growing. Digitalization will help the Russian

agro-industrial complex make a powerful leap forward.

Russian agriculture performance

In the past 12 years, there has been a significant breakthrough associated with the construction of new agricultural enterprises with the introduction of modern technology and equipment.

The Russian Federation ranks 5th in the world in terms of value added in agriculture, and 7th in terms of foreign direct investment in agriculture.

At the same time, thanks to the state policy for the development of agriculture, the Russian Federation is currently the world's largest producer of barley, ranks second in the production of sunflower seeds, third in the production of potatoes and milk, and fourth in the world - in the production of wheat, having become in recent years the largest exporter of this crop, and 5th in the production of eggs and chicken meat.

Despite unfavorable weather conditions, in 2019 the gross grain harvest in net weight amounted to 121.2 million tons, which is 7.0% higher than the level of 2018 (113.3 million tons), the gross harvest of soybeans was a record 4.4 million tons, which is 8.3% more than its production in 2018 (4 million tons). The gross harvest of rapeseed in 2019 amounted to 2.1 million tons in net weight, which is 3.6% more than in 2018 (2 million tons). The average yield of rapeseed was 14.5 c per hectare (in 2018 - 13.3 c per hectare). The gross harvest of sunflower amounted to 15.4 million tons of oilseeds in weight after processing (in 2018 - 12.8 million tons) with a yield of 18.3 c per hectare (in 2018 - 16 c per hectare).

The gross harvest of potatoes in all categories of farms in 2019 amounted to 22.1 million tons (in 2018 - 22.4 million tons), vegetables - 14.1 million tons, which is higher than the level of 2018 winter greenhouses in agricultural organizations and peasant (farm) farms, including individual entrepreneurs, exceeded 1.15 million tons (in 2018 - about 1 million tons), which is a record figure [9].

The gross harvest of fruits and berries amounted to 3.46 million tons. A record 18.1 thousand hectares of new orchards and new vineyards were laid on an area of 6.94 thousand hectares. In 2019, the production of livestock and poultry for slaughter in live weight in farms of all categories amounted to 15.2 million tons, which is 1.9% more than in 2018. Increase in the production of raw milk (the growth rate was 104.6%) affects the volumes of dairy products production. Milk production in farms of all categories in 2019 amounted to 31.3 million tons (102.4% of the level of 2018). Milk yield per cow in agricultural enterprises (excluding micro-enterprises) increased by 401 kg compared to 2018 and amounted to 6,492 kg. The production of eggs in farms of all categories in 2019 amounted to 44.9 billion pieces, or 99.9% of the level of 2018. The average egg production of 1 laying hen in agricultural organizations in comparison with 2018 was 312 pieces. The food production index in 2019 remained at the level of 2018 and amounted to 104.9%. The beverage production index was 103.1% (102.6% in 2018). The production of eggs in farms of all categories in 2019 amounted to 44.9 billion pieces, or 99.9% of the level of 2018. The average egg production of 1 laying hen in agricultural organizations compared to 2018 was 312 pieces. The food production index in 2019 remained at the level of 2018 and amounted to 104.9%. The beverage production index was 103.1% (102.6% in 2018). The production of eggs in farms of all categories in 2019 amounted to 44.9 billion pieces, or 99.9% of the level of 2018. The average egg production of 1 laying hen in agricultural organizations in comparison with 2018 was 312 pieces. The food production index in 2019 remained at the level of 2018 and amounted to 104.9%. The beverage production index was 103.1% (102.6% in 2018).

In January-December 2019, compared to the corresponding period of 2018, food and processing industry enterprises shipped: food products (work performed, services) in the amount of 6,061.2 billion RUB, or 7.4% more than in the corresponding period of 2018; drinks worth 869.6 billion rubles, or

13.5% more than in the corresponding period of 2018.

In the structure of retail trade turnover, the share of food products, including drinks and tobacco products, amounted to 47.9% of the total volume, or 16,062.3 billion rubles.

In 2019, the production of livestock and poultry for slaughter increased (the growth rate was 103.0% compared to the level of 2018), which favorably affects the work of processing enterprises and contributes to an increase in the output of meat products. The growth rate of production volumes in 2019 was: canned meat (meat-containing), including canned food for baby food, - 112.2% (676.5 thousand tones); semi-finished meat products - 108.7% (3,559.9 thousand tons). The production of milk and dry cream, freeze-dried, increased up to 112.4% (149.9 thousand tons), cheese - up to 112.2% (523.9 thousand tons).

High rates of production of frozen fruits and vegetables also remained - 131.8% (95.4 thousand tons), processed and canned potatoes - 121.7% (298.2 thousand tons), sugar - 116.5% (7,309.7 thousand tons), vegetable oils and their unrefined fractions (including corn) - 112.6% (6,697.8 thousand tons), mineral water - 104.3% (14,866.4 million half liters), pasta and similar flour products products - 101.6% (1,437.2 thousand tons), cereals - 101.3% (1,540.2 thousand tons). The production of flour from cereals, vegetables and other plant crops remained at the level of 2018, mixtures from them at the level of 99.0% (9,511.5 thousand tons), sausages - 99.7% (2,275 thousand tons), bread and bakery products - 99.1% (6,306 thousand tons), confectionery - 100.4% (3,931.2 thousand tons).

Digital transformation of the agro-industrial complex

An important goal of the strategy for the development of the agro-industrial complex is the digital transformation of agriculture with an increase in the number of digital agricultural enterprises and a 2-fold increase in labor productivity by 2021 [8].

Table 1. Indicators and indicators of the program of digitalization of agriculture

Indicator	Base value	2020	2021
In the field of implementation of the national intellectual system of state support measures and private agricultural services			
The share of data on objects of agricultural resources (land, livestock, agricultural machinery) included in the Digital Agriculture Center:			
- agricultural land,% of the total area of agricultural land	75.0	100	100
- farm animals,% of the total livestock	1.0	50	100
- agricultural machinery,% of the total number of units	50.0	100	100
Share of “smart” contracts concluded with recipients of subsidies,% of the total number of subsidies	0	50	100
Number of Russian regions that have implemented digital sectoral planning of agricultural production based on the digital platform "Digital Agriculture", units	0	25	85 (100% regions)
In the field of achieving economic effect by agricultural producers			
Cost reduction factor for agricultural production,%	0	15	20
The share of material costs in the cost of a unit of agricultural products (FCM, fertilizers, electricity, planting material, feed, etc.),% of the cost	65	55	50
Labor productivity growth rate at agricultural enterprises,%	0	125	150
Share of investments for the purchase and implementation of digital technologies and digital products,% of the total investment of agricultural enterprises	0.5 (0.1)	3 (1.5)	7 (5)
The share of agricultural raw materials and finished products tracked and shipped for export by the intelligent system "Agroexport",% of the total export of agricultural products	0	15	50
In the field of training industry specialists with the competencies of the digital economy			
The share of specialists of agricultural enterprises who have undergone retraining in working with digital technologies,% of the total number of specialists employed in agricultural enterprises	five	20	35

Source: Platform "digital agriculture", https://www.mcxac.ru/upload/medialibrary/0f3/0f3e94a2348bb7122977c138e069ece1.pdf, [11].

Modern information and digital technologies allow real-time monitoring of production processes in agriculture, which makes it possible to adapt these technologies to the needs of modern agriculture based on the construction and development of an electronic agriculture system in the agricultural sector of the Russian economy. The main indicators of digitalization of agriculture are presented in Table 1 (Platform "digital agriculture") [11].
The introduction of modern land use systems and information agricultural technologies requires the development and development of innovative digital technologies. Such systems include GLONASS, Rapid Eye satellites, CORINE Land Cover. For example, to ensure a successful harvest, farmers must be able to create ideal conditions for crop health and identify any potential pest or disease threat before they spread. Digital technologies allow accelerating soil testing before planting, as well as monitoring plant nutritional status and recognizing plant diseases after growing. Autonomous vehicles and drones can be equipped with cameras and sensors to collect data, which are then loaded into software. This allows you to quickly present information about the crop to the user or farmer to see and quickly identify potential problems [12].
The introduction of GIS technologies, precision farming allows to reduce the costs of farmers and increase the efficiency of resource use. One of the most promising areas is the use of GIS technologies for monitoring agricultural land [13].
Robots and autonomous vehicles can reduce labor costs while increasing production efficiency. GPS and drone contour mapping quickly provide farmers with detailed information on water levels and soil fertility - and the data can even be transferred via the cloud.
The use of the achievements of the space industry is one of the main requirements of the modern functioning and development of agricultural production, since the presence of significant territories of the agricultural sector of the Russian Federation predetermines the need for obtaining information on the state of resources and forecasting yields. Satellite navigation systems allow monitoring the vast territory of Russia, preventing or minimizing losses from the onset of adverse weather events. Note that the scope of application of global navigation satellite and geographic information systems, as well as methods of remote sensing of the Earth is constantly expanding.
GLONASS technologies in the agro-industrial complex can be used in three cases:
- guidance systems;
–Systems for data analysis;
- variable rate systems.
The main function of satellite navigation systems in agriculture is contact mapping of fields by soil fertility (humus content). Another area of application of GPS technology is precision irrigation (irrigation) systems for linear irrigation equipment. This system improves the accuracy and quality of irrigation equipment and the irrigation process.
In the agro-industrial complex, in order to make timely and informed decisions, information about the current state of crops is needed, for the collection of which it is possible to use data from RapidEye satellites, which allow collecting data for monitoring and analyzing the state of the vegetation cover (assessment of the content of chlorophyll, protein and nitrogen) [1].
The introduction of modern technologies in animal husbandry is characterized by the renewal of the technological base of farms with the latest equipment for keeping animals. Thus, China, as part of the modernization of agriculture, is switching to innovative technologies in the management of pig breeding complexes. A multifunctional artificial intelligence system allows you to effectively manage large farms. With the help of infrared sensors, it is possible to keep track of the number of pigs, as well as track the movement and health of animals. Thanks to artificial intelligence, it has become possible to abandon expensive and ineffective RFID tags. This technology allows you to read data from tattoos applied to pigs. Artificial intelligence technologies can be useful in shaping the diet of animals. On modern farms, pigs are kept in relatively small groups, in

which the most similar animals are selected. Obtaining information on the progress of feeding individual individuals allows you to create individual pig feeding programs and the selection of an individual composition of food additives, which, in turn, significantly increases the yield. For example, in the UK, they launched a project to use artificial intelligence to identify diseases in calves. The project aims to develop a robust approach for early detection of respiratory disease in cattle using infrared thermography coupled with artificial intelligence. Obtaining information on the progress of feeding individual individuals allows you to create individual programs for feeding pigs and the selection of an individual composition of food additives, which, in turn, significantly increases the yield. For example, in the UK, they launched a project to use artificial intelligence to identify diseases in calves. The project aims to develop a robust approach for early detection of respiratory disease in cattle using infrared thermography coupled with artificial intelligence. Obtaining information on the progress of feeding individual individuals allows you to create individual pig feeding programs and the selection of an individual composition of food additives, which, in turn, significantly increases the yield. For example, in the UK, they launched a project to use artificial intelligence to identify diseases in calves. The project aims to develop a robust approach for early detection of respiratory disease in cattle using infrared thermography coupled with artificial intelligence.

The main advantage of using neural networks for decision-making in agriculture is the ability to reduce the risks associated with a shortage of qualified personnel, to provide a high level of management of the usual economic activities of an agricultural enterprise.

For the effective use of neural networks in the Russian agro-industrial complex, it is necessary to form a national publicly accessible neural network, focused, among other things, on solving problems related to veterinary medicine. This will make it possible to make a qualitative leap in the development of animal husbandry, as well as significantly reduce the costs of farms for veterinary services [10].

The effect of the introduction of such systems will be especially noticeable in small farms, which normally cannot afford a full-time veterinarian.

Thus, Table 2 presents the possibilities of using information and digital technologies in agriculture.

Table 2. Possibilities of using digital technologies and neural networks in crop and livestock production

Parameter	Plant growing	Livestock
Possibilities of use	- precision farming systems - GLONASS; - satellite technologies; - maps of the landscape cover; - determination of the actual cultivated areas; - forecasting the productivity of harvesting and crop losses; - computer vision for planting analysis; - monitoring of crop health; - automatic irrigation systems	- machine vision for counting livestock; - face recognition systems for livestock; - the formation of the diet of animals; - veterinary service; -optimization of the agricultural machinery fleet
Application problems	-significant need for financial investments; - requires a large amount of research and development; - the need for highly qualified personnel, scientists; - closeness of informational data of aerial photography	- high cost of equipment renewal and modernization; - the need to import modern technological means of keeping, feeding and caring for animals; - a high level of physical wear and tear of domestic equipment.

Source: Altukhov, A.I., 2019, Global digitalization as an organizational and economic basis for the innovative development of the agro-industrial complex of the Russian Federation./A.I. Altukhov, M.N. Dudin, A.N. Anischenko. 2019, Problems of market economy. No. 2, pp.17-27 [1].

CONCLUSIONS

The agro-industrial complex plays an important role in the development of the Russian economy, therefore one of the important tasks of the state is to ensure its effective functioning. The digital transformation of the agro-industrial complex contributes to ensuring food security, reducing the cost of agricultural production, as well as increasing the country's competitiveness in the global food market.

The greatest potential in agriculture will be possessed by technologies for monitoring and controlling machinery and technologies for precision farming. Popularization of scientific ideas about the advantages of the latest achievements of science and technology among the population, training of specialists - IT agronomists and IT zootechnicians - will also contribute to the activation of the processes of introducing digital technologies into production processes in the field of agriculture.

Carrying out an end-to-end digital transformation of all processes in the agro-industrial complex will allow to overcome existing barriers to the introduction of information tools in the agricultural sector of the Russian economy.

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FORMATION OF THE PERSONNEL POTENTIAL OF THE DIGITAL TRANSFORMATION OF THE AGRICULTURE IN RUSSIA

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Abstract

Currently, real competitive advantages in the market are acquired by agricultural enterprises that introduce and develop modern digital technologies. At the same time, for the effective implementation of the digitalization process, it is necessary to complete the staff of enterprises with the appropriate number of specialists. The theoretical foundations of training and employment of IT specialists, as well as methods of managing IT personnel in the agro-industrial complex are considered. The current state of the training of information technology specialists in Russia is analyzed. The situation with the training of students in leading universities is considered in detail. The regularities reflecting the annual volatility of the number of applicants with a general trend of moderate growth are revealed, the forecast of preservation of the corresponding parameters of human capital development is made, the attractiveness of vacancies in the agricultural sector is determined on the basis of a retrospective analysis of indicators characterizing the formation of personnel potential in the IT sphere. A set of measures to improve the provision of the agricultural sector with highly qualified IT specialists is proposed.

Key words**:** *digitalization, agriculture, personnel training, Russia*

INTRODUCTION

At the present stage of the development of the world economy, those agricultural companies have significant advantages in which modern technologies are fully applied, and not only production, but also business management. The stability of the company and high competitiveness today are possible only under the condition of the active use of innovations, digital tools and technologies that ensure the constant relevance of information about the status of all processes and allow making effective management decisions when planning and organizing activities, monitoring performance, analyzing the results [25]. In the near future, companies that integrate their business into a single system based on a digital platform will take the leading positions in the market.

For these reasons, digital management systems are already becoming more and more popular, which belong to a special class of industry software products focused on working in agribusiness [7]. The head of the agricultural enterprise has a real opportunity to control the entire production cycle in the crop and livestock sectors through the use of smart devices that transmit and process operational information about the current parameters of each object (equipment and sensors that determine the state of soil, plants, animals, microclimate), as well as seamless channels communication between them and external partners [21]. Incorporation of objects into a single network, dispatching and aggregation of data streams based on the Internet of Things, the increased productive capacity of computers, improvement of software and cloud platforms make it possible to design and automate accurate business processes by developing a digital model of the entire production cycle and interconnected links in the value chain, with mathematical

accuracy to plan a work schedule, emergency measures to prevent losses in the event of an identified threat, to predict the result [12]. Most of these digital control systems are browser-based or cross-platform applications installed on computers or mobile devices. As a result, their use presupposes the presence of personnel with relevant knowledge in the field of Big Data, Data Science, mathematics, analytics, robotics and skills in working with digital devices.

The study of modern processes of digitalization of the economy and the integration of information technologies with real processes in it scientists began in the mid-90s of the last century. Don Tapscott [31] was the author of the first cited work in 1994, which interprets the term “digital economy”. Neal Lane, exploring various aspects of the formation of the digital economy, focuses on e-commerce and the impact of information technology on privacy, standards, innovation and the digital divide [17]. Collaboration of Eric Brynjolfsson and Brian Kahin led to the publication of their joint work, in which the authors noted that the term "digital economy" is applicable only to the currently observed transformation of various sectors of the economy based on the intellectualization of processes through the spread of IT technologies [6]. The key components of the digital economy were first identified by Lynn Margherio [18], which served as the foundation for further research, which resulted in the publication of a joint work by Rob Kling and Roberta Lamb [13]. The authors defined the digital economy as a combination of four components: “Digital products and services. Mixed digital products and services. Services and production of IT-dependent goods. A segment of the IT industry that serves the three segments of the digital economy under consideration. " In turn, Thomas Mesenbourg talks about the bifurcation of the digital economy to the products of IT infrastructure and the use of information technology in order to implement business processes [20].

Currently, world scientists continue to work on the study and improvement of the digitalization mechanism of various branches of the agro-industrial complex, investigate the role of science and obstacles in the development of digital agriculture [30], new methods of managing the agro-industrial complex in the context of digitalization [22], interaction between the state and business during digital transformation [11] and digitalization as a tool to overcome the consequences of the pandemic [29]. In addition, specific digitalization tools are considered: the creation of a single digital platform in the agro-industrial complex [19], the introduction of fuzzy logic in vegetable growing [4], cloud systems [3], digitalization of various food regimes [28], the design of digital tools [23], UAV in agriculture [14, 32], digital grain platforms [5], monitoring and feedback of agricultural projects [9]. At the same time, active research is underway on the issues of training specialists in digital agriculture [1, 2] and digitalization of educational processes [15, 24].

These initiatives are being actively implemented in practice. A number of recommendations for the development of digitalization were developed by the Food and Agriculture Organization of the United Nations (FAO UN) [8]. Currently, a number of state projects in the field of digitalization of the economy are being implemented in Russia: The Strategy for the Development of the Information Society in the Russian Federation for 2017-2030, the Strategy for Scientific and Technological Development of the Russian Federation, the National Program "Digital Economy of the Russian Federation", the National Technology Initiative (NTI) and the National Science Project. In the field of the agro-industrial complex, the Ministry of Agriculture has been implementing the Departmental Project "Digital Agriculture" [10] since 2020, which includes the following areas:

(1)Creation of a national platform for digital public administration of agriculture "Digital Agriculture" (DSA) (effective hectare, smart contracts, agro-export "from field to port");

(2)Implementation of the "Agro-solutions" module of the national platform of digital public administration to improve the efficiency of the activities of commodity

producers (smart: farm, field, herd, greenhouse, processing, warehouse, agro-office);
(3)Creation of a system of continuous training of specialists of agricultural enterprises in order to form their competencies in the field of the digital economy ("Land of Knowledge" = 55th digital agricultural university).
Thus, it can be noted that a unified approach to understanding the term "digitalization of agriculture" has not yet been formed. For the most part, the digitalization of agribusiness is the result of the inclusion of digital technologies (including the use of local subsystems for managing technological operations) in various elements of the activities of an agricultural organization (production, processing, sale, supply and service) to create consumer value of products, ranging from planning, organization and implementation of the production cycle, and ending with the satisfaction of consumer demand. Also important are the issues of digitalization of public administration processes in all areas of the agro-industrial complex at the state and regional levels [26], [27]. At the same time, effective implementation of new technologies requires an increase in the staff of both developers of "hard" and "soft" products, as well as qualified users and maintenance personnel of the IT infrastructure.

MATERIALS AND METHODS

In preparing the article, data from the Ministries of Economic Development, Agriculture, Science and Higher Education of the Russian Federation, and the Federal State Statistics Service of Russia were used. Information of higher educational institutions and scientific institutes of the federal and regional level. Works of Russian and foreign scientists on the digitalization of various sectors of the economy and the training of highly qualified personnel, materials of research organizations from around the world. In the study of theoretical and methodological aspects of various organizational and economic aspects of digitalization of enterprises, monographic and logical methods were used. The study of the current state of training of specialists in information technology direction was carried out on the basis of statistical and economic analysis, as well as the method of comparative analysis. The definition of directions for the development of staffing for the digital transformation of the activities of agro-industrial enterprises in Russia was carried out using abstract-logical and computational-constructive methods.

RESULTS AND DISCUSSIONS

Today, a high level of shortage of IT specialists is recorded in the industry labor market. According to the Ministry of Agriculture, there are half of them in Russia than in other countries with a traditionally developed agricultural sector. The Russian agrarian sector, according to experts, needs about 90 thousand IT specialists [16]. Note that the degree of staff “hunger” does not differ significantly across regions. This is the most important obstacle to the implementation of modern digital solutions in agricultural enterprises, since without experience working with IT technologies it is impossible to fully use the software product, comprehensively revealing its potential, and, therefore, to obtain the expected economic effect. Therefore, modern companies are even forced to attract specialists from related industries who do not have experience in agriculture.
Thus, the transfer to a new technological paradigm associated with the active use of digital technologies inspires the need to solve a whole range of problems in matters of staffing. In particular, universities are faced with the task of training personnel with competencies that are not currently articulated in the current federal educational standards for the areas of training specialists in the agricultural sector. For example, there is no doubt that in the coming years there will be a growing trend in demand for multidisciplinary specialists in the integration of intelligent solutions in agriculture, possessing knowledge in the field of agronomy, fleet management, as well as IT technologies in a broad sense (software developers , specialists in the deployment of hardware, local networks and databases of farms with a mandatory

knowledge of the principles of satellite navigation, data transmission networks, telemetry and the principles of agricultural machines). However, there is still a low adaptive potential of educational programs to the requirements of real production and the peculiarities of the formation of modern professional competencies in the agricultural sector. The process of developing educational standards is quite lengthy and often demonstrates significant inertia against the background of permanently changing economic requirements. As a result, most agricultural universities today lack areas of training related to IT technologies. The situation noted is also determined by the sequestered capabilities of universities due to the lack of the necessary material base and teaching staff. As a result, enterprises are forced to retrain graduates or entice specialists from competitors.

In the last decade, many scientific publications have been devoted to various aspects of the digital transformation of the economy in general and individual industries in particular. However, to date, the prospects of digitalization in the regional agricultural sector have not been studied from the point of view of the correspondence of the existing personnel potential to the necessary. In addition, the data on the number of students in training areas related to the use of information technologies, the prospects for their employment and the eventuality of work in agricultural organizations have not been systematized and studied.

For several years in Russia, the reform of education and the transition to a two-tier Bologna system - bachelor's degree (first 4 years) and master's degree (next additional 2 years) have been progressing, but at the same time, in some areas, the traditional option remains - specialty (5 years). A similar situation is typical for IT specialties, which are gaining popularity every year (Table 1).

If in 2013, 416.6 thousand applications were submitted for these areas of training, then in 2020 it is already 85% more - 770.2 thousand. The competition has grown almost one and a half times, but the total number of students in 7 years has increased only by 2.6%.

This table took into account various areas of student training, in particular, the following areas of undergraduate and graduate programs: applied mathematics and computer science; mathematics and computer science; fundamental informatics and information technology; software and administration of information systems; cartography and geoinformatics; informatics and computer technology; information systems and technologies; Applied Informatics; Information Security; infocommunication technologies and communication systems; mechatronics and robotics; business informatics, etc. Specialty programs: computer security; information security of telecommunication systems; information security of automated systems; information and analytical security systems; infocommunication technologies of a special communication system, etc. To study in detail the situation with the preparation of students, it is necessary to consider the indicators of specific universities. For example, in one of the typical agrarian regions of Russia - the Saratov region - there are a large number of educational institutions and a developed labor market in the information technology and agricultural sectors.

In the Saratov region, specialists in the field of IT technologies are graduated from 2 universities: "Saratov State Technical University named after Y. Gagarin" and "Saratov National Research State University named after N.G. Chernyshevsky ". It should be emphasized that “Saratov State Agrarian University named after N.I. Vavilov”, which is one of the largest higher educational institutions of the country and trains specialists for the agro-industrial complex of the Volga region, does not prepare students for work in the field of IT-format technologies.

Faculty of Computer Science and Information Technologies, SSU n. a. N.G. Chernyshevsky trains programmers capable of working in the field of information security of an agricultural enterprise (creation of a system for protecting information, including personal data of employees, its support and development of measures to prevent the occurrence of information risks associated with information leakage, hacker attacks, etc.), in the field programming (full support of software performance, creation and maintenance of enterprise databases, creation of web sites in the

format of trading platforms for the sale of agricultural products), as well as in the direction of system analytics.

Table 1. Indicators of training specialists in higher educational institutions of Russia in IT specialties in 2013–2019

Years	Indicators	Qualification types			Total
		Bachelor degree	Specialty	Master's degree	
2013	Applications submitted	377,836	24,442	14,384	416,662
	Applications accepted	66,548	2,780	9,156	78,484
	Competition, people for one place	5.68	8.79	1.57	5.31
	Number of students in all courses	191,049	92,397	13,568	297,014
2014	Applications submitted	351,373	21,351	16,523	389,247
	Applications accepted	61,367	2,651	8,900	72,918
	Competition, people for one place	5.73	8.05	1.86	5.34
	Number of students in all courses	221,001	38,144	16,331	275,476
2015	Applications submitted	327,682	22,434	37,763	387,879
	Applications accepted	60,974	2,908	15,523	79,405
	Competition, people for one place	5.37	7.71	2.43	4.88
	Number of students in all courses	222,067	19,457	23,617	265,141
2016	Applications submitted	356,024	25,312	50,157	431,493
	Applications accepted	56,886	3,057	17,543	77,486
	Competition, people for one place	6.26	8.28	2.86	5.57
	Number of students in all courses	214,251	12,535	31,885	258,671
2017	Applications submitted	392,168	77,642	51,245	521,055
	Applications accepted	59,554	21,746	18,220	99,520
	Competition, people for one place	6.59	3.57	2.81	5.24
	Number of students in all courses	209,435	14,685	35,463	259,583
2018	Applications submitted	475,300	28,583	58,774	562,657
	Applications accepted	66,131	3,930	18,917	88,978
	Competition, people for one place	7.19	7.27	3.11	6.32
	Number of students in all courses	215,955	15,662	37,528	269,145
2019	Applications submitted	539,834	24,374	49,245	613,453
	Applications accepted	71,775	4,154	15,769	91,698
	Competition, people for one place	7.52	5.87	3.12	6.69
	Number of students in all courses	227,690	16,613	38,024	282,327
2020	Applications submitted	658,144	46,176	65,878	770,198
	Applications accepted	76,650	4,733	18,899	100,282
	Competition, people for one place	8.59	9.76	3.49	7.68
	Number of students in all courses	247,844	18,313	38,437	304,594

Source: Compiled by the authors based on the data of the Ministry of Science and Higher Education of the Russian Federation.

Graduates of the Faculty of Mechanics and Mathematics solve similar problems (audit and monitoring, analysis of information risks). The only exception is the development of an information security system.

After completing their studies at the Faculty of Geography, graduates effectively work with maps (update them via satellites, track the directions of land use, the proportion of abandoned lands, etc.).

SSTU named after Gagarin Yu.A. carries out training of specialists in the field of automated control systems capable of servicing any control system in an agricultural organization (an on-board computer in a tractor, automated feeding, milking, watering, etc.) in terms of functioning, as well as analyzing information from sensors.

The number of students studying at SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. in the above areas of training related to the use of information technology, in dynamics does not decrease (Figure 1).

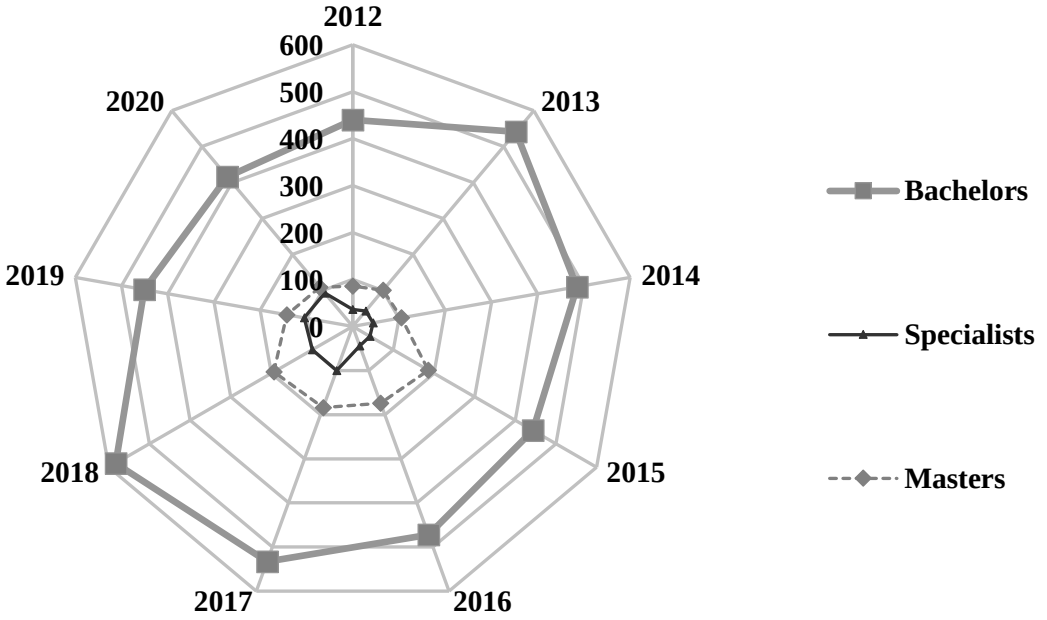

Fig. 1. Dynamics of the number of students of SSU named after N.G. Chernyshevsky and SSTU named after Yu.A. Gagarin, enrolled in areas of training related to the use of information technology, in 2012–2020.
Source: Compiled by the authors based on university data.

The radial diagram shows data grouped by years in the context of higher education levels (bachelors, specialists, masters), which spectacularly indicate a significant fluctuation in the number of students in the areas under consideration over the past 9 years, however, on average, there is a growth trend in the studied indicator.

It should be noted that the insignificant enrollment of students for a specialty in recent years compared to bachelor's and master's degrees was inspired by the transition to a three-level education system. At the moment, the specialty has remained only in those areas of training for which the bachelor's format is impossible.

In addition, in the learning process, some groups of students are subject to unification or, on the contrary, separation. Therefore, in the future, when constructing a model, we will consider the number of young specialists who entered the labor market as a whole, without differentiating them by levels of education and areas of training.

The study made it possible to build an economic and mathematical model in the form of a regression equation, reflecting the forecast of the number of students who will be enrolled in the considered areas of training. Forecast calculations were carried out by the method of mathematical extrapolation of the general development curve (trend), which consists in the continuation of the curve characterizing the previous changes in the economic indicator over time. This allows you to build all kinds of mathematical forecast models presented in Table 2.

Table 2. Simulation of the dynamics of the numerical series of the number of applicants for the IT specialty in Saratov

Model type	Model equation	Approximation coefficient (R^2)
Linear	$Y = 14.933x + 620$	$R^2 = 0.1768$
Exponential	$Y = 618.97e^{0.0214x}$	$R^2 = 0.1858$
Logarithmic	$Y = 72.23\ln(x) + 591{,}93$	$R^2 = 0.2873$
Polynomial	$Y = -0.9738x^4 + 16.299x^3 - 91.56x^2 + 232.5x + 423.33$	$R^2 = 0.8906$
Raised to degree	$Y = 593x^{0.1054}$	$R^2 = 0.3106$

Source: Calculated by the authors based on university data.

The main indicator of the quality of the model is the coefficient of determination (R2), which characterizes by what percentage the constructed regression model explains the variation in the values of the resultant variable relative to its average level. Thus, the higher the coefficient of determination, the higher the quality of the model. In this case, the polynomial model of the fourth degree of the form $y = -0.9738x^4 + 16.299x^3 - 91.56x^2 + 232.5x + 423.33$ has the highest quality. Its coefficient of determination is $R^2 = 0.8906$. It was this model that served as the basis for predicting the dynamics of the investigated time series (Figure 2).

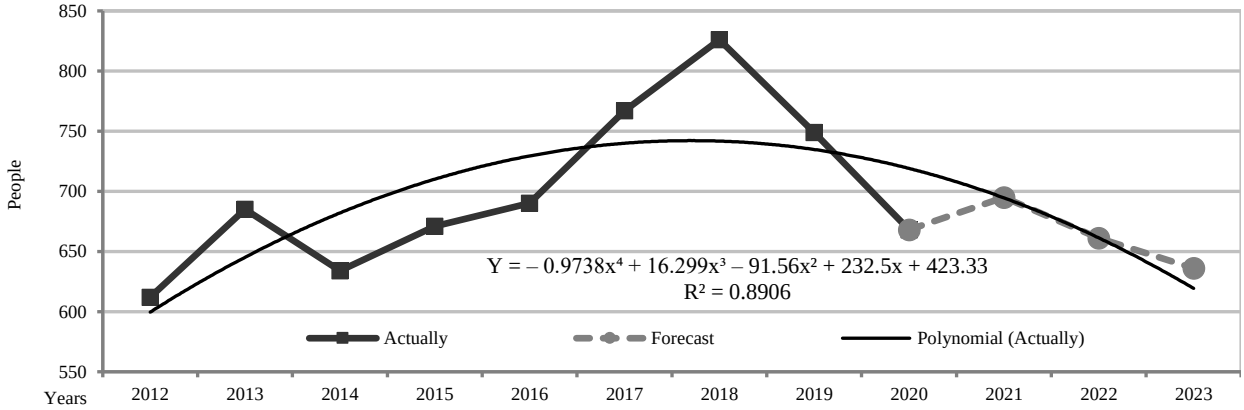

Fig. 2. Dynamics of the actual and projected number of students enrolled in SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. for areas of training related to the use of information technology in 2012–2023
Source: Calculated by the authors based on university data.

According to calculations, the number of students enrolled in the areas of study we are interested in within the framework of this study, in the next 3 years will average from 600 to 660 people per year. A significant increase in this indicator in the near future is not expected, since the number of budget places in such popular and demanded areas, unfortunately, is decreasing, and the curriculum consists of disciplines that can only be mastered by students with a high level of basic training. At the same time, admission to a university on the basis of an agreement on full reimbursement of training costs requires significant financial resources, and therefore is not available to everyone.

Practice shows that boys predominate in the composition of students enrolled in IT-areas (Figure 3).

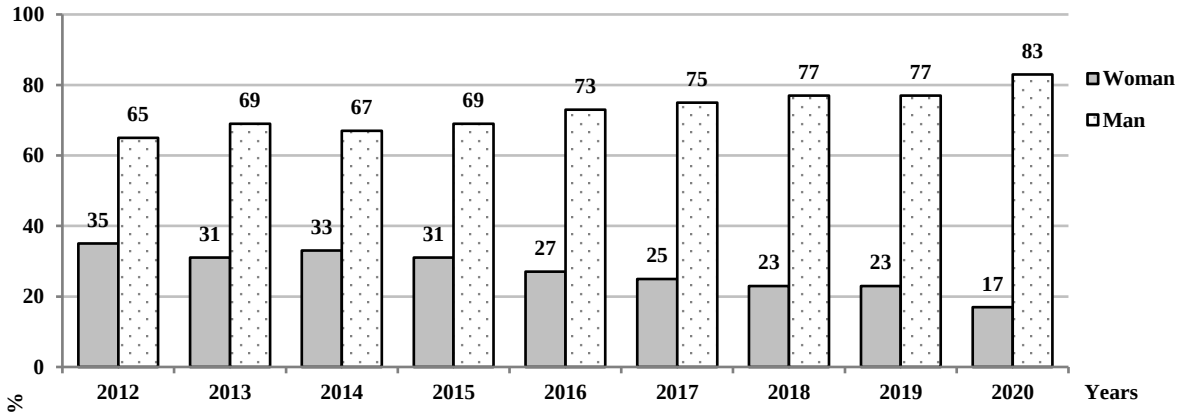

Fig. 3. The structure of students enrolled in SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. in 2012–2020 on the areas of training related to the use of information technology, in the context of sex
Source: Calculated by the authors based on university data.

A particularly noticeable difference is observed in YA Gagarin SSTU: the proportion of girls is from 17 to 24%, depending on the direction. At SSU named after N.G. Chernyshevsky, this figure varies from 42 to 67%.

Analysis of the composition of students who have successfully completed their studies in the areas under consideration, in terms of gender, shows that the proportion of girls in the total number does not practically differ from the same indicator calculated for enrolled students. Therefore, they are successful in their studies (Figure 4). In particular, in 2012, girls accounted for 35 % of the total number of students enrolled and 29 % of the total number of graduates; in 2020, these figures were 17 % and 31 %, respectively. Thus, more boys were expelled during the period of study, which led to an increase in the percentage of girls.

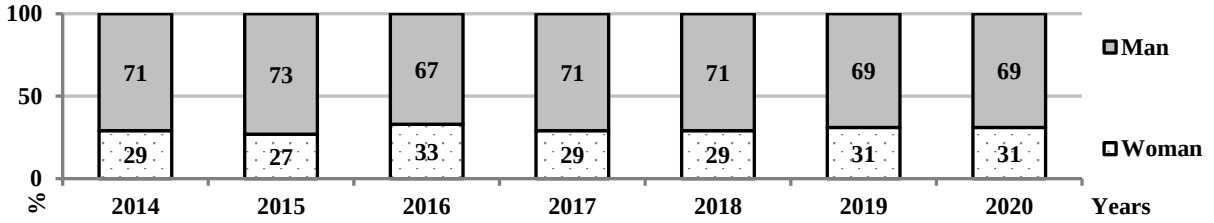

Fig. 4. The structure of students who graduated from SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. in 2015–2020 in areas of training related to the use of information technology, in the context of sex
Source: Calculated by the authors based on university data.

It is also important to note that, according to the results of data analysis, only 71% of the total number of enrolled students successfully complete their studies in the areas of interest (Figure 5).

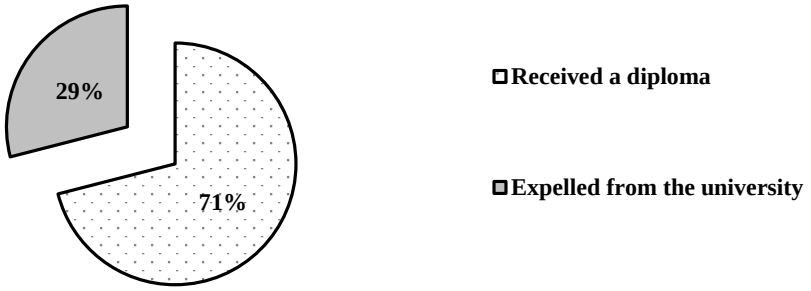

Fig. 5. The share of students who successfully completed their studies at SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. in areas of training related to the use of information technology, on average for 2016-2020
Source: Calculated by the authors based on university data.

The availability of actual data on the number of students enrolled in the studied universities in the period 2017–2020 suggests that about 1,200 people will enter the market of young IT specialists in the next 2–3 years. Already now, they need to be interested in possible employment in the agricultural sector.

Similarly to the predictive model of the number of students who will be enrolled in the IT-areas of training at SSU named after N.G. Chernyshevsky and SSTU named after Y. Gagarin, various models are being built to predict the number of graduates and their assessment (Table 3).

Calculations have shown that the highest quality is also possessed by the polynomial model of the fourth degree of the form $y = – 5.9242x^4 + 90.732x^3 – 463.75x^2 + 945.16x – 95.857$. Its coefficient of determination is $R^2 = 0.9583$. The forecast of the number of graduates based on this model is graphically presented in Figure 6.

All specialists in the field of information technology graduating from Saratov universities are in high demand in the market. Most of them find a job while still studying at

the university. Unfortunately, they do not consider the agricultural sector of the economy to be a promising area of application of professional competencies acquired during training.

Table 3. Modeling the dynamics of the numerical series of the number of young IT specialists in the city of Saratov

Model type	Model equation	Approximation coefficient (R^2)
Linear	$Y = 45.321x + 433.14$	$R^2 = 0.7162$
Exponential	$Y = 449.49e^{0.0743x}$	$R^2 = 0.7255$
Logarithmic	$Y = 137.31\ln(x) + 447.2$	$R^2 = 0.6606$
Polynomial	$Y = -5{,}9242x^4 + 90.732x^3 - 463.75x^2 + 945.16x - 95.857$	$R^2 = 0.9583$
Raised to degree	$Y = 458.34x^{0.2281}$	$R^2 = 0.6866$

Source: Calculated by the authors based on university data.

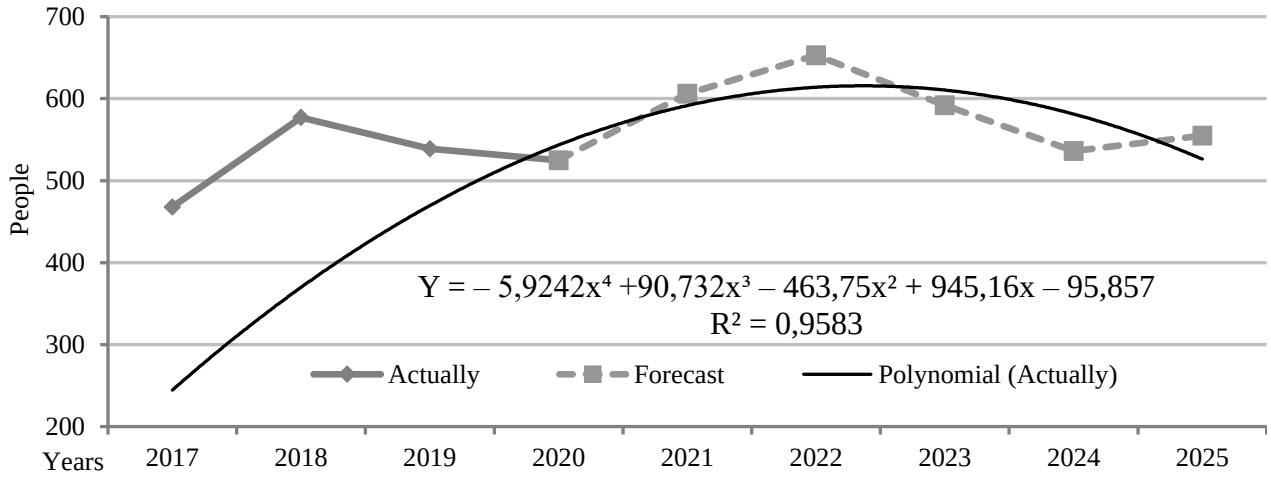

Fig. 6. Dynamics of the actual and projected number of students who successfully graduate from SSU named after N.G. Chernyshevsky and SSTU named after Gagarin Yu.A. in the areas of training related to the use of information technology in 2017-2025
Source: Calculated by the authors based on university data.

Traditionally, energy, raw materials, IT companies, research centers, business structures (banks), security services, government structures have the characteristics that graduates are guided by, namely: stability, predictability of career and professional development, high wages ...

In modern conditions, the task of attracting highly qualified IT specialists to agriculture can be solved by increasing the prestige of labor in the countryside, creating financial conditions and formatting the attitude of the population to this area as a non-technological sector of the economy.

Undoubtedly, male graduates at this stage are more in demand in the agro-industrial complex, since many works are associated with the use of agricultural machinery, GIS technologies, control of fuel consumption, etc. about modern technologies used in this area, directions of their development at the present stage. Their involvement in agriculture is possible at the stage of their coursework or diploma work by setting practice-oriented tasks. According to the results of 2-3 years of study at the university, students are able to create program code, websites, form databases, work with quadrocopters (calculate their trajectory, the weight they can lift, for example, seeds or fertilizers, etc.).

An effective measure of attracting students to the agricultural sector can be their employment on a part-time basis. As a result, agricultural enterprises should establish effective strategic partnerships with universities in terms of:

– resource support of universities (provision of equipment, specialized software);

– creation of joint scientific, educational and innovative structures (scientific and educational laboratories, training centers, basic departments and branches of departments);
– conducting classes at the university by leading specialists of enterprises (reading special courses and electives, consulting in the preparation of course and diploma projects);
– participation in the work of state certification commissions,
– organization of educational, research, industrial, including pre-diploma practice, internships;
– holding various kinds of competitions of student works;
– participation in design and research activities.

A very effective form of cooperation between the university and an agricultural enterprise is the organization of additional targeted training of students, the selection of which takes place on a competitive basis following the results of two to three years of study. Students who have passed the selection procedure are registered as employees of the enterprise. Their task is to study in the afternoon specific disciplines included in a specially formed program. At the same time, students are not exempt from the main educational program of study.

At the same time, female students cannot be ignored. The persisting low level of wages in the countryside and the lack of infrastructure make this area unattractive for the employment of young specialists in the field of IT-technologies. Meanwhile, girls with a higher education in computer science and information technology, but who are on maternity leave or parental leave, can be attracted by this employment option if it involves performing a number of jobs remotely (in particular, creating a database or updating website of the organization).

It should be noted that another possible solution to the personnel issue in the countryside is the development of outsourcing. One IT specialist will perform work for several enterprises, while the management does not need to register an employee on the staff, which will reduce costs and costs.

Among the measures to increase the human resources of agriculture in the context of the digital transformation of the industry, it is also necessary to indicate:
– training of employees of agricultural enterprises on the job (both full-time and remote format in the form of online webinars). In the educational process, situations that employees regularly encounter in practice are considered and analyzed, which makes it possible to provide an understanding of the essence of the processes;
– the creation of advanced training and professional retraining courses at agricultural universities, within which cycles of seminars and webinars for employees of agricultural organizations on the implementation of digital technologies can be held.

In both cases, it is possible to attract specialists from companies developing industry digital products, which can significantly increase the efficiency of training due to a detailed consideration of the features of a software product or technology.

CONCLUSIONS

As a result, it can be noted that currently in Russia there are active processes of digitalization of various sectors of the economy. The agro-industrial complex does not lag behind other industries, where projects for the development of information technology have been developed and are being implemented in recent years.

However, today the level of use of information technologies in agriculture in Russia is very low and is mainly reduced to the use of computers and general-purpose software for accounting and fixing commercial transactions. Some commodity producers use digital technologies, but mainly for monitoring the condition of fields, crops and animals. With the help of special software, control over some links of the agricultural process is carried out. Long production cycle, exposure to natural risks, seasonality of work, crop losses during harvesting and storage largely predetermined the restrained, but much needed progress in

increasing labor productivity and introducing innovations. There is an urgent need for digitalization of all areas of activity of agricultural enterprises, which is due not only to the need to improve the quality and efficiency of production management, but also to increase investment attractiveness. At the same time, one of the obstacles to the widespread use of IT in agriculture is the lack of qualified personnel, the main reason for which is the low attractiveness of working in the countryside.

At the same time, the country is witnessing an increase in the popularity of professions in the IT field, as evidenced by the rates of enrollment in universities. Over the past 7 years, the competition for IT specialties has significantly increased, while the number of training places is almost not growing. The considered experience of work of 2 largest universities of one of the leading agricultural regions of the country - the Saratov region - testifies to the preservation of all-Russian trends at the regional level. From year to year, there are fluctuations in the number of students in information technology areas of training with a general trend of slight growth.

At the same time, measures are required to develop the involvement of specialists in the agricultural sector and to popularize work in the countryside. The main objectives of the training should be the formation and development of users' technical skills for working with the interface of an agricultural digital system, a detailed study of related applied specific technologies (for example, determining the size of a land plot and classifying crops in the context of agricultural crops using drones and computer vision, differentiated seed application and fertilizers, installation of sensors for measuring moisture and temperature of soil and air, the level of solar insolation, the amount of precipitation). In agricultural universities, which almost never train IT specialists, it is necessary to work towards the technological updating of educational programs in specialized disciplines. It is also possible to ensure that lectures and practical classes on digital agricultural technologies are included in the educational programs of other specialties, which will make it possible to form the necessary set of modern competencies among potential agribusiness workers even in the process of university studies. In order to ensure the visibility of all the processes under study, it would be advisable to use real functioning IT systems deployed in educational and experimental facilities of universities.

Thus, it is necessary to establish effective cooperation between the methodological councils of universities and the management of large industrial enterprises in the process of forming a register of relevant professional competencies in order to adjust student training programs in accordance with the needs of enterprises. In addition, it is advisable to carry out regular monitoring of the needs of the regional economy in industry specialists who possess digital technologies.

The implementation of these measures, ultimately, will allow attracting the necessary number of specialists to the agricultural sector of the regions for the development, implementation and operation of digital production and management systems. And the development of digitalization of all spheres of activity of agricultural enterprises will create the preconditions for increasing efficiency and competitiveness in the international market of Russian agricultural and food products.

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PERFORMANCE - LIGHT SATURATION CURVE FOR GRAPEVINE PHOTOSYNTHESIS

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Abstract

*Performance - Light saturation curve for photosynthesis is determined by the genetics of grapevine genotypes, through the physiological element - the degree of penetration of leaves by solar radiation, photosynthesis intensity, leaf structure, physiological state of plants, influence of ecological factors, etc. It results of the diurnal phytonomonitoring are exposed to different genotypes of grapevines under the influence of green operations, in the conditions of the drought of 2020. The research undertaken established the moment of initiation and gradual increase of the performance up to the level of solar radiation of 1,000 micromol/m^2*s. The essential optimization is maintained between the parameters of the solar radiation of 1000-1500, the saturation at the level of the solar radiation of 1,400 and the stopping of the performance reaches the level of the solar radiation of 1,800 micromol/m^2*s.*

Key words: *grapevine, phytonomonitoring, photosynthesis, photorespiration, perspiration*

INTRODUCTION

Plant productivity is determined by the activity of a complex of physiological and biochemical processes, of which the primary role belongs to photosynthesis. It is necessary to mention and demonstrate that the performance of the genotype is achieved through the complex connection with other processes, first of all with respiration, a process in which a considerable amount of organic substances is consumed to obtain the energy necessary for the plant. In coordination with photosynthesis, the viability of the plant organism during the vegetation period is ensured. Each genotype is characterized by a certain genetic production potential, which is achieved following the activity of metabolic processes. Physiological processes, including photosynthesis, are permanently subject to the influence of ecological factors, such as: light, CO_2 concentration, temperature, humidity, etc., which have a significant influence in achieving plant productivity. Performance, Light saturation curve for photosynthesis is the qualitative genetic element, which can be determined by the degree of penetration of leaves by solar radiation and the intensity of photosynthesis, leaf structure, physiological state of plants and confirmed by diurnal physiological processes: photosynthesis (raw-net), perspiration, photorespiration in direct connection to weather conditions: light, temperature, humidity, CO_2 concentration, etc. [1, 2, 8].

MATERIALS AND METHODS

The studies were carried out during the active vegetation period from 2020, and the grapevine genotypes were used as a research object: Cardinal, Augustina and Viorica.
Diurnal phytomonitoring was performed using phytomonitor PTM-48A.
The measuring chambers were installed directly on the intact leaves, located in the middle part of the shoot.
The volume of air required for the measurements is standardized with the help of the Ascarid tube, which is filled with calcium hydroxide Ca(OH) 2 > 75.5%; Sodium hydroxide - NaOH < 3.5%, Water < 21.0% - constructive element of the measuring device.
Inorganic salt <0.2% is used as indicator. The calibration of the air takes place preventively in automatic regime, regarding the CO_2

content and the humidity of the air in the 4 measuring chambers. After calibration, the actual measurements are performed immediately, automatically, through the analog contact points - sensors [5-7, 9-11].

Fig. 1. Diurnal phytomonitoring. Phytomonitor PTM-48A.
Source: Original.

RESULTS AND DISCUSSIONS

The establishment of reciprocal links of photosynthesis with other metabolic processes in the plant organism is based on the main way of researching photosynthesis. Light is one of the main exogenous factors necessary for the activity of the photosynthesis process. Performance - the light saturation curve for photosynthesis, represents the qualitative genetic level, determined by the physiological element of leaf penetration by solar radiation and the intensity of photosynthesis.
The ecological plasticity of the grapevine genotypes is determined by the structure of the foliar apparatus, the physiological state of the plants under the influence of green operations and ecological factors. As a result of the research was established the gradual increase of the initial solar radiation up to 1,000 micromol $(CO_2)/m^2*s$. Higher level of photosynthesis from 17 to Cardinal; 16 at Augustina and 15 micromol $(CO_2)/m^2*s$ at Viorica, falls within the optimal solar radiation of 1,000-1,500 micromol $(CO_2)/m^2*s$. The light intensity of 1,500-2,200 micromol $(CO_2)/m^2*s$ initiates the process of saturation and gradual decrease of the photosynthesis intensity up to 6 micromol $(CO_2)/m^2*s$. The performance - of the light saturation curve for photosynthesis, represents the modification of the Michaelis-Menten equation by the positive correlation between the light intensity and the photosynthesis intensity depending on the studied factors (Fig.2).

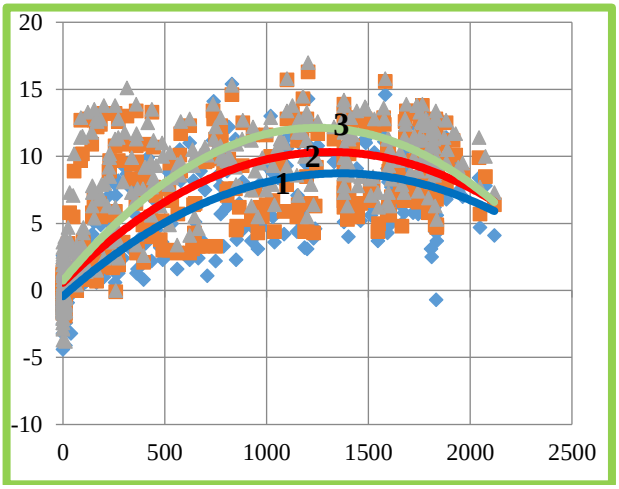

Fig. 2. Light saturation curves for photosynthesis. (1. Viorica; 2. Augustina; 3. Cardinal).
Source: Own design reflecting the obtained results (Original).

The lighting conditions of the leaves are directed in the vineyards, through technical agronomic interventions on the habitus of the plants: the orientation of the rows, the density of the plants, the form of management and the operations in green. The temperature of 20-25°C is considered optimal for the activity of photosynthesis. In the case of growing vines in warm areas, this optimum can be much higher (about 30-35°C). Most authors, when referring to the optimal temperature level, consider the air temperature, but there are also authors who mention the leaf temperature. Meteorological measurements of temperature,

humidity and dew point (Fig. 3.) confirm the performance - light saturation curve for photosynthesis.

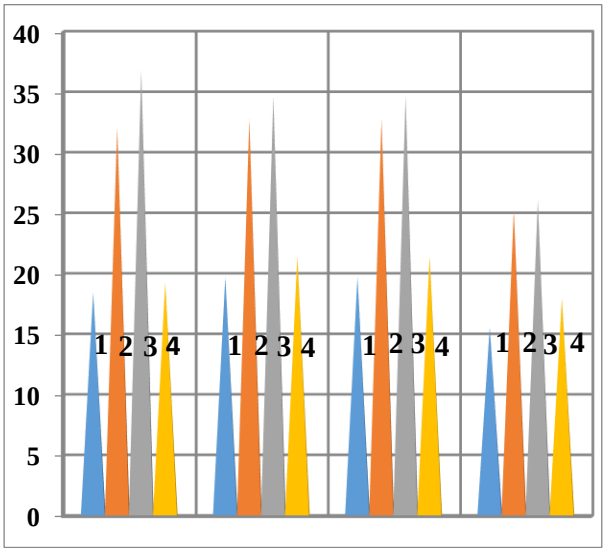

Fig. 3. Phytomonitoring temperature, humidity and dew point.
Note: 1. Absolute humidity (g/m^3). 2. Air temperature (°C). 3. Leaf temperature (°C). 4. Dew point (°C)).
Source: Own design based on the obtained results (Original).

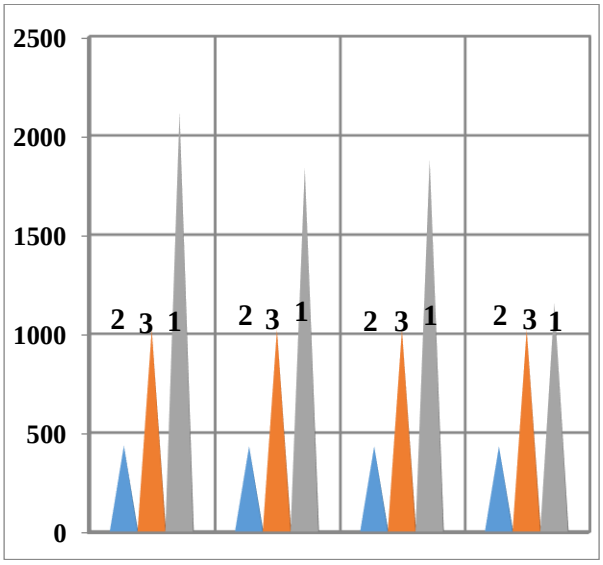

Fig. 4. Phytomonitoring
Note: 1. Radiation (micromol/m^2*s). 2. CO_2 conctration (ppm), 3. Atmospheric pressure (mbar)).
Source: Own design reflecting the obtained results (Original).

The phytonomonitoring researches allowed the determination of the weather factors through the direct connection with the vine plants, in the weather conditions of 2020. On 09.06.2020, before the green operations, the weather data (Fig. 3.), demonstrate a temperature of 35°C air and 36°C leaf. The humidity of the air is 18 g/m^3 and the dew point is 19°C (decisively indicates the plant protection process). On the day of green operations, on 10.06.2020, the air temperature drops to 33°C and the leaf to 34°C, the air humidity - 19 g/m^3, and the dew point - 21°C. After performing green operations, on 11.06.2020, the air temperature level remains unchanged at 33°C, the leaf level - 34°C, the air humidity at 19 g/m^3 and the dew point - 21°C. On 12.06.2020: we observe the optimal air temperature of 25°C, the leaf - 26°C, the air humidity - 15 g/m^3 and the dew point - 17°C (Fig. 4.).

Photosynthetic activity, in the presence of sufficient illumination associated with optimal temperature and increased air humidity, is intensified 1.5-2 times by increasing the CO_2 concentration to 0.04-0.1%. The leaves of the grapevine, with a high content of organic acids, record the maximum activity of photosynthesis, in the presence of a concentration of 10% CO_2. The weather conditions (Fig. 4) before the green operations, on 09.06.2020, show a high level of radiation of 2,000 micromol/m^2*s, CO_2 concentration of 430 ppm and atmospheric pressure of 1,000 mbar. On the day of the green operations, on 10.06.2020, the radiation level decreases to 1,800 micromol/m^2*s, but the CO_2 concentration is maintained at 430 ppm and the atmospheric pressure - 1,000 mbar. After performing the operations in green, on 11.06. 2020, the radiation is 1,800 micromol/m^2*s, the CO_2 concentration - 430 ppm and the atmospheric pressure - 1,000 mbar. On 12.06.2020, the solar radiation decreases up to 1,100 micromol/m^2*s, the CO_2 concentration - 430 ppm and the atmospheric pressure - 1,000 mbar. Simultaneously with photosynthesis, the process of respiration takes place, and in order to obtain the value of a real intensity of photosynthesis (crude photosynthesis) it is necessary to make a respective change in the intensity of diurnal photosynthesis. Thus, we obtain the increase in weight of the dry matter on a unit of surface of the leaves or of a plant that defines the photosynthetic productivity. Gross-net photosynthesis (Fig. 5.).

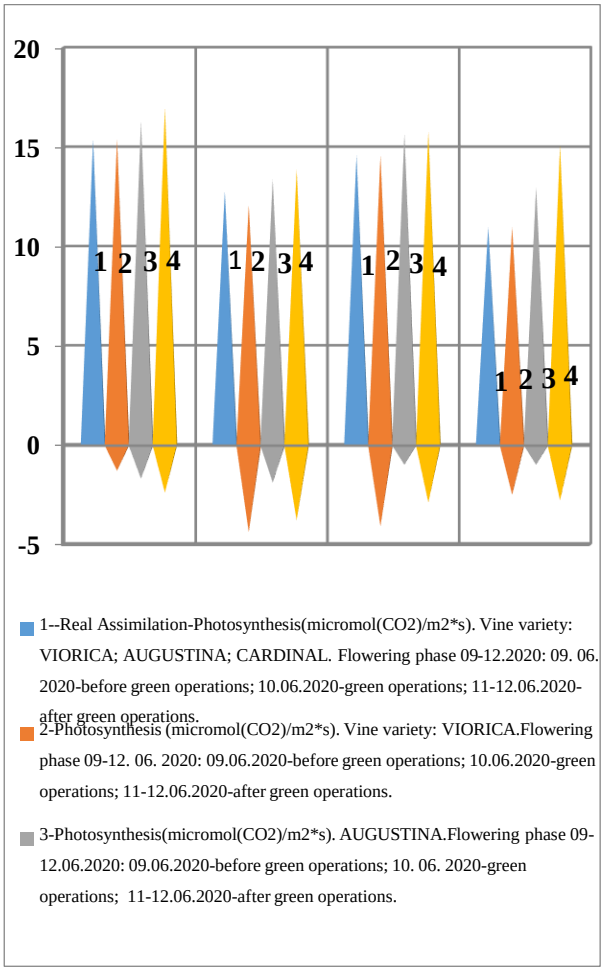

Fig. 5. Phytomonitoring crude and net photosynthesis. Source: Own design reflecting the obtained results (Original).

Grapevine plants are highly dependent on nutritional conditions and especially in low light. The yield of net photosynthesis (apparent assimilation) highlights the assimilation of organic substances by weight gain of the dry matter, relative to a certain length of time, taking into account the increase in leaf area. Soil moisture has a direct influence on the yield of net photosynthesis. Under different experimental conditions, knowing the net photosynthesis of a leaf and the total leaf area, we can appreciate the photosynthetic yield of a plant. The measurements of the gross-net photosynthesis (Fig. 4.), before the green operations, on 09.06.2020, show a higher level of the real assimilation of 15 micromol $(CO_2)/m^2$*s, photosynthesis - 18, respiration - 4 to the Cardinal variety; photosynthesis - 13, respiration - 2 in Augustina and photosynthesis - 15 and respiration - 2 micromol $(CO_2)/m^2$*s in the Viorica grapevine variety. On the day of green operations, on 10.06.2020, the upper level of real assimilation decreases sharply, reaching 13 micromol $(CO_2)/m^2$*s, photosynthesis - 14 and respiration - 4 in Cardinal; photosynthesis - 13 and respiration - 4 in Augustine; photosynthesis - 12 and respiration - 5 micromol $(CO_2)/m^2$*s for the Viorica grapevine variety. After performing green operations, 11.06.2020, we mention a return by increasing the higher level of real assimilation to 14 micromol $(CO_2)/m^2$*s; photosynthesis at 16 and respiration at 4 Cardinal variety; photosynthesis - 16 and respiration - 2 in Augustine and photosynthesis - 14, respiration - 4 micromol $(CO_2)/m^2$*s in the Viorica grapevine variety. On 12.06.2020, the upper level of real assimilation decreases to - 11 micromol $(CO_2)/m^2$*s; photosynthesis is maintained at 15 and respiration at - 4, Cardinal; photosynthesis at - 12 and respiration -2 at Augustine and photosynthesis at 11 and respiration at 3 micromol $(CO_2)/m^2$*s for the Viorica grapevine variety. In warm climates, when the leaf temperature at 2 pm reaches 46 °C, the maximum values of photosynthesis for all leaves are in the morning. In some leaves, the presence of two maxima (before and in the afternoon) was found. Photosynthesis (Fig. 6.) As a result of phytomonitoring the intensity of photosynthesis and respiration before green operations 09.06.2020 demonstrates a level of photosynthesis of 17 and respiration of 3 in the Cardinal variety; photosynthesis of 16 and respiration of 2 for the Augustina variety and 15 and 2 micromoles $(CO_2)/m^2$*s for the Viorica grapevine variety. The measurements on 10.06.2020, on the day of performing the operations in green, denote a physiological shock through the superior level of photosynthesis low of 13 and average of respiration of 3 at Cardinal; 12 and 2 for Augustina and 12 and 5 micromoles $(CO_2)/m^2$*s for the Viorica grapevine variety. After the operations in green, on 11.06.2020 the photosynthesis gradually returns to the values of 16 and the respiration of 4 to the Cardinal; 16 and 1 for Augustina and 14 and 4 micromoles $(CO_2)/m^2$*s for the Viorica grapevine variety. On 12.06.2020 the intensity

of photosynthesis is 14 and the respiration of 3 at Cardinal; 13 and 1 for Augustina and 12 and 3 micromoles $(CO_2)/m^2$*s for the Viorica grapevine variety (Fig.7.).

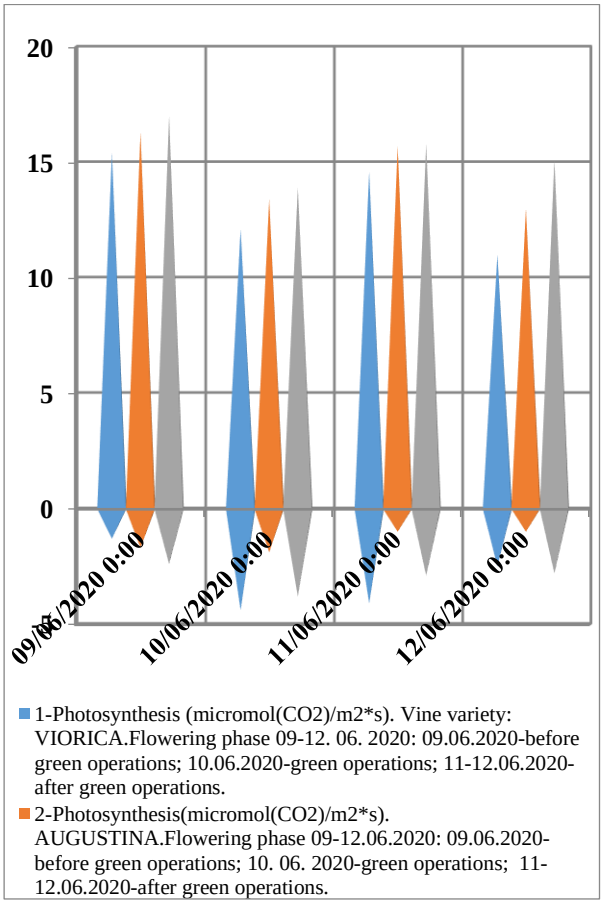

Fig. 6. Phytomonitoring photosyntesis.
Source: Own design reflecting the obtained results (Original).

Plant perspiration has a special role in the ecotype relationship, contributing to the intensification of the soil solution absorption and to maintaining the temperature of the aerial organs at a lower level during the hot days registered in summer in the vineyards. The leaf is the organ with the most intense perspiration. Water vapor loss is mainly due to stomata. Sweat measurements until green operations, dated 09.06.2020, show that the respiration for the Cardinal variety is 60, for Augustina - 51 and Viorica - 50 mg/m^2*s. Sweat measurements on 10.06.2020, on the day of the green operations, demonstrate a level of 99 mg/m^2*s for the Cardinal variety, 38 for Augustina and 42 for Viorica. After the green operations, on 11.06.2020 the level of perspiration is 49 for Cardinal, 36 for Augustina and 33 mg/m^2*s for the Viorica grapevine variety. On 12.06.2020 the level of perspiration drops sharply to 8 mg/m^2*s in Cardinal, 10 in Augustina and 9 in Viorica (Fig. 8.). Photorespiration is an inseparable process of photosynthesis, and has been shown in C_3 metabolic plants. Unlike mitochondrial (dark) respiration, present in all metabolic types (C_3, C_4, CMA), photorespiration (light sensitive), having as respiratory substrate glucose, takes place in green cells, in peroxisomes, at the level of chloroplasts [8].

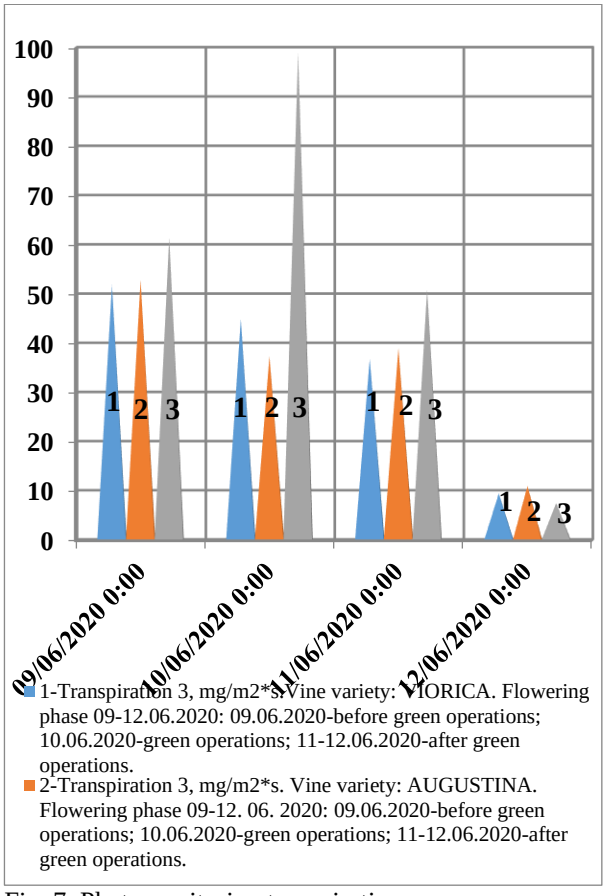

Fig. 7. Phytomonitoring transpiration.
Source: Own design reflecting the obtained results (Original).

The photorespiratory substrate is phosphoglycolate synthesized in chloroplasts in the process of photosynthesis. CO2 consumption by photorespiration generally amounts to 20-50%, compared to a maximum consumption of 20% by respiration. As a result, photorespiration reduces the rate of photosynthesis and affects plant productivity. Photorespiration research has proven difficult. Only phytomonitoring with the help of Phytomonitor PTM-48A, allowed the

necessary accumulation of data, and their processing demonstrates the real value of photorespiration in plant analysis, compared to photosynthesis, transpiration and weather factors in 2020.

Photorespiration is intensified by increasing the O_2 content in the atmosphere, even up to 100%. Stimulating effects, but for a short time, it also has light. Temperature stimulates photorespiration, up to a certain thermal level, which is generally lower than that of breathing in the dark, but higher than that of real and apparent photosynthesis [3, 4]. Research on grapevines on the variation of photorespiration and photosynthesis under the influence of light intensity and water supply, has shown that in field conditions and good water supply, CO_2 consumption by photorespiration amounts to 13.7 % for the Riesling de Rein variety, 16.1 % for the Phoenix interspecific variety of the assumed one. In the presence of water stress conditions, the intensity of photorespiration increases, the CO_2 consumption reaching 34.5 - 52.4 %. The increase of the light intensity up to 0.55 micromol/m^2*s, determines the rapid increase of the photorespiration, the CO_2 consumption reaching the maximum level. The further increase in light intensity does not influence photorespiration, it remains almost constant [11]. The photorespiration measurements performed until the green operations, dated 09.06.2020, demonstrate a level of 2.2 for Cardinal, 1.0 for Augustina and 1.2 micromol (CO_2)/m^2*s for the Viorica grapevine variety. On 10.06.2020, on the day of the green operations, the level of photorespiration is 6.0 for Cardinal, 1.1 for Augustina and 3.0 micromol (CO_2)/m^2*s for the Viorica grapevine variety. After the green operations, on 11.06.2020, the photorespiration demonstrated 3.7 for Cardinal, 1.6 for Augustina and 1.3 micromol (CO_2)/m^2*s for the Viorica grapevine variety. On 12.06.2020, the level of photorespiration reaches 2.0 for Cardinal, 0.3 for Augustina and 1.0 micromole (CO_2)/m^2*s for the Viorica grapevine variety.

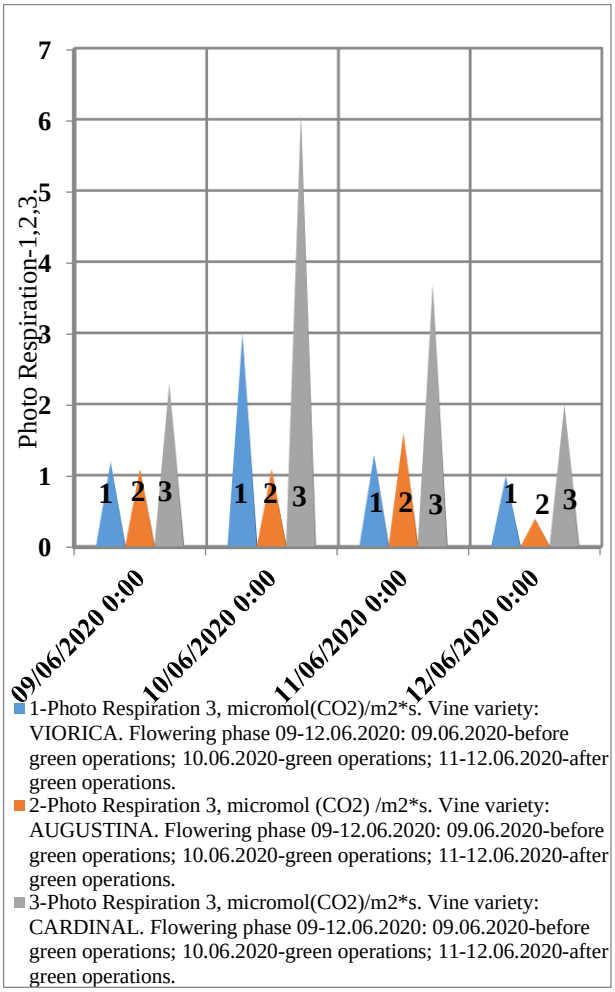

Fig. 8. Phytomonitoring Photo Respiration.
Source: Own design reflecting the obtained results (Original).

CONCLUSIONS

Performance - light saturation curve for photosynthesis, represents the qualitative genetic level, determined by the physiological element of leaf penetration by solar radiation and the intensity of photosynthesis, which can be confirmed by the intensity level of photosynthesis, perspiration, photorespiration, weather conditions and so on.

Day phytomonitoring from lysimeters, allowed to establish the reaction of physiological processes to vine genotypes, depending on green operations and fluctuations of weather factors: light, temperature, humidity, CO_2 content in the atmosphere, etc., in the conditions of 2020.

Research conducted in the time interval 09 - 12.06.2020, flowering phase, demonstrates an optimal level exceeded by weather factors: light, temperature, humidity, CO_2 content in

the atmosphere, etc., which demonstrates the essential influence of physiological processes on genotypes of vines.

Research on photosynthesis, transpiration and photorespiration in vine genotypes, presents a stable ecological plasticity in Augustina, fluctuated in Viorica and increased in the Cardinal vine variety, depending on the influence of green operations and the fluctuation of the weather factors of 2020.

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CLIMATE FACTORS OF COMPETITIVENESS OF THE RUSSIAN AGRI-FOOD COMPLEX

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Abstract

After the signing of the 2015 Paris Climate Agreement, the documenting decline in the carbon balance will play an increasingly important role in strengthening the competitiveness of products in the global market. In early 2021, the Russian Federation clarified the methodology for accounting for the deposition of greenhouse gases by natural ecosystems, which takes into account forests on agricultural land as part of "managed forests", which allows agricultural producers to demonstrate their contribution to reducing greenhouse gas emissions. A significant reduction in the area of agricultural crops in Russia at the beginning of the XXI century opens up the possibility of expanding the area of "managed" forests on agricultural land. In the Russian Federation, the accounting of emissions into the atmosphere of combustion products, including carbon dioxide, has been conducted for several decades. In modern conditions, it is worth studying the experience of monitoring forests planted in the late twentieth and early twenty-first centuries in Russia as part of the implementation of the Kyoto Protocol in order to sell carbon sequestration quotas. The implementation of the RUSAFOR – SAP project has shown the feasibility of using unused agricultural land for afforestation using technologies that provide the maximum increase in carbon dioxide deposition. This experience can be used to finance carbon-dependent forest plantations to confirm the commitment of food producers to zero carbon emissions. To implement the identified opportunities, it is necessary to take a set of organizational measures, including combining the results of monitoring the state of agricultural land and the impact of agricultural production on the environment in a single information system.

Key words**:** *carbon tax, agriculture, forest, mitigation, monitoring, agrolandscape*

INTRODUCTION

In the present conditions of the first quarter of the XXI century, producers and consumers of food products pay increased attention to reducing the negative impact on the environment, including climate change. Such attention is manifested in the desire to achieve a zero balance of greenhouse gas emissions, primarily carbon dioxide, in the production of their products. Documentary evidence of a reduction in the carbon balance is also important for improving the competitiveness of products on the world market. In early 2021 in the Russian Federation, the methodology for accounting for the deposition of greenhouse gases by natural ecosystems has been clarified, which takes into account forests on agricultural land as part of "managed forests" [12], which allows agricultural producers to demonstrate their contribution to reducing greenhouse gas emissions.

The possibility of expanding the area of "managed" forests on agricultural land in Russia is associated with the reorientation of agricultural producers to intensify production, which led to a significant reduction in the area of agricultural crops (Figure 1). In 2019, the area of crops decreased by 36% compared to 1980, including grain crops decreased by 38%, but sunflower crops - the most profitable crop, increased by 3.6 times. Uncultivated land is often overgrown with random forest-shrub vegetation, in many cases such land is transferred to the forest fund lands. Only in 2008, agricultural companies, by decision of federal, regional and municipal authorities, transferred 647.8 thousand hectares from agricultural land to forest land, including 447 thousand hectares in the Nenets Autonomous District, located in the Arctic zone [8, p. 21].

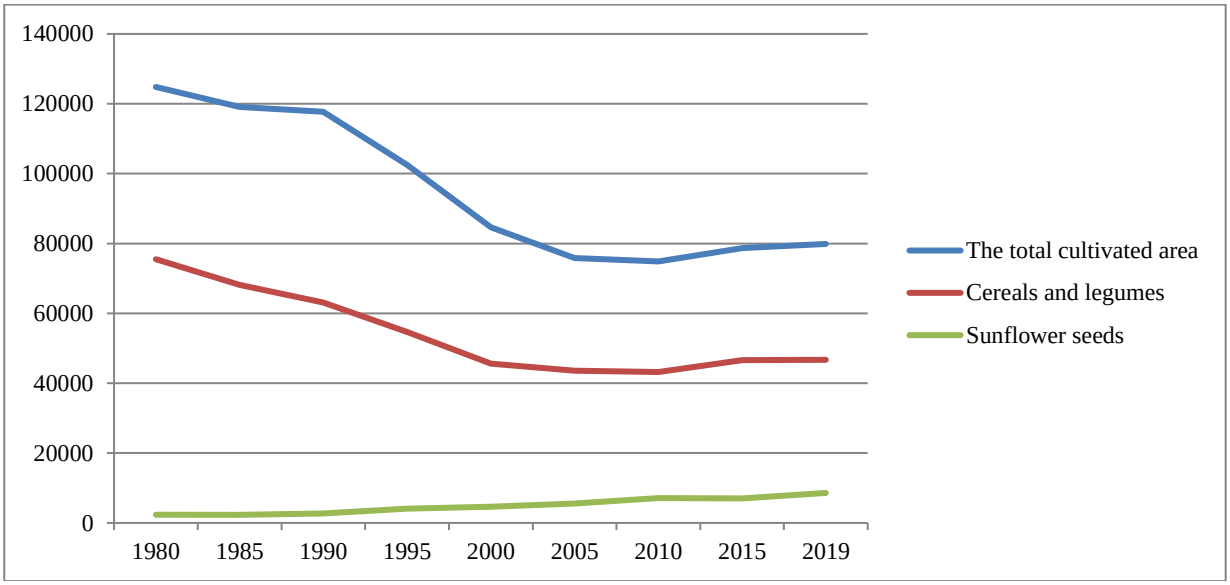

Fig.1. Dynamics of the area of agricultural crops, including cereals and sunflowers in Russia in 1980-2019
Source: [15].

The intensification of agricultural production has led to an increase in food production in Russia and to the expansion of its export opportunities [5]. In this regard, the Russian Federation faces the urgent task of overcoming future barriers to exports and deploying a domestic carbon monitoring system. It is necessary to combine the existing subsystems for collecting information on the state of environmental components, sources and depositors of greenhouse gases, and the best available technologies that help reduce their negative impact on the Earth's atmosphere. It is also necessary to create a subsystem for calculating "nationally determined contributions" to reducing carbon dioxide emissions in accordance with the Paris Climate Agreement of December 12, 2015 [18], adopted by the Government of the Russian Federation on September 21, 2019 [17].

The most important scientists of the country, such as A. M. Sergeev and V. A. Sadovnichy, point out the need to counteract a possible threat [11]. The seriousness of the European Union's intentions to increase the production of "green products" and, accordingly, to use economic instruments to protect its market from imported products that are not certified according to European "green" standards is confirmed by the EU Council's Recovery and Resilience Facility (RRF). The RRF was approved in February 2021 and provides for the use of €672.5 billion to help the 27 EU member states overcome the consequences of the COVID-19 pandemic, while simultaneously transforming the economy and society in a green and digital way. These funds will be allocated for the implementation of programs of the EU member states, provided that at least 37% of the costs are used for environmental transformation [20]. Most likely, compliance with this requirement will lead to an increase in the cost of food produced in the EU, and protective measures against imports will be required.

Calculations carried out by Russian scientists show that the application of an import duty in the form of a "carbon tax" to exported Russian products will lead to significant financial losses and slow down the renewal of production assets [3], while competing countries will have the opportunity to discriminate against Russian goods [14]. Carbon monitoring should provide reliable accounting of carbon dioxide emissions and uptake, and the Federal Scientific and Technical Program for Environmental Development of the Russian Federation and Climate Change for 2021-2030 is being developed in Russia to create it [4]. The aim of the study is to identify opportunities to improve the competitiveness of the Russian agri-food complex by implementing a targeted policy in the field of climate protection using the Russian experience gained in the creation

of carbon-depositing forests on agricultural land in the framework of the Kyoto Protocol.

MATERIALS AND METHODS

Accounting for emissions of combustion products, including carbon dioxide, into the atmosphere has been conducted for several decades in the Russian Federation. The tasks, structure and methodology of monitoring anthropogenic changes in the natural environment in Russia were formulated in 1974 [9]. This information was mainly used to calculate the amount of payments for emissions, which were used as an economic tool to stimulate the improvement of atmospheric air quality. The tasks of monitoring carbon dioxide emissions were radically expanded in 1997. After the Kyoto Protocol to the United Nations Framework Convention on Climate Change (adopted in 1992) was signed by most countries of the world. The Kyoto Protocol entered into force in 2005, this document provides for monitoring compliance with restrictions on greenhouse gas emissions and, in addition to monitoring emissions, monitoring commercial forest plantings that absorb carbon dioxide in the process of their growth. The volume of carbon dioxide uptake by such forests is considered as a commercial product that can be sold to industrial enterprises as quotas for additional emissions [2, p.389]. The potential possibility of obtaining financing for planting forests has aroused great interest among the owners of agricultural land in Russia. Forest plantations on agricultural land are carried out for various purposes: to protect arable land from dry winds, to combat soil erosion and the formation of ravines, to protect reservoirs, to create recreational zones near settlements, etc. The ability to sell quotas for deposited carbon allowed for additional investment to be raised to recover the cost of creating planted forests.

Under the current conditions of the Paris Agreement, the experience of monitoring forests planted in Russia in the late twentieth and early twenty-first centuries in order to sell carbon sequestration quotas can be used to finance carbon-depleting forest stands and confirm the desire of food producers to zero carbon emissions. In 2008-2012, it was planned to land 25 thousand hectares of carbon-deposing plants (Kyoto forests) in the European part of Russia, including 3 thousand hectares in the Saratov region [10], where a significant part of the new forests were planted on the land of agricultural enterprises that had gone out of circulation.

The creation of Kyoto forests was preceded by experiments on Joint implementation projects for the creation of carbon-intensive forests; one of the first was the Russian-American project "RUSAFOR-SAP" in the Saratov region. The aim of the project was to assess the biological and organizational possibilities of creating carbon-absorbing forests in the regions of Russia, as well as to assess the institutional and economic possibilities of managing such forests in Russia as elements of the CO_2 stocks system. The RUSAFOR-SAP project can be considered as a model for the formation of carbon units by forests on agricultural land, a total of 400 hectares of forest were planted on two plots. In the course of the project, approaches were developed to organize the interaction of stakeholders, methods for assessing the amount of carbon dioxide deposited by various tree species, assessing the expected results of planted forests, not only economic from the future sale of carbon units, but also water protection, recreational and others. As shown by economic calculations of the cost recovery for planting new forests and caring for them, taking into account the payback period of investments in different districts of the Saratov region, on the right bank of the Volga, where there is relatively sufficient precipitation, investments in new forest planting could be paid off by selling quotas for deposited carbon. In left-bank areas with arid climates, financial support from the federal or regional budgets is needed [21]. In general, the implementation of the RUSAFOR – SAP project has shown the feasibility of using unused agricultural land for afforestation using technologies that provide the maximum increase in carbon dioxide deposition.

The need to take into account the different carbon intensity of different tree species when planning protective forest plantations in agricultural landscapes is demonstrated by the results of studying the processes of accumulation of phytomass and carbon in the state protective forest strip in the steppe zone on the territory of the Stavropol Krai. These spaces more than 50 years survived in the steppe conditions, has approached or reached a ripe age, as shown by measurements taken by scientists of the Novocherkassk engineering and land reclamation Institute and the Don state agrarian University, the values of specific volume figure is the accumulated carbon per 1 ha of area different for different combinations of planted forest species is 2.4 times: from 80 to 195 t/ha. Thus, the specific costs of depositing 1t of CO_2 in protective forest plantings may differ several times, which makes it necessary to take into account the depositing capacity of different variants of the planned protective forest plantings [16].

Also, when assessing the effectiveness of planted forests, it is necessary to take into account the risks of partial or complete destruction of trees. The causes of death or damage to forest stands in the steppe zone can be the depressing effects of weeds in the first years of growth, drought, exposure to wild and domestic animals, diseases, insect damage. Steppe fires are particularly dangerous, and the probability of fires should be taken into account when choosing tree species. To counteract the existing threats, it is necessary to systematically implement measures for the care of forest stands, including annual plowing to protect against fire.

RESULTS AND DISCUSSIONS

Russia's agriculture sector has a whole range of opportunities to participate more actively in solving the problems of increasing carbon deposition in order to reduce the impact of the entire country's economy on climate change. As a rule, measures aimed at reducing greenhouse gas emissions simultaneously allow us to solve other environmental problems: to prevent soil degradation, to reduce the flushing of pollutants into water bodies. Comprehensive environmental protection measures contribute to a significant improvement in the quality of drinking water, create the possibility of organizing the production of organic and other "green" food products. To realize these opportunities, a set of organizational measures must be taken.

First of all, it is necessary to expand the tasks of federal and regional information and analytical systems on agricultural land in order to facilitate the collection of information on the emission and absorption of greenhouse gases, to identify areas of land where agroforestry measures are required, including the planting of forest stands, as well as to identify land masses suitable for the organization of the production of organic products or products with improved characteristics [1]. The Unified Federal Information System on Agricultural Land and Land Used or Provided for Farming as Part of Other Categories of Land (EFIS ZSN) has been functioning in the system of the Ministry of Agriculture of the Russian Federation (Ministry of Agriculture of the Russian Federation) since 2018, and more than 20 regional information systems containing information on the state and use of agricultural land are also functioning.

Noteworthy is the experience of the agro-industrial segment of the regional geoinformation system of the Moscow region, which contains data on agricultural land, including the contours of agricultural fields and their characteristics, on particularly valuable productive agricultural land, information on reclaimed land, unused land and their involvement in agricultural turnover. Based on the results of the work performed in 2018 and earlier, the data on the boundaries of 1.26 million hectares of agricultural land that are subject to mandatory use in crop production were clarified. In addition, contours were identified, including isolated coastal strips, which, as a rule, are planted with forest plantations in order to prevent soil flushing [8, p.258, 169]. FAO and UNECE studies indicate a direct relationship between water quality in reservoirs and the presence of forested coastal strips [7].

Another area of effective use of planted forests in agriculture is the transformation of degraded and unproductive arable land into pastures based on the principles of adaptive forest reclamation. Long-term research by scientists of the Federal Scientific Center for Agroforestry of the Russian Academy of Sciences allowed them to establish measures for the formation of adaptive agrolandscapes (forest pastures), where forest protective strips occupy up to 10% of the land. The risk of implementing agricultural landscape transformation projects is associated with the need for investments in the amount of several thousand rubles per 1 ha of land with the withdrawal of land from circulation for at least 4 years to ensure the safety of plantings [19]. At the same time, investments in forest pastures will increase the production of beef and lamb, which are in short supply in Russia. The ability to declare the amount of carbon deposited by new forests can serve as an incentive for investors, but state support will definitely be required, especially at the stage of developing science-based projects for the transformation of agricultural landscapes.

Government support measures can motivate investors to invest in the transformation of agricultural landscapes across the country, especially when choosing land areas are sufficient for the organization of commercial production of organic and other types of "green" food products, such as products with improved characteristics. For the preparation of such projects, it is necessary to unify information systems that ensure the storage and processing of monitoring results carried out by various departments, and to coordinate departmental projects in order to ensure a favorable state of the rural environment and preserve the competitive advantages of Russian food products. Accordingly, projects aimed at preserving soil fertility and reducing the negative impact on the environment should be carried out within the framework of integrated environmental projects (IEP) of the state programs for the development of agriculture and rural areas.

Performance indicator IEP can serve as an integral indicator of growth in the number of rural districts, which meet the requirements of an "favorable state of the environment" or "satisfactory state of the environment". The criteria for assessing the environmental friendliness of each rural district can be indicators of the state of soils, reservoirs, and atmospheric air in accordance with the standards of maximum permissible concentrations of harmful substances (MPC), requirements for reclaimed land and protected areas, as well as indicators of compliance with environmental requirements by agricultural producers [13]. Some of the requirements for farmers contained in the “statutory management requirements” (SMR) and the “good agricultural and environmental conditions” (GAEC), applied within the framework of the Common Agricultural Policy of the European Union, can also be used [6].

Information for the calculation of the integral performance indicator of the IEP should be generated automatically based on the data of the Unified Information System on Agricultural Land (EFIS ZSN), which will free potential investors from collecting additional documents when receiving state support or loans. Rural districts that meet the requirements of the "favorable state of the environment" can be recommended to investors for the development of organic production. A satisfactory assessment can serve as a basis for organizing the production of products with a geographically defined place of production. The ability to inform potential consumers about the degree of environmental well-being of production sites creates additional competitive advantages for the export of Russian products, organic and with a specific place of production.

CONCLUSIONS

One of the most important conditions for improving the competitiveness of the production potential of the country's agri-food complex is to increase the number of measures to transform agricultural landscapes in order to preserve soil fertility, reduce the negative impact of agricultural production on water resources; also, Russian agriculture has a whole set of opportunities for more active

participation in solving the problems of increasing carbon deposition in order to reduce the impact on climate change. Many conservation measures involve increasing the area of forests on agricultural land.

To fulfill this condition, we consider it necessary:

- to combine in a single information system the results of monitoring the state of agricultural land and the impact of agricultural production on the environment, conducted by various government departments, in order to coordinate departmental projects to ensure a favorable state of the environment in rural areas;
- to continue work on the establishment by the Agency for Water Resources of Russia and the subjects of the Russian Federation of the boundaries of water protection zones and coastal protective strips for water bodies in order to prevent the flushing of soils into reservoirs;
- to use the integrated indicator of the effectiveness of integrated environmental projects to evaluate projects aimed at preserving soil fertility and reducing the negative impact on the environment within the framework of the unified state program for the development of agriculture.

The practical application of the proposed approach to identifying opportunities for increasing the participation of agricultural enterprises in mitigating the negative impact of the economy on the climate is to modify the practice of planting carbon-depositing forests on unused agricultural land in accordance with the Kyoto Protocol, in the transition to integrated projects for the transformation of agricultural landscapes.

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ASPECTS REGARDING THE EVOLUTION OF THE NUMBER OF OPERATORS IN ORGANIC AGRICULTURE IN ROMANIA AND IN PRAHOVA COUNTY

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Abstract

This paper represents an analysis of how the number of operators in the organic agriculture sector in Romania, in general, and in Prahova County, in particular, has evolved. The analyzed interval is 2010-2019 for the world and European level and 2010-2020 for national level, period for which complete data were found. The global and European context regarding this indicator of organic agriculture was initially analyzed and interpreted and then the data regarding its evolution in Romania and in Prahova County. The following were analyzed: the evolution of the organic number producers, the number of processors, the number of importers and exporters of organic products, using documentation as a working method. The conclusions that emerge are that, in the context in which organic farming is considered the agriculture of the future, human society is increasingly concerned about the protection of the environment and the health of its members, this production system has expanded in recent years, in parallel. increasing the number of operators in the system. Also, Romania followed the general trend of development of the organic agriculture sector, the Romanian farmers being motivated, in increasing number, to practice this production system. Farmers in Prahova County are no exception, being certified both for organic production in the plant and animal sector and for processing, import-export and marketing of organic production.

Key words**:** *organic agriculture, organically cultivated areas, producers, processors, traders*

INTRODUCTION

Organic farming whose theoretical foundations, as a system of agricultural production, were laid with the process of industrialization of agriculture, has established itself in recent years as the best solution to solve many problems that concern scientists [13].

Thus, it is considered the agriculture of the future [5] and the only source of "living food", contributing to maintaining the health of the population by providing clean products, without pesticides and chemical fertilizers, but richer in nutrients than the products offered by conventional agriculture [1, 2].

At the same time, organic farming contributes to maintaining and even increasing soil fertility, increasing resistance to climatic pressures such as drought and high temperatures [6].

In addition, there are other arguments in favor of the large-scale expansion of this production system: recycling of organic waste, use of natural fertilizers and pesticides, non-use of GMOs, care for animal welfare, respect for the environment through conservation and development of biodiversity and prevention of environmental degradation [3, 12].

Of great importance is its role in the socio-cultural field, positively influencing community development, interactions between farmers and consumers and cooperation between farmers [8].

Therefore, it is no coincidence that this system of agriculture has evolved so rapidly in recent decades, especially after the Brundtland Report in 1986 showed how important it is to practice sustainable agriculture that meets the needs of the present without affecting generations. future [11].

Thus, organic farming is experiencing a sustained development worldwide, the areas cultivated in this production system evolving upwards from one year to another.

The data from Table 1 show that in 2019, as well as for the entire analyzed period, the region with the largest organically cultivated area is Oceania, with 35.88 million hectares, the average of the analyzed period being 21.8 million ha. In fact, Oceania also records the highest average annual growth rate, namely 12.8%. Oceania is followed by Europe with 16.52 million hectares and an average annual growth rate of only 5.7%, Latin America (8.29 million hectares and growth rate of 1.1%), Asia (5.91 million hectares and an annual growth rate of 10.2%), North America (3.64 million hectares and a growth rate of 4.4%) and Africa (2.03 million hectares with a growth rate of 4.4 %).

It can be noted that Europe ranks second in the world, with European policy paying particular attention to the further development of this highly dynamic sector [10].

Table 1. Evolution of organically cultivated area worldwide and by continent in the period 2010-2019

Zone/UM	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean	Variation coeficient	Anual growth rate
	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	mil ha	%	%
Africa	1.1	1.1	1.1	1.2	1.3	1.7	1.7	1.9	1.9	2.0	1.4	26.5	7.4
Asia	2.5	3.7	3.2	3.4	3.5	3.8	4.9	6.0	6.4	5.9	4.1	32.8	10.2
Europe	10.0	10.5	11.2	11.4	11.8	12.7	13.5	14.4	15.6	16.5	12.3	17.8	5.7
Latin America	7.5	7.0	6.9	6.7	6.8	6.9	7.5	8.0	8.0	8.3	7.3	7.9	1.1
Nord America	2.5	3.0	3.0	3.0	2.5	3.0	3.1	3.2	3.3	3.6	3.0	12.2	4.4
Oceania	12.1	11.4	11.4	17.3	22.9	22.3	27.3	35.9	36.0	35.9	21.8	46.8	12.8
Total mondial	35.7	36.7	36.8	43.7	48.7	50.4	58.1	69.4	71.2	72.3	50.1	29.3	8.1

Source: FIBL, 2021, Statistical data, www.fibl.org, Accessed on March 10, 2021 [4].

Along with the development of the organic agriculture sector, the parallel development of the organic products market is noticeable, its growth being generated by the growing demand of consumers of organic products. It can be noticed that a high consumption of organic products is registered in the countries with developed economy, where the living standard of the population is high. Thus, worldwide, in 2019, the highest consumption of organic products per capita is recorded in: Denmark (344 €/head), Switzerland (338 €/head), Luxembourg (264 €/head), Austria (215 €/head) (Table 2).

Denmark also records the highest average of the period 2010-2019, namely 198.9 €/head. Romania, in 2019, recorded a consumption of only 2 €/head, although the annual growth rate is 14.9%.

Moreover, it should be noted that the Romanian market for organic products did not provide enough data to make a correct assessment of the situation at a given time.

Table 2. Evolution of consumption of organic products per person, in the countries with the highest consumption, in the period 2010-2019

Zone/UM	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Average**	**Variation coefficient**	**Annual growth rate**
	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	€/pers	%	%
Austria	118	127	126	125	148	158	177	196	205	215	153.3	23.8	6.9
Belgium	30	30	35	38	40	48	53	56	61	68	43.4	30.6	9.5
Denmark	142	142	158	163	162	190	243	278	312	344	198.9	37.8	10.3
Finland	14	30	37	39	41	43	49	56	60	66	41.0	37.1	18.8
France	52	57	61	66	73	83	100	118	136	173	82.9	47.8	14.3
Germany	73	82	86	92	96	106	116	122	131	144	100.4	22.9	7.8
Italy	26	28	31	33	35	38	43	51	57	59	38.0	31.4	9.5
Luxemburg	129	133	142	156	163	166	188	203	221	264	166.8	25.7	8.3
The Neatherlands	39	41	47	54	57	58	62	64	68	71	54.4	20.1	6.9
Norway	29	30	40	54	63	68	75	79	79	82	57.4	35.8	12.2
Romania	0	0	0	0	1	1	2	2	2	2	0.9	106.1	14.9
Spain	19	20	21	21	25	32	36	42	46	46	29.1	37.9	10.3
Sweden	86	96	95	108	141	194	224	237	230	214	156.8	40.2	10.7
USA	55	57	69	74	82	109	118	122	124	136	90.0	33.8	10.6

Source: FIBL, 2021, Statistical data, www.fibl.org, Accessed on March 10, 2021 [4].

As a volume of the total market value for organic products, Germany stands out, which in 2019 reached a level of 11,970 million Euros and France with 11,295 million Euros. France also recorded a high average annual growth rate of 14.3%. Romania has the highest average annual growth rate, 19.6%, although the Romanian market for organic products is a small, emerging market. Finland (18.8%), Norway (13.4%) and Sweden (11.5%) also recorded high growth rates in the period 2010-2019 (Table 3).

Table 3. Evolution of the market value of organic products in the countries with the highest consumption in the period 2010-2019

Zone/UM	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	Variation coefficient	Annual growth rate
	mil €	mil €	mil €	mil €	mil €	mil €	mil €	mil €	mil €	mil €	mil €	%	%
Austria	986	1,064	1,064	1,064	1,260	1,360	1,541	1,723	1,810	1,920	1,319.1	26.4	7.7
Belgium	333	340	391	424	438	536	600	627	698	779	487.4	31.8	9.9
Canada	1,903	1,903	2,135	2,375	2,523	2,757	3,001	3,001	3,118	3,480	2524.0	21.4	6.9
Denmark	791	881	887	917	912	1,079	1,392	1,600	1,807	1,978	1,140.7	38.2	10.7
Finland	80	163	202	215	225	240	273	309	336	378	227.0	38.3	18.8
France	3,384	3,764	4,020	4,383	4,830	5,534	6,736	7,921	9,559	11,295	5,570.1	48.1	14.3
Germany	6,020	6,440	6,970	7,420	7,760	8,620	9,478	10,340	10,910	11,970	8,217.6	24.5	7.9
Italy	1,550	1,720	1,885	2,020	2,145	2,317	2,644	3,137	3,483	3,625	2,322.3	31.8	9.9
Luxemburg	65	68	75	84	90	94	108	122	129	160	92.8	32.6	10.5
The Neatherlands	656	697	781	912	890	991	1070	1103	1164	1211	918.2	21.1	7.0
Norway	142	149	201	276	325	351	394	418	422	441	297.6	38.4	13.4
Romania	8	10	11	14	24	24	40	40	40	40	23.4	59.2	19.6
Span	906	965	998	1,018	1,203	1,498	1,641	1,903	2,133	2,133	1,362.8	35.9	10.0
Sweden	803	908	905	1,029	1,363	1,892	2,207	2,366	2,300	2,143	1,530.3	42.5	11.5

Source: FIBL,2021, Statistical data, www.fibl.org, Accessed on March 10, 2021 [4].

In terms of the market share of organic products, in the total food market, the highest share, on average of the period 2010-2019, is recorded in Denmark, ie 7.8% of the total food market. Denmark is followed by Austria with 6.9%, Sweden with 5.9% and Luxembourg with 4.9%. The highest annual growth rates were recorded in the Netherlands, 16.7%, followed by France and Italy and Belgium with 13% (Table 4).

Table 4. Evolution of the share of the market value of organic products, in the total food market, in the countries with the highest consumption, in the period 2010-2019

Area/UM	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	Variation coefficient	Annual growth rate
	%	%	%	%	%	%	%	%	%	%	%	%	%
Austria	6	6	6	6	7	7	8	8	8	9	6.9	16.0	4.6
Belgium	1	1	1	1	2	1	2	2	3	3	1.6	52.9	13.0
Canada	2	2	2	2	2	2	2	2	2	3	2.0	15.8	4.6
Denmark	6	6	6	7	7	8	9	10	11	12	7.8	28.3	8.0
Finland	1	1	1	1	1	1	1	2	2	2	1.2	39.5	8.0
France	2	2	2	2	2	2	3	4	4	6	2.6	53.6	13.0
Germany	3	4	4	4	4	4	4	5	5	5	4.1	15.4	5.8
Itally	1	1	1	2	2	2	3	3	3	3	2.0	43.8	13.0
Luxemburg	3	3	4	4	5	5	6	7	7	8	4.9	35.8	11.5
The Neatherlands	1	2	2	2	3	4	4	4	4	4	2.9	40.0	16.7
Norway	1	1	1	1	1	1	1	1	1	1	1.0	0.0	0.0
Spain	0	0	0	1	1	1	1	2	2	2	0.9	91.9	12.2
Sweden	4	4	3	4	6	7	7	9	9	9	5.9	39.9	9.4

Source: FIBL,2021, Statistical data, www.fibl.org, Accessed on March 10, 2021 [4].

For Romania, organic farming is an important niche in agriculture which could support the farmers who are interested to carry out organic products respecting the EU legislation in the field, as due to their high quality these products are more and more preffered by consumers and prices are higher than for the products achieved in the conventional

agriculture assuring a higher income and profitm therefore a higher farming efficiency [9].

In this context, the purpose of the paper was to analyze the dynamics of the number of operators in organic farming (producers, processors, traders etc), the cultivated areas, the value of organic products in the world, the EU and Romania and also in Prahova County in the period 2010-2019.

MATERIALS AND METHODS

Following the above, we can say with certainty that in economically developed countries, with a high standard of living, organic farming has developed much faster than in countries with a less developed economy. As we have seen, this is clearly manifesting itself at European level. This article highlights a series of aspects regarding the indicators of organic agriculture in Romania and in Prahova County with the help of an analysis of the evolution of the number of operators in the sector, in comparison with the existing situation at European level. The analysis is based on statistical data provided by Eurostat and FIBL for the situation at World and European level and, in addition, for the situation in Romania and Prahova County, based on data available on the Ministry of Agriculture and Rural Development website. The interpretation of the data was performed, using as statistical indicators: the average, the coefficient of variation, then calculating the annual growth rate of the period.

RESULTS AND DISCUSSIONS

At the level of the European Union, the main indicators analyzed were: the area cultivated in organic system, the number of producers in the system, the total value of organic production, the value of production per ha and the value of production per producer in organic system.

In the period 2010-2019 the growth rate for the organically cultivated area was 5.4% and the coefficient of variation was 16.6%. The number of producers in the system had a growth rate comparable to that of the surface, ie 5.1%, the coefficient of variation being 14.5% (Table 5).

Table 5. Evolution of the main indicators of organic farming in the European Union, in the period 2010-2019

Year/UM	Organic area	Producers	Total value	Value/ha	Value/ producer
	Thousand ha	No.	mil €	Hundreds €/ ha	Hundreds €/ prod
2010	9,074	220,421	18,029	1.99	81.8
2011	9,469	236,009	19,642	2.07	83.2
2012	9,980	253,381	20,852	2.09	82.3
2013	10,170	256,432	22,115	2.17	86.2
2014	10,383	256,272	23,895	2.30	93.2
2015	11,135	269,111	27,350	2.46	101.6
2016	12,048	295,123	30,801	2.56	104.4
2017	12,820	305,610	34,637	2.70	113.3
2018	13,763	327,631	38,384	2.79	117.2
2019	14,580	343,858	41,452	2.84	120.5
Average	11,342	276,385	27,716	2	98
Variation coefficient (%)	16.6	14.5	29.8	13.2	15.3
Grow rate (%)	5.4	5.1	9.7	4.1	4.4

Source: FIBL,2021, Statistical data, www.fibl.org, Accessed on March 10, 2021 [4].

The total market value of organic products registered a higher coefficient of variation of 29.8%, and the growth rate was 9.7%. For the value calculated per ha of organic products, the coefficient of variation was 13.2% and the growth rate of 4.1%. Another indicator, the value per producer, registered a coefficient of variation of 15.3% and a growth rate of 4.4%.

The same indicators analyzed for Romania reveal the following aspects (Table 6):

- The area under organic farming had a higher coefficient of variation and growth rate than those recorded at EU level of 21.8% and 9% respectively;
- The number of producers also recorded a higher coefficient of variation and growth rate than at EU level, namely: 35.7% and 13.4% respectively;
- The total market value registered a coefficient of variation of 25% and the growth rate 53.3%, higher than those at EU level;
- The average value per hectare of organic products registered in Romania is only 0.091 thousand euro, unlike the average registered at

EU level, of 2 thousand euro / ha. However, the coefficient of variation is 54.03% and the growth rate is 9.1%, higher than those recorded at EU level.

Table 6. The evolution of the main indicators of agriculture in organic system in Romania in the period 2010-2019

Year/UM	Organic area	Producer	Total value	Value /ha	Value/ producer
	ha	No.	Mil. €	Hundreds €/ha	Hundreds €/prod
2010	182,706	2,986	8	0.046	2.67
2011	229,946	9,471	10	0.043	1.05
2012	288,261	15,280	11	0.038	0.71
2013	301,148	14,553	14	0.046	0.96
2014	289,251	14,151	24	0.082	1.69
2015	245,924	11,812	24	0.097	2.03
2016	226,309	10,083	40	0.176	3.96
2017	258,471	7,908	40	0.154	5.05
2018	326,260	8,518	40	0.122	4.69
2019	395,228	9,277	40	0.101	4.311
Average	274,350	10,404	25	0.091	2.7
Variation coefficient (%)	21.8	35.7	55.3	54.03	61.3
Grow rate (%)	9.0	13.4	19.6	9.1	5.5

Source: MARD, 2021, Organic agriculture (Agricultura ecologica) 2017-2020, Accessed on March 10, 2021 [7].

The analysis of the evolution of organic agriculture operators in Romania in recent years (2017-2020), by types of activities highlighted the following:

- The average of the period 2017-2020 for the number of producers in the system is 8,242. The coefficient of variation is 8.5% and the annual growth rate is 4.74%;
- For the category of processors, the average of the period 2017-2020 is 149, the coefficient of variation 22.5% and the growth rate is 11.42%;
- Operators selling organic products recorded an average of 273, a coefficient of variation of 21.7% and a growth rate of 5.94%;
- For operators operating in the spontaneous flora, the average of the period is 31, the coefficient of variation 18.7% and the growth rate is negative, -9.74%, registering a decrease in their number;
- The same situation is registered in the case of operators in organic aquaculture, with a negative growth rate of -36.10%;
- Importers and exporters in the organic production system also show negative growth rates, ie -20.63% for exporters and -6.47% for importers (Table 7).

Table 7. Evolution of the number of operators in organic agriculture, by types of activities in Romania, during 2017-2020

Operators/ UM	2017	2018	2019	2020	Media	Stand. dev.	Variation coefficient (%)	Growth rate (%)
	No.	No.	No.	No.	No.		%	%
Producers	7,381	8,069	9,035	8,481	8,242	697	8.5	4.74
Processors	120	121	187	166	149	33	22.5	11.42
Traders	233	226	355	277	273	59	21.7	5.94
Spontaneous flora	34	38	28	25	31	6	18.7	-9.74
Acvaculture	23	32	11	6	18	12	65.3	-36.10
Importers	11	13	15	9	12	3	21.5	-6.47
Exporters	4	4	3	2	3	1	29.5	-20.63
Total	7,806	8,503	9,634	8,966	8,727	770	8.8	4.73

Source: MARD, 2021, Organic agriculture (Agricultura ecologica) 2017-2020 [7].

Prahova County, famous for its tradition in the wine sector, has the advantage of having a wide variety of landforms that provide favorable conditions for cereals, fruit trees, animal husbandry and forestry. In the county are organically cultivated areas that represent approximately 1.06% of the total agricultural area, organically cultivated, at the country level. The operators of the ecological system cultivate cereals and other field crops, vegetables, meadows, alfalfa, permanent crops (fruit trees, shrubs), vines, sea buckthorn, medicinal plants. Also, a number of 24 operators owned, at the level of 2018, a number of 3,069 bee families [7].

The evolution of the operators from the ecological agriculture system from Prahova county, in the period 2017-2020, had the following route (Table 8):

- The number of producers increased from 40 in 2017 to 60 in 2020, the average for the period being 58. The annual growth rate was 14.47%;
- The number of processors also increased, the average of the period being 7, and the annual growth rate of 10.6%. They process: honey and bee products, bakery products (bread, puff pastry, pretzels), wines, cocktails.

- For the traders of ecological products the growth rate was lower, of only 4%, the average of the analyzed period being of 9.
- For the export activity in 2017, 2 operators were certified and from 2018 to 2020 only one operator remained in activity, which delivers pollen for export. So the growth rate in this segment of ecological operators is negative, -29.29%.
- From the evolution of the operators in Prahova County it can be noticed the average of the period of 75 and the fact that their number increased from 56 in 2017, to 77 in 2020. The registered growth rate is 11.2%.

Table 8. Evolution of the number of operators in organic agriculture, by types of activities in Prahova county, during 2017-2020

Operators/ UM	2017	2018	2019	2020	Average	Standard deviation	Variation coeff. (%)	Growth rate (%)
	No.	No.	No.	No.	No.	No.	%	%
Producers	40	68	65	60	58	13	21.6	14.47
Processors	6	5	8	8	7	2	22.2	10.06
Commerce	8	8	9	9	9	1	6.8	4.00
Export	2	1	1	1	1	1	43.3	-29.29
Total	56	82	83	77	75	13	16.9	11.20

Source:MARD, 2021, Organic agriculture (Agricultura ecologica) 2017-2020 [7].

CONCLUSIONS

At European level there are important changes in the organic farming sector that can be highlighted:

-The organic farming sector has generally experienced a large development in the period 2010-2019. This is characteristic for the ecologically cultivated area but also for the number of producers, whose growth rate was 5.1%, close to that of cultivated areas, 5.4%.

-In Romania there was the same trend of increasing the cultivated areas and the number of producers, in the period 2010-2019, the growth rates being higher than those registered at European level.

-The average of the period 2010-2019 for producers in the organic farming system in Romania (13.4%) is higher than the average of the period of 2017-2020 (4.74%).

-In the structure of operators, by types of activities there were positive growth rates for the categories of producers, processors and traders.

-In Prahova County, most operators in organic agriculture are in the category of producers, the growth rate of their number (14.47%) being higher than that recorded nationally (4.74%).

-The category of processors in Prahova County also registered a high growth rate (10.06%), lower than the one registered at national level (11.42%)

As a general conclusion, we can say that the organic farming sector in Romania, in general, and in Prahova County, in particular, has a chance to become a strong sector, given that the National Strategic Plan 2021-2027, provides for growth the area cultivated in an ecological system at 15-20%, this desideratum being supported by the allocation of an amount of 550 million euros.

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AN ISSUE OF DEVELOPMENT STRATEGY FOR THE ROMANIAN ECONOMY IN THE EUROZONE CONTEXT

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Abstract

This paper aims to identify the mechanisms by which the state and the entire economy will be geared towards identifying feasible solutions for creating a sustainable and lasting economy. This will require reforming the role of the state in the economy, depoliticizing actions and deeds that ensure the sustainability of the economy to eliminate corruptible actions and factors supporting corruption of the statistic system and those adjacent to them. Currently, the state economy is viewed piecemeal, based on the categories of economic agents who are being assisted or with whom they are developing partnership relations. The state also influences the social and economic conditions through the legal system, through promoted actions, generating systemic attitudes and behaviors at the entire societal community's level. The state is directly involved in ensuring the welfare of society, if we look at this aspect through the prism of promoting factors of welfare, respectively endowment with factors of production, access to education, legal system that encourages the right to employment, infrastructure investments to accelerate the process of compatibility of the economies, with the auxiliary objective of creating alternative jobs but also moving to a higher stage of development in line with the principles of sustainable development.

Key words: *economy, economic orientation, state, social protection, social economy*

INTRODUCTION

Romania's economic priorities and objectives will focus on areas eligible for structural interventions and the need to correlate strategic investments in areas of interest of the Romanian economy with natural endowment with production factors. It also requires a new dimension to financial support of the European Union, amounting to around 4% of the annual GDP of Romania, plus national co-financing. This means an annual grant assistance of about three times higher than the pre-accession financial assistance granted, focusing on the following areas:

- ✓ Increasing economic competitiveness and development of the knowledge based economy
- ✓ The development and modernization of transport infrastructure
- ✓ Protection and improvement of the environment
- ✓ Human resources development, increasing employment and combating social exclusion
- ✓ Development of rural economy and increasing productivity in the agricultural sector
- ✓ Support balanced development of all regions of the country

Absorption of structural funds in the Romanian economy should catalyse all political forces to formulate and implement a necessary economic framework ascension process. Romania is in a difficult period of the initial stage-specific integration into a functional competitive economic area. The development gap to the EU economy is all the greater as the lack of funding for investment in creating jobs reverberates exponentially affecting social stability of the workforce, the obsolescence of the moral values of the society such as the interest in education, family, religion, community in favour of antisocial practices as bribery, corruption,

discrimination, facilitating crime, depreciation of neighbours and the environment. That is why increasing the absorption of structural funds would empower Romanian society, institutions and businesses alike in accessing financial resources with a lower economic cost of attracting from international financial institutions or the international capital market. The pace of absorption is very low, being the cumulative result of several influential factors, thus:

✓economic factors: reduced possibility of the authorities and the economic system as a whole to facilitate the co-financing part incumbent of Romania;

✓institutional factors: low labour flexibility of administration in relation to the volume of work and information needed to disseminate to policy makers and groups directly interested in accessing structural funds;

✓social factors: low motivation of the workforce directly involved in the management of Structural Funds, on the one hand due to low pay and, on the other hand, because of the pressure it is subjected to, from some pressure groups or excessive media coverage or even unsuitable training of the workforce for the European rigors and standards;

✓media factors: the lack of public accessibility to the means of mass information regarding the importance of structural funds makes the a low degree of access precisely because the means of producing sustainable development (for citizens in areas affected by poverty, unemployment, dropout) stand for the decision of citizens who do not perceive the imminence of running funds in highly affected areas in terms of capital;

✓factors of social responsibility: accessing European funds must become a national priority, through the prevalence of information, to unlock the co-financing sources and stimulating the process of doing management projects.

In order to adopt feasible and sustainable solutions for the economic recovery of Romania it's necessary to rethink the Romanian state, considering the following factors [1]:

− manifestation of an explicit or implicit authority over banks which represents, in almost all countries, the main channels of transferring savers capital to investors;

− management of capitalism by generating tax exemptions for certain companies or sectors, exclusive license (legal monopoly) or government contracts that service investments in certain areas with high economic potential, as well as creating jobs;

− promoting policies that encourage exports through guidance methods of economic agents towards competitive products in foreign markets and helping them through some economic levers (interest rate, exchange, rate of taxation) while also promoting substitution policies of imports to promote economic growth of some economic branches or sectors;

− promoting and supporting public services that benefit the general population, without seeking to impose which sectors or industries should prosper;

− promoting green economy and elements of renewable energy in the production of goods;

− forming a rational behaviour in relation to natural resources and consumer demand;

− identifying levers of self-elimination and elimination of corrupt practices that destroy fair competition and competitiveness of economic assets on the markets.

MATERIALS AND METHODS

The paper uses the heuristic method to achieve an understanding of the factors that influence the implementation of a strategy for the development of the Romanian economy in the context of endogenous and exogenous limits. The paper takes into account the elements of national influence, determined by the symbiosis between economic, social and political, but also the regional ones, determined by the causal relations between the principles of European economic policy and the national development program/programs. Thus, in order to create a synergy between national and European development goals, we will consider the principles set out in the *2030 Agenda for Sustainable Development* that promotes the balance between the three dimensions of

sustainable development - economic, social and environmental, their correlation with the principles *The European Green Pact* which defines the *EU Development Strategy from the perspective of becoming a climate-neutral continent by 2050* but also with the principles of the *Integrated National Plan for Energy and Climate Change 2021-2030 (PNIESC*).

The paper aims to identify national resources that, through implementation, should lead to the growth of welfare, employment, economy on the principle of sustainability. At the same time, achieving a macroeconomic balance closely follows the level of interest rates, inflation, as a means to support the business environment.

RESULTS AND DISCUSSIONS

In the content of this paper we analysed a series of factors that can contribute to the sustainable economic growth that Romania expects in order to increase societal well-being. Thus, we considered the reduction of public expenditures, in order to make rational use of economic resources, to implement a behaviour based on economic utility; adopting fiscal measures to encourage entrepreneurship and the development of the economic environment, as precursors of a sustainable economy; promoting the public-private partnership in the form of implementing the principles of economic governance, by making economic agents accountable in relation to property, assuming the decision regarding the rational use of resources, flexing the labour market, attracting investments and allocating them to areas with a high propensity to develop.

Economic Recovery Programme in Romania should focus on the following economic measures:

(i)Reducing budget expenditures

It takes the reduction of public spending measures on the background of creating prerequisites for private sector development: on the one hand to absorb redundant staff in the public sector, and on the other hand to increase the tax base (by increasing the number of firms and economic activities in the real economy) as a source of revenue to the budget used for public investment for development. Measures which will be undertaken by the government come amid a sharp social instability, marked by a lack of jobs, rising prices amid energy and fuel price changes, damaging cost of living. Perhaps applying differentiated salary and pension cut as a solution to reduce material and psychological impact of the crisis on people with low and very low incomes (Fig. 1).

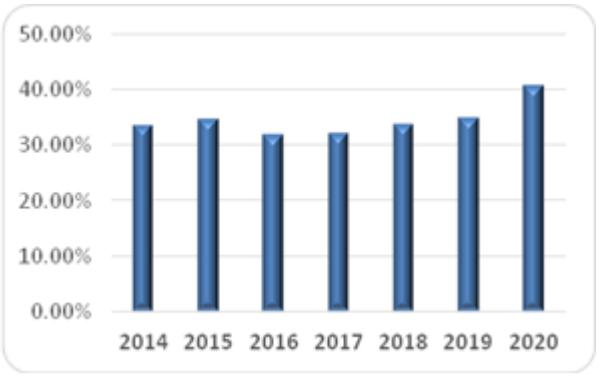

Fig. 1. Public Expenditure (% of GDP)
Source: Ministry of Public Finance, Romania [8, 9].

Besides managing the domestic economy, the government faces external pressures regarding the implementation of measures to facilitate the transition to the single European currency calendar or acceptance of specific conditions needed to implement the Europe 2020 + strategy. Thus, to enter the euro zone, Romania needs to achieve nominal convergence indicators involving measures of lowering the budget deficit to 3% of GDP, which implicitly means tough measures in the budget unit. On the other hand, the transition to Euro also requires real convergence taking measures involving, among other things, income per capita, increased purchasing power of wages in labour productivity coverage, increase capacity to support economic development (Fig. 2).

What is surprising is that to achieve real convergence necessary for transition to the euro area, Romania needs investments, especially in infrastructure, measures to support private initiative and business environment through fiscal and monetary tools, which are implicitly related to adjusting the budget deficit, respectively through increased public spending.

Fig. 2. Budget deficit
Source: Ministry of Public Finance, Romania [8, 9].

The possibility of government spectrum to adjust the economy to fall into certain budgetary and fiscal targets, and to make it more flexible and accommodate the needs of growth and development without acting through budgetary anchors, becomes somewhat uncertain [4].

European strategy for 2020+ aims to increase the employment of people between the age of 20 and 64 years, up to a rate of 75%. In this regard, the private sector must be motivated and supported to absorb the labour force: either by reviving the market, which means increased demand for economic goods, and hence the demand for labour, or by taking measures to shift the workforce towards innovative economic activities, benefiting from statistic support for development, such as developing non-conventional energy production, producing environmental goods or those goods and services that are in demand in foreign markets.

Fig. 3. Total unemployment rate
Source: Eurostat, 2021 [6].

The fact is that in Romania the active population in the sector is very high, the organizational structure of public institutions and the autonomous bodies is overloaded, which results in inefficiency of public spending in an economy that does not ensure the domestic demand for consumption. To identify the optimal number of posts required for the public system it's necessary to identify the calculation lists of needed personnel on activities and economic transactions whose performance is assessed on the basis of real benefit to society. Thus the state must be guided by the corporate principles; adjustment of expenses should be made based on the state of the economy and the premises of its growth and development.

The danger hanging over Romania, as a result of the deepening budget deficit and external indebtedness, is the loss of sovereignty over the management of the state budget, implicitly on the formation and allocation of public revenues in the economy.

The current system of governance in Romania manages the public debt system on the international financial market in the form of hot money, which it places in search of gains resulting from higher capitalization rates. The increase of the public debt is quite high but caused by the decline of the development of the economy, still framed in a growth bubble, on account of the existing potential. This fact favours the process of attracting financing for the development of sustainable economic activities. In order to make the public debt service more efficient, it will be necessary to start the process of reducing public expenditures.

At the same time, the reduction of budget expenditures will be correlated with the efficiency of public expenditures in the form of investments in durable goods. Increasing investments and their correlation with job creation will determine a welfare effect among communities but also an exposure of the population to proactive, rational behaviours.

(ii)Fiscal and monetary measures to encourage and support business

Overcoming the crisis and resuming economic growth are the concrete measures of

supporting the business environment, being able to create jobs and adapting domestic supply to the demand of economic goods. These measures involve both direct subsidies to producers of supporting the economic sectors to ensure the necessary production, development areas and regions' economic development, reducing the tax burden.

The granting of subsidies - is highly controversial in Romania. Most times, taking this measure is discretionary, by favouring certain political client or economic areas. The subsidy should be directed primarily towards economic regions with developing potential, i.e. endowed with natural resources, labour, absorption capacity and economic assets subsidy would act by facilitating the development of economic activities. Among the economic sectors that have favoured the system of subsidies include agriculture, handicraft industry, and construction, arrangements of spas, rural tourism, and development of energy production from renewable resources.

Reducing the number of taxes to attract investors and facilitate competition in the capital markets by targeting those areas where the expected return is as high as possible. Fiscal pressure is a prerequisite for the development of economy and encouraging corruption. Also, in terms of economic legality, the trader will act to increase the selling price of the product. In any case, the increase in taxes in the economy will not act to increase budget revenues there are channels through which to escape from the trap of imposing income. The loser will be the state through the loss of taxable citizens and increasing the price of products on the market or job loss.

Differentiated application of VAT is to guide the economy towards productive activity in those areas with high incidence in the production of economic goods to attract additional investment and thus jobs, or to support its initiative favouring local producers and economic development of the area.

Reduce the interest rate to increase lending, to support private initiative and business environment. As we know, the current crisis was generated by lowering the interest rate monetary policy especially in the US economy which encouraged excessive consumption at the expense of savings [3]. In Romania, the lax conditions of the financial market and the growth prospects of the economy stimulated the attraction of a huge flow of capital, especially on a speculative short-term 2004-2008. These capital inflows were used by the banking system to extend credit to support unsustainable consumption and investment. Once the international crisis was triggered, the Romanian economic sectors based on foreign capital were among the first affected; crisis came suddenly, when the interest rate has ceased to reflect the cheap money policy with a direct impact on the private sector and employment. Getting out of this situation was based on the implementation of adjustment measures severe spending in the private sector, emphasizing policies to stimulate productivity, increasing competitiveness both in price (cost reductions both material and wage but intensifying intensive use of technology and new factors of production) and in the quality of products to attract new market segments, especially in foreign markets [2].

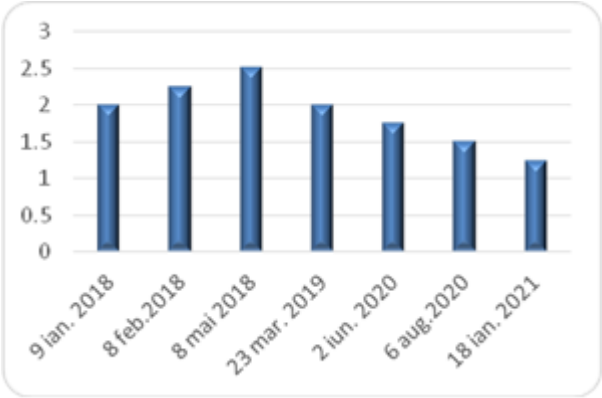

Fig. 4. Monetary Policy Interest rate
Source: National Bank of Romania, 2021 [10].

This lack of liquidity and limited access to credit has renewed especially the private system, paving the way for the adoption of development strategies based on intensive use of inputs and responding to the needs of a creditworthy category of a certain clientele.

Also, another advantage of the crisis can be identified as stimulating the saving and the eradication of wasteful tendencies manifested

by a number of operators in a position to absorbing market.

It would be ideal that most Romanian companies to manifest this attitude to the crisis. Just proliferation of large budgets for expenses, both companies and individuals or to the state of economic boom, emphasized the dramatic fall of the Romanian economy with fewer opportunities to remedy in a short period of time without international support. The IMF, together with the European Union gradually injected in Romania liquidities for economic recovery and deficit reduction, on the one hand, and the current account deficit on the other. The result is not far from a revival of the economy but widening disparities while the state budget expenditures have continued amid, deepening a contraction in the private sector. The necessary measures are promoting policies to support the private sector in order to generate income for the support of the adjusted public sector [11].

It also aims at stimulating differentiated sectors of the economy based on the expected competitiveness, by promoting technical progress and scientific research, with positive impact on occupancy rates on medium and long term. These sectors should benefit from reduced rates of loaning interests or rescheduling investment opportunity.

Supporting the business environment through cheap capital inflows, coming from European money/ structural funds, can generate low costs for starting a business, which favours market development, increasing the productivity and competitiveness of an industry. This can stimulate the economy by engaging specialized labour, by creating economic goods that can cope with competition, produced at lower costs. To overcome the current pandemic crisis, there is a need to rethink the production process, reduce costs and increase value through innovation and creativity [12].

(iii)Promoting a handful of measures to encourage public-private partnerships in the areas of education and public health

In Romania, the both public education and health systems are near collapse. Financing from the state budget for revival are hardly accepted under conditions of moderate economic growth. Under these circumstances, increased action is needed to attract private sources of financing of the two sectors to become both compatible and competitive with similar systems in the European Union.

Education requires a reorientation of educational policies to adapt their curricula to both the present and future realities of the European and global economy. Educational services market should be approached through both its flexibility and its efficiency. Investing in education is paid back over time by the proven productivity of labour, drawn into the economic process. Romania will need to develop the education system while increasing and developing the economy in order to provide jobs and increase the attractiveness of the Romanian economy for the younger generation, whose education responds to higher quality requirements [5].

Another measure to increase the efficiency of education is to implement educational policies lifelong active, to increase productivity and attractiveness of labour regarding the development needs of the employer and the market.

Health needs financial support, logistical and human capital. Impairment of a substantial proportion of the income of an economic producer or consumer for financing the health system in Romania, was not enough to increase the competitiveness of the system and efficient management of funds, for its operation from several causes: the maladministration of public funds, the existence of bottlenecks level funding channels between the state budget, health insurance funds and institutions, insufficient funds regarding the high number of public administered hospitals.

The solution would be decentralization of the health system and retaining the best health facilities to serve the real needs of the population; privatization of a large number of hospitals in order to attract funding sources to increase the quality of medical service and subsidizing medical services for some of the population in financial difficulty or with low income; public awareness of the need to resort to health insurance policies while reducing funding to cover the integration of health

services; with and without crisis, the Romanian economy cannot fully fund public services in reducing the number of contributors to the state budget because of rising elderly population and the shrinking of active population. Under these conditions, it must be supported the health system competition, between the public and the private institutions [2].

Current issues of both the education and the health systems in Romania have deep causes, proliferation and outsourcing losses, in maintaining a branched organizational structure, overloaded with un-adapted services to the lately development requirements and therefore a cumbersome and an inflexible market. The state will have to give up to a part of the budgetary management of these entities to promote public private partnerships, to increase the capacity of finance and administration, attracting investments that would grow to become reliable and competitive.

(iv)Attracting investment and facilitating public-private partnerships

Developing public-private partnerships requires the state to provide technical support (land and utilities), companies to provide capital and labour. In these conditions, works will be made in infrastructure, utilities, health services and higher education, of which costs cannot be covered entirely from budgetary sources; the success of such an association lies in negotiating power and favourable terms, of understanding, for the benefit of the consumer.

The idea of launching public-private partnerships is not innovative. Ever since 2002, the government launched an ordinance (16/2002) that regulates this kind of business but the provisions were highly restrictive, limiting partnerships in construction and the non-transparent selection procedures. Moreover, the ordinance was repealed in 2006, after numerous failures, and since then, there has been a legal vacuum. The government wants to change *The Concessions Law* to make public-private partnerships more attractive in the business environment and recognizes that the current implementation framework is insufficient to motivate and attract significant investment through public-private partnership projects.

The need to implement public-private partnerships is a consequence of lack of funding in the public domain and reduced capacity to manage public resources in order to increase the competitiveness of public services. It also wants private sector development and the ability to take the necessary and effective managerial experience from the private sector and the consistent management of public resources [7].

Developing public-private partnerships on the one hand, involves amending legislation through which to capitalize and interests of both parties and increase transparency in the decision-making process for managing capital.

(v)Legislative changes to help more flexible labour market

It is necessary to liberalize the labour market, to make the labour supply and the labour demand flexible, having a foundation with the efficient allocation of resources and increase of employee remuneration, based on labour productivity. Great pressure of public employees and pensioners makes the efficiency of private sector employees to be decreasing; unlike employees in the public sector, most often having political support and trade unions, in the private sector, employees are paid the most, in terms of labour productivity and achieved turnover. Low remuneration is a consequence of low productivity, regarding the European Union; the low level of labour productivity achieved by employees has multiple causes, including: reduced competitiveness of economic goods carried, especially in foreign markets, low equipping of capital to labour forces, low share of consumer goods on a daily basis, which makes the revenue's volume of the producers to be low. A solution to this would be to increase the competitiveness of products through investments in quality and scientific research, and the professionalism of the workforce.

As noted, the crisis seems to have affected only the private sector, meaning that, according to movements in the economy that have significantly reduced sales and return on

economic activity, it has adjusted its personnel. Public sector efficiency can be analysed in terms of revenues collected, to cover expenses through tax levies imposed on the private sector namely, the active population.

CONCLUSIONS

Achieving a level of development for an economy that is temporarily in a state of imbalance can be achieved by assuming a continuous reform program in which to distinguish result indicators pursued by public policy makers. Any deviation from the reform process, any change in the strategy, depending on the circumstances, lead to imbalances that can only be covered by reducing public spending, with severe consequences on the level of the welfare. At the same time, the continuous reform process aims to make the business environment more reliable by supporting entrepreneurial ideas in the form of easy access to finance, encouraging risk-taking in conditions of fiscal predictability, attracting investment in order to create jobs by optimizing resources and exploitation potential of them in conditions of competitiveness.

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FAMILY FARMING IN THE CONTEXT OF GLOBAL CHALLENGES

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Abstract

The current challenges related to the Covid-19 pandemic raise concern regarding security and sustainability of the global food system. As family farming plays a crucial role in the European agricultural sector, its support and development are vital to ensuring food sovereignty and security, including rural areas. It is the predominant farm model which accounts for more than 90% of the number of holdings and is considered as a main source of income and employment for rural population. In the context of global health crisis it is important to focus the attention on the issues and opportunities that family farms face. The aim of the study is based on an analysis of the observed trends in various aspects of family farming, to discuss the effects of Covid-19 and to highlight the strategies for the development of these agricultural production systems. The paper compares Bulgarian family farming with other EU member states. The survey indicates that although family farms dominate in the EU agricultural structure, they face number of challenges such as access to resources, financial aid, low competitiveness and investment activity.

Key words**:** *food security, financial support, COVID-19 pandemic*

INTRODUCTION

Family farms play a significant role in the rural economy. They are key factor for food security and increase the vitality of rural areas.

Historically, the family farms are the first and most widespread representatives of the family and small business in the world.

The current challenges related to the Covid-19 pandemic raise concern regarding security and sustainability of the global food system.

Family farming plays crucial role in European agricultural sector, especially in the rural areas. It is the predominant farm model which accounts for more than 90% of the number of holdings Family farming is considered as a main source of income and employment for rural population [20].

In the context of global health crisis it is important to focus the attention on the issues and opportunities that family farms face.

The aim of the study is to observe the changes and trends in family farming, discuss the effects of the Covid-19 and highlight the strategies for development of the sector. The paper compares Bulgarian family farming with others Member-States of the EU.

MATERIALS AND METHODS

Despite the common use of the term family farm, in the scientific literature the definitions vary widely and depend on context, country and aim of the survey [22].

One of the earliest definitions is proposed by Marx (1867). Family farms are defined as small farms engaged in production based on family labour, where science finds no application. Agricultural households use the major part of their production to meet the physiological needs of the family through exchange with nature. Therefore according to Marx they have poor opportunities for economic and social development [32].

Chayanov (1986) considers important to analyse of the economic activity of the rural family, which uses own land and has no interest in hiring external labour, but sometimes is also engaged in non-agricultural activities [9].

The most commonly cited definition of family farming is that of Gasson and Errington (1993). Their study is focused on six elements and outlined also family and territory ties in addition to labour and management [25].

The Food and Agriculture Organization (FAO) defines family farms „as managed and

operated by a family and predominantly reliant on family labour, both women's and men's. The family and the farm are linked, coevolve and combine economic, environmental, reproductive, social and cultural functions" [21, 22].

On that basis, Eurostat (2019) considers family farms as "farms in which at least 50% of the workforce is family-owned." [20].

According to the authors of CIRAD-Tera (1998), family farming represents the basic link between agricultural activity and the family organization, affecting assets, production methods, motivation and decision-making [10].

Berdegué and Escobar (2002) propose a framework in order to characterise family farms and dived them into three groups, based on land, labour and/or capital assets, and market environment [6].

Depending on the context, different surveys outlined different definitions of a family farm. They are most often based on: (1) the employment of the family on the farm; (2) farm management; (3) the production structure; and (4) business risk.

In order to observe the trends and opportunities of family farms, conceptual models of their behaviour can be presented. Based on neoclassical economic theory, family farms can be considered as profit-optimizing economic agents. In this way, their behaviour is explained by the economic laws related to the marginal revenue and marginal costs. The assumption that producers are efficient suggests that the main driving force of households is maximum profit. Efficiency and profit maximization are seen as "two sides of the same coin" [12].

The other model is related to the rental opportunities - distribution of revenue and cost between the actors is a form of land lease in which the rent is a percentage of the total yield of the farm.

Risk minimization and diversification is another typical behaviour of some family farms. Lipton (1968) presented the so-called survival algorithm. According to his thesis, poorer and smaller farms are risk avoiding [31].

The economic model of the leisure optimizer is developed in 1920 by Chayanov. His model is revised further by a number economists such as Melor (1963) and Sen (1966). The model outlines the exceptional vitality and ability of family farms to survive in difficult conditions. Farm household model is also part of Chayanov theory. The author suggests that his concept works more successfully in less urbanized rural areas, and especially in cases where farmers have the opportunity to rent additional land [34, 41].

According to the European Council (1997), family farms are a key element in the European model of agriculture. This model could lead to the diversification and sustainable development [2].

The importance and future of family farms are widely discussed in survey by IPC-IG (2016). Based on their study some main characteristics of the family farms can be outlined [28] (Figure 1).

A very important feature of family holding is that it has control over the main resources in the farm, which gives autonomy. Other feature is related to family farms as a source of income and employment. Family holdings are contributing to the rural economy and related to concepts as pluriactivity and multifunctionality [30].

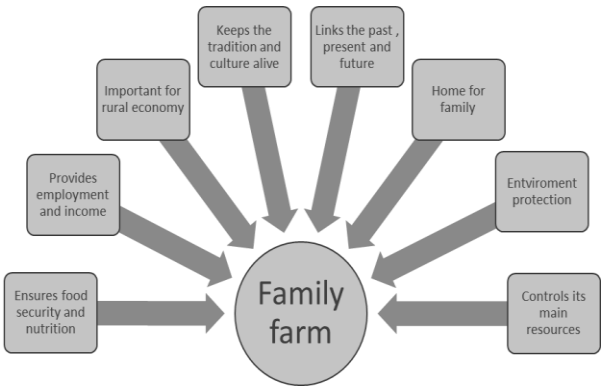

Fig. 1. Features of family farms
Source: Based on Van der Ploeg (2013); Chatel (2014) [44, 8].

However, there is far more than ownership, employment and decision-making [22]. Family farm is also home to the farming family and related to the connection and interaction between members and relatives of

the household. In addition family farms link past, present and future [1, 45].

The family farming is also part of a rural community and keeps culture and traditions alive. Family farms have a key role in maintaining biodiversity by using ecological processes and balances [38].

According to the FAO, 90% of the farms in the word can be defined as family farms and rely mainly on family labour [21]. Bruni and Santucci (2016) conclude that this type of farms are very successful in helping rural poverty reduction [7]. In number of regions of the EU, especially in Bulgaria family farms are key driver for this process [35]. In recent decades, however, family farming has changed significantly and these farmers face a number of challenges. Based on a study by the European Parliament, they are grouped into the three dimensions of sustainability: economic, environmental and social.

In this document the main economic challenges to family farms are systemised as: access to resources (land and capital), access to markets and their role in value chain [18].

On the other hand, European Commission (2012) indicates that social challenges are related to age structure and the role of women [14]. In addition, several challenges to family farming are linked to the geographical patters – for example mountainous and underdeveloped regions which are distant from urban centres and have less alternatives for employment [18, 24].

The study analyses the trends and outlines the patterns in family farming development based on the data from Farm structure surveys in the European Union Member-States.

Eurostat definition and classification of family farms is used.

RESULTS AND DISCUSSIONS

In terms of their number, family farms are predominant structures in EU agriculture. (Figure 2).

According Eurostat (2019), 95 % of all 10.5 million farms in the EU are classified as family farms [20]. The share increases by almost 2 percent points compared to the Farm structure survey in 2013.

More than one third of family holdings in the EU are concentrated in Romania (3.4 million). Poland (1.4 million), Italy (1.1 million) and Spain (0.8 million) are the next three Member States with the largest number of family farms.

The share of family farms in total holdings is the highest in Luxemburg (100%), followed by Romania (99.21%), Slovenia (98.7%), Ireland (98.86%), and Poland (98.75%).

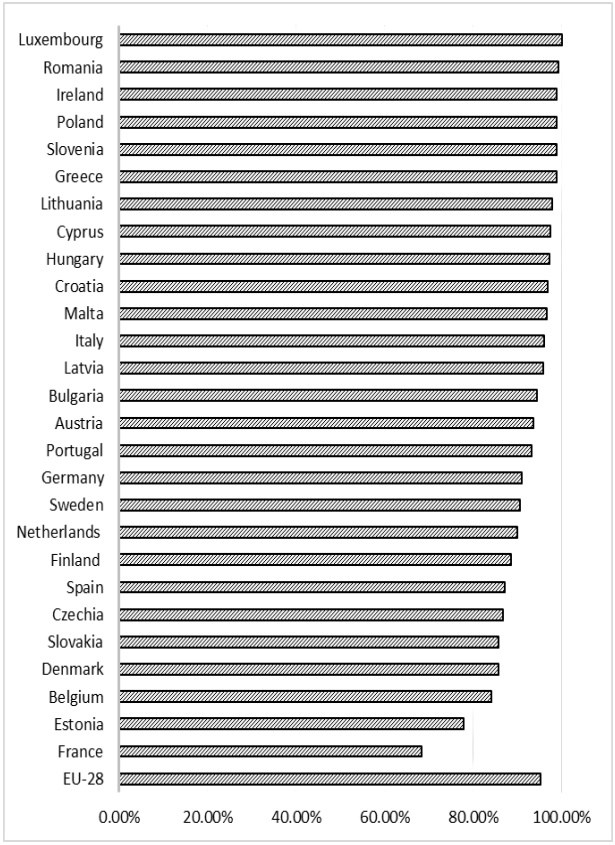

Fig. 2. Share of family farms in total farms in the EU, 2016 (%)

Source: Eurostat statistic explained, Farm structure survey, 2016.

On the other hand, the lowest share is registered in France (68.34%), Estonia (77.84%) and Belgium (84.03%). Bulgarian share is close to the EU-28 average (94.4%) and decreases slightly in comparison to the results in 2013 (95.5%). Based on the data it can be concluded that family farming are important part of in European agriculture and play significant socio-economic role. In the rural area there are ensuring food security, help in poverty reduction and mitigation of global pandemic crisis.

Another important indicator is the average size (Figure 3). In the scientific literature, the term "family farming" is often related to "smallholder farms" [11]. On the other hand, FAO (2014) suggests that farm size can be of a secondary importance in determining family farms [21]. Farm size depends on agro-ecological and socio-economic conditions. The latter is confirmed by the Eurostat data. The average size of family farms in Member States varies significantly.

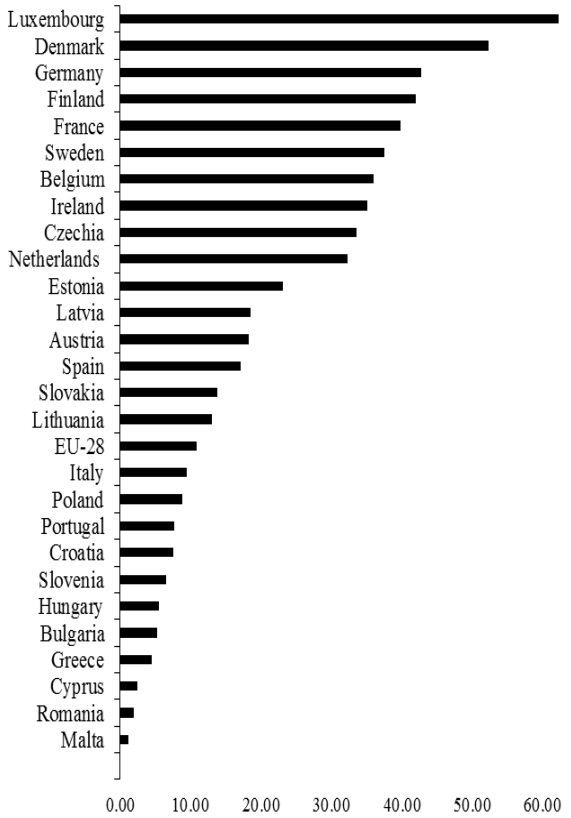

Fig. 3. Average size of family farms, 2016 (hectares per farm)
Source: Farm structure survey, 2016.

Family farms are the largest in Luxembourg (62 hectares per holding) and Denmark (52 hectares per holding). On the other hand the smallest family farms are registered in Malta (2.51 hectares per holding), Cyprus (2.02 hectares per holding) and Romania (1.17 hectares per holding).

Bulgarian family farms have average size of 5.25 hectares per holding which is smaller than EU-27 average (10.84 hectares per holding).

Based on the data, it can be concluded that family farms are predominantly small in most of the EU Member-States (Figure 4).

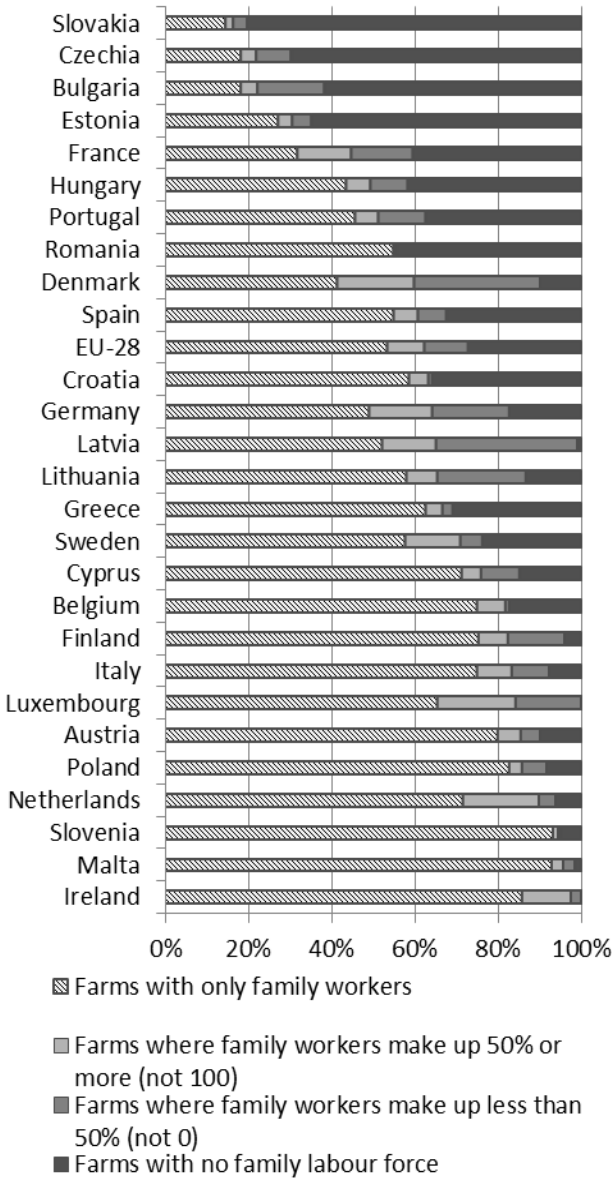

Fig. 4. Distribution of the utilised agricultural area by type of farm labour, 2016
Source: Farm structure survey, 2016.

However, the countries can be divided into groups - the first group, with an average size higher than the EU-28, the second group with an average size around the EU-28 and the third group - lower than the EU average.

The majority of Eastern-European countries and new Member-States are in the third group. After the accession of Bulgaria and Romania, the number of farms in the EU has doubled. Majority of family farms in these countries

were very small holdings based on self- or semi-sufficiency [17].

By contrast, the first group of the farms includes Western European countries which have different agricultural structure and production patterns.

Family farms concentrate more than 62% of all UAA in the EU-28 (Figure 3). In 2016 the lowest shares is recorded in Slovakia (16.3 %), Czech (21.9 %) and Bulgaria (22.2 %) [4].

By contrast, the highest shares of UAA are registered in Ireland (97.4%), Malta (95.3%) and Slovenia (97.45). The results in these countries show that the UAA is concentrated mostly in commercial farms and large enterprises. Although the share of family farms in total number of holding is more than 80% in almost all Member-states, the share of family farms in UAA shows different trends.

The access to land is pointed out as a main issue for family farming. There are wide variations that also influence rental contract conditions, which distorts the land markets [42, 26]. According to the Transnational Institute (2013) there are serious challenges related to the term "land grabbing" in the EU [43].

In Bulgaria this process is changing the rural regions substantially and therefore is leading to numerous social, economic and ecological challenges.

Other important indicator related to the topic is the generated standard output (Figure 5).

Family farms account for 59.5 % of the value of produced output in the EU-28. In Ireland (92.8%), Slovenia (89.1%) and Greece (88.4%) is registered the highest share of the indicator.

By contrast, the lowest share of standard output is generated in Slovakia (13.9%), the Czech Republic (15.1%), Estonia (20%) and Bulgaria (31.3%) [5].

Based on these data it can be outlined that the trends in standard output distribution are in parallel with land concentration tendencies.

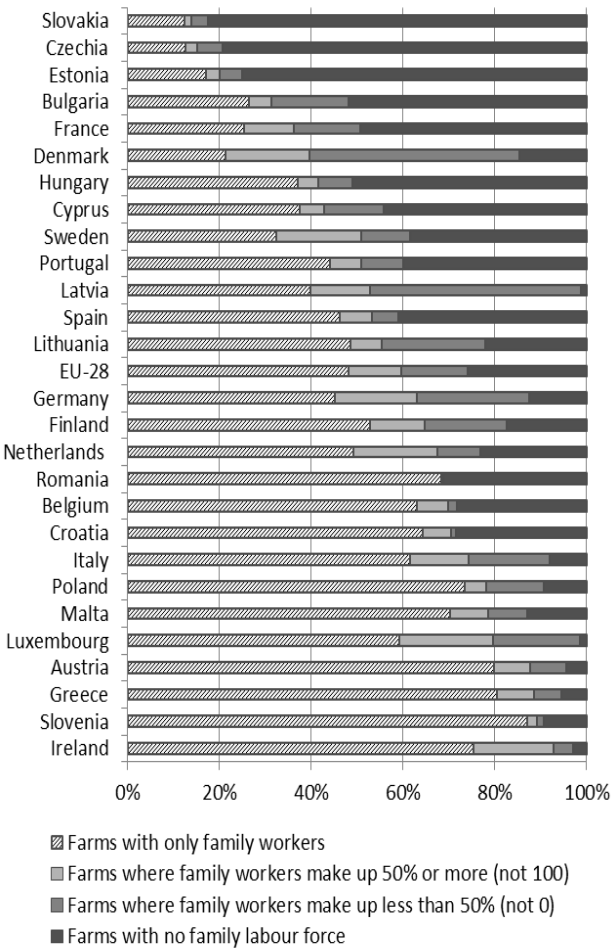

Fig. 5. Distribution of standard output by type of farm labour, 2016

Source: Eurostat statistics explained.

Another serious challenges for family farming is related to generation renewal and aging. (Table 1).

According to Eurostat (2019) one third of farm managers are 65 years or over. In family farms including only family workers, the share of managers aged over 65 is 34.3 % and is much higher than in non-family farms (9.3 %). In Cyprus and Romania more than 60 % of all family farms are managed by older farmers [3].

Young farmers are often employed in larger or commercial farms mainly due the better working conditions and bigger wage.

The share of young farm managers under 40 in family farms is the highest in Luxembourg (26.0 %), Austria (21.7 %) and Poland (20.0 %). On the other hand, in Cyprus (2.9 %) and Portugal (3.3 %) their share is the lowest.

In Bulgaria, both the share of young farmers and older managers is higher than the EU average.

Table 1. Farm managers by age class (%)

Countries	Family farms	
	Managers less than 40 years	Managers 65 years of over
EU-28	9.92	32.26
Belgium	8.24	18.24
Bulgaria	12.66	35.61
Czech Republic	7.57	23.36
Denmark	5.55	25.21
Germany	13.01	7.49
Estonia	9.00	28.93
Ireland	12.60	28.85
Greece	8.18	33.13
Spain	7.03	28.56
France	9.40	13.47
Croatia	9.57	32.66
Italy	7.51	40.03
Cyprus	2.94	43.71
Latvia	8.94	29.66
Lithuania	11.76	30.57
Luxembourg	26.00	29.00
Hungary	12.13	30.26
Malta	6.10	29.10
Netherlands	7.35	17.11
Austria	21.67	6.98
Poland	20.03	11.59
Portugal	3.31	50.10
Romania	7.31	44.27
Slovenia	9.16	28.87
Slovakia	16.56	19.56
Finland	7.14	6.86
Sweden	9.83	23.26

Source: Farm structure survey.

In general, the generation renewal is substantial issue, especially with regard to the future of European agriculture. Zagata, Sutherland (2015) suggest that "young farmer problem" affects mainly small farms, which are predominant structures in the agriculture of Southern and Eastern European countries [46].

The issue with aging of farm manager may have negative effect on the future sustainability of family farming in the EU, since older farmers are usually with lower education, less willingness to take risk and to implement innovative technologies [18].

Impact of Covid-19 on family farming

Nowadays agriculture is facing number of challenges such as climate change, ensuring food security and sovereignty. COVID-19 as a global pandemic is a major concern and put the lives of billions at risk [23]. This crisis has significant impacts on countries, regions and the most vulnerable groups of the society. Family farmers are also affected by the pandemics.

The impact of the crisis related to COVID-19 can be found in the following directions: (1) The market access of the farmers is limited due the closed farmers' markets and lack of procurement opportunities. On the other hand, during the pandemic there are changes in consumer's behavior and perceptions; (2) The restrictions during the health crisis led to restaurant closures and decrease demand for fresh products. This is affecting family farmer's productive capacities and small holding are particularly vulnerable. (3) Majority of family farmers, together with their main professional activity rely on agriculture to provide an additional income. In rural areas, COVID-19 led to decrease of their main income due restrictions and closures in various sectors. Based on that family farming becomes important source of employment in order to ensure normal standard of living. 4) On the other hand, often except agricultural production, family farmer's income is supplemented by permanent or temporary additional employment. The pandemic caused crises in economic activities and small businesses in rural areas and on that basis in family farmers' wellbeing. This process can affect negatively family farming production potential and opportunities for development.

In order to address the challenges related to the COVID-19 pandemic, European Commission (2020) [16] proposed measures that can be divided into: (1) Measures to ensure food supply chain- for seasonal workers and secure food systems; (2) Measures that directly are supporting farmers and rural areas like flexibility of financial instruments implementation under Rural development program (RDP). There are also new measures for farmers and small and medium enterprises under Pillar II. (3) Market

measures like private storage aid for dairy and meat products. Also there is flexibility for market support programmes in the some sectors (fruits and vegetables, olives and olive oil, apiculture). (4) CAP simplification and flexibility related to the deadlines for CAP payment applications and less farm on-the spot monitoring visits.

The COVID-19 pandemic has consequences for family farming such as disruption of the food supply chains because of lockdowns, but also a major economic issues [47]. The situation remains uncertain. According to the World Health Organization, even worse consequences are expected in the future years [29]. Some authors predict that this virus will continue to circulate for a least couple more years [40].

There are various studies related to the institutional modelling of changes in the CAP and the impact on agriculture and rural areas [13, 33, 19, 39].

Based on a different model of family farmers, government policy could be directed in different aspects. The profit maximization family farms generate good income and have competitive advantages compare to the other family holdings. In practice, their behaviour is very close to that of the large commercial businesses. Therefore these farms are more successful in accessing investment support under Pillar II. On the other hand, their number is small and does not require specifically targeted measures expect the proposed by European Commission. However, it can be assumed that: (1) if producers are competitive but limited by the technologies in the long run agricultural productivity can be increased changing resources or/and technologies, such as large-scale irrigation facilities, innovations implementation, etc. (2) if the efficiency of farmers is hampered by a lack of knowledge in the field of new technologies - the policy should focus on raising their awareness and human capital development

However, most of the family farms are smaller than profit maximizing holdings. For this group agriculture could be considered as a main source of income. In the European Union, these farms are the important agricultural structure. Agricultural support can have significant effect on them due their large number and significant potential. In some Member-states these farms face serious difficulties in applying and receiving financial support for investments [27]. On one hand, their size is too large to participate in small farmer's schemes. On the other hand, they have been engaged in agriculture for a long time and do not meet the criteria for young farmers. In Bulgaria, although investment measures of the RDP provide opportunities for support for small family farms, the requirements could be complied mainly by the largest profit optimizers due to the heavy administrative procedures. The high ceiling of the eligible activities under the investment measures, the formal requirements and the relatively expensive consulting assistance regarding the value of the project, make the participation in these measures difficult for the smaller producers. For these farms, the effective and well-targeted agricultural policy is essential.

In the other models of family farms behaviour, the agriculture is a source of additional income rather than a main activity. Due pandemic, there is a decrease in income from non-agricultural activities in rural areas and the government should focus on social measures.

In some Member-states, including Bulgaria, agriculture is an additional income for retirees. The rest of the income of these producers comes from different types of pensions which often are low. Therefore, for them agriculture is vital, although they do not have significant growth potential. These farm households are very important in the processes of poverty reduction in the country. For this type of farms, measures with a stronger social focus could be useful.

On the other hand, for hobby farmers, have various motives - free time, the desire to consume environmentally friendly and quality products, enjoyment of rural life, farming related to tourism activities and more. These farms can be classified as "boutique" or "hobby farms", which are not of great economic importance. It could not be expected the latter to be seriously affected by

the various instruments of agricultural, economic or social policy. However, due the pandemic their significance could increase.

Established in 1962, the CAP main goal was to ensure a stable supply of affordable food and support farmers and their reasonable living [36]. Over the last 60 years, EU policy has changed and evolved, but family farming remains one of the main official priorities. However, numerous studies (Pe'er et al, 2018; European Court of Auditors, 2018) pointed out that financial support is unequally distributed and ineffectively targeted [37]. Therefore, it's the instruments for family farmer support can be further developed [15].

CONCLUSIONS

Based on the analysis, some conclusions and recommendations could be highlighted:

(1)Family farms remain an important part of the rural economy and play a key role in social development and biodiversity maintenance;

(2)Family farms are the most common structure in the EU agriculture. However, in the majority of the Member-States they have small average size;

(3)Access to land remains a major problem for family farms, with some negative processes such as "land grabbing'' and market distortions.

(4)Generation renewal is other major challenge for family farming;

(5)The COVID-19 pandemic as a global challenge has had consequences for family farming;

(6)Experts predict that the crisis will continue and will have long-term consequences in a number of sectors;

(7)Family farm remain major source of income in rural areas, especially during the COVID-19 pandemic.

Therefore, agriculture policy should consider their vital role and propose measures well-designed for their different needs and models of development

Family farmers are a key factor for sustainable development of rural areas. These agricultural holdings have a personal interest in protecting the environment, as well as in increasing the socio-economic development of rural areas.

During an economic or other crisis, society relies on them. The market is not able to take into account the positive externalities that they create, hence there is an underestimation of their social significance. Therefore, the awareness of family farming role in those processes needs to be improved. On the other hand, different types of farmers react in a different way to the agricultural policy.

Knowing and observing the specifics of the individual groups of family farms could help the governments in shaping the future agricultural policy of the EU.

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CHALLENGES AND SUPPORT POLICIES FOR SOCIAL ENTERPRISES IN BULGARIA

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Abstract

The concept of social entrepreneurship is relatively new, both as a theory and as a practice, and is entirely determined by the economic and cultural challenges in Bulgaria. The promotion of innovative ideas in public policy plays a crucial role in supporting the values of an active-oriented problem-solving social system. These views are fundamental to the ongoing social reforms in Bulgaria and focus on the development of social entrepreneurship and policies that support social enterprises. The purpose of this article is to explore and identify the challenges and policies for social enterprises and social entrepreneurship in Bulgaria and their sustainable development. This research presents the results of a pilot study held in Bulgaria under the SESBA Project - Social Enterprise Skills for Business advisors. The field studies were carried out on the basis of primary and secondary data. The collection of the primary data included a questionnaire survey to collect information by using a face- to-face interview. The secondary data were extracted from official data, reports and official websites, etc. The challenges for Bulgaria regarding the development of social enterprises can be formulated as follows: need for sectoral reforms, opportunities for capacity building, opportunities for startup funding available and prioritizing a target group.

Key words**:** *social entrepreneurship, social enterprise, challenges*

INTRODUCTION

Social enterprises are a way for creating jobs and increasing training level of the population as sustained by the EU policy [3].

Social enterprises operate in Bulgaria and develop traditionally as a means of providing employment and in the fields of education, social services and in rare cases, education, health and culture. Therefore, a key factor for their future development are upgraders reforms in these areas, market liberalization and provision of a quick and easy access to services for consumers.

At present in the Bulgarian legislation there is no a legal act that gives the legal regulation of the activities of the social enterprise or social entrepreneurship. There is a fragmented legal regulation of individual sectors (social service providers, specialized enterprises for people with disabilities), where subjects engaged in activities are covered by social enterprises, but this approach is rather negative effect on the development of a coherent state policy to support the social economy and social enterprises, which ultimately reflects on their sustainability and efficiency.

It is important to note that the National development program: Bulgaria 2020 identifies a specific area of impact and measures related to the social entrepreneurship, in particular in Priority: Reducing poverty and promoting social inclusion, Providing employment opportunities and raising wages: "promoting entrepreneurship - encouraging entrepreneurship, including social entrepreneurship for unemployed persons and persons from disadvantaged groups."

As main features of social enterprise are included: achieving social purpose; making of economic activity; predominantly reinvestment of profits back into the business than distribution among individual partners, shareholders, founders/members.

In terms of the types of legal and organizational forms through which one can develop social enterprise, inconsistencies and discrepancies are observed between different strategic documents and programs (The national concept of social economy;

Operational Program "Human Resources Development" 2014-2020).

There is no unified framework and general binding characteristics of social enterprises. This makes it difficult referencing them in each case to an enterprise and determination what is a social enterprises or not. Solving this problem would have been related to more effective planning and efficient spending of public funds to promote the development of social entrepreneurship.

In the last decade the concept of developing and promoting the social economy and social entrepreneurship has been part of the European Union's policy to tackle the social exclusion of vulnerable individuals and groups [4].

The purpose of this article is to explore and identify the challenges and policies for social enterprises and social entrepreneurship in Bulgaria and their sustainable development.

MATERIALS AND METHODS

This research presents the results of a pilot study held in Bulgaria under the SESBA Project - Social Enterprise Skills for Business advisors. The field studies were carried out on the basis of primary and secondary data.

The collection of the primary data included a questionnaire survey to collect information by using a face- to-face interview. The secondary data were extracted from official data, reports and official websites, etc**.**

The collection of the primary data included a questionnaire survey to collect information and data by using a face-to-face interview. The secondary data were extracted from official data, reports and official websites, etc.

The current study provides implications that social enterprises and social entrepreneurship are facing a number of challenges related to their better visibility, creating a more favorable legal and institutional environment for their operation, as well as providing better financial opportunities for their development. [5].

The challenges for Bulgaria regarding the development of social entrepreneurship can be formulated as follows: broad understanding of the social enterprise; need for sectoral reforms; prioritizing a target group; opportunities for capacity building; opportunities for startup funding available. There are no adequate and consistent programs funded with public funds for capacity building for the development of social enterprises as such. Especially it is important for social enterprises NGOs, par excellence recognized their business as social enterprises, to upgrade their entrepreneurial skills and visibility on the market [6]. The implications on the funds allocated for the development of social enterprises in various national initiatives and mechanisms lead to the conclusion that substantial financial resources are allocated, but at the same time social enterprises received support fail to achieve financial sustainability and remain project-oriented. This prevents, on the one hand, social enterprises to build their own image in the business environment and become recognizable in society, and on the other - to establish themselves as a successful tool for achieving the objectives of national social policies [1].

RESULTS AND DISCUSSIONS

Social enterprises are established in order to accomplish certain social objectives (overcoming social injustice or social inequalities with regard to vulnerable groups of people or achieving socially significant goals in the sphere of ecology and sustainable development) and their whole economic activity is subordinate to these goals and objectives, as opposed to profit-making objectives for the benefit of individuals.

The activities of social enterprises can be defined as crucial in helping the state policy on social inclusion of vulnerable groups.

*Social enterprises pursue socially significant objectives***:**

Social benefits are measured by integration and employment of disadvantaged people, the contribution to the process of social inclusion of other vulnerable people [7].

The following **challenges** faced by Bulgarian social enterprises have been identified [11, 12]:

-Lack of regulatory legal framework to provide a definition for a social enterprise so that the policies in the field to be properly targeted; in Bulgaria there is not yet a legal definition for a social enterprise, but there are a set of characteristics (in the National Concept of Social Economy) that can serve as a starting point for defining a social enterprise.
-The majority of social enterprises in Bulgaria focus on providing different types of services (passive), while social entrepreneurship should move towards active inclusion of target groups in the process [8].
-Lack of sufficient preferences related to the marketing of products offered by social enterprises.
-The need of training and motivation of people who work in social enterprises and of those who are willing to work in them [9].
Involvement in social enterprises
Answers to the question concerning the involvement in social enterprises and the following explanations point out the misunderstandings and confusions between volunteering, philanthropy, corporate social responsibility and social entrepreneurship.

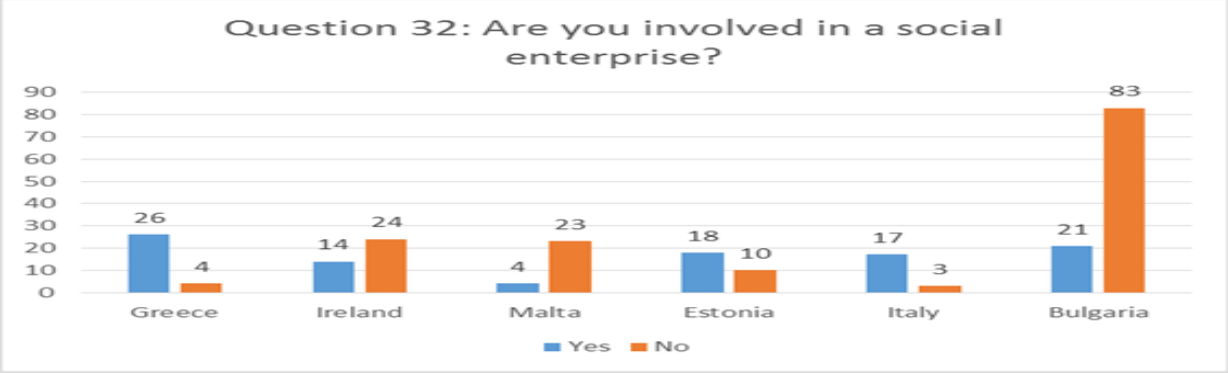

Fig. 1. Distribution of the answers regarding the involvement in social enterprises
Source: Own calculation.

National policies to promote social enterprises should provide concrete measures regardless of their nature (legal, financial, administrative) must comply and achieve as a result those principles:
(a)*Promotion and sustainability*
-Support for social entrepreneurship should include the release of public funds to support the activities of social enterprises to deal with social problems;
(b)*Coordination and decentralization*
-Establishment of mechanisms for the participation of social enterprises in the planning and evaluation of policy for social entrepreneurship at national level;
-Creation of conditions for development of social entrepreneurship at the local level, according to the specificities and the needs of the territory by involving the municipalities in this process (in local and regional strategies).
(c)*Solidarity and Partnership*
-Creation of conditions for cooperation, consultations, open dialogue and sharing responsibility among all stakeholders [10].
*Support of the activities undertaken by social enterprises and innovation policies***:**
-Social marketing and promotion of social economy and social entrepreneurship;
-Training and qualification for people employed in social enterprises, specialized enterprises and cooperatives of people with disabilities;
-The evaluation on the advisory services needed by social enterprises show a great variety of topics that should be covered. The assessments for all listed options in the question are good to very good: legal services, technology, finances, fund raising, participatory leadership, business planning, market analyses, participation in funding programmes, access to markets, strategic planning, governance [2].

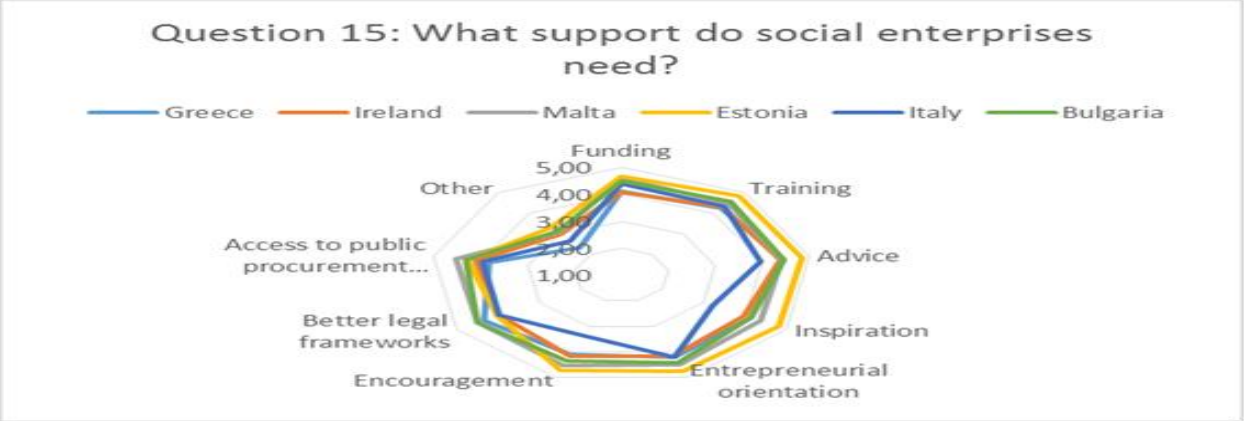

Fig. 2. Answers to the question regarding what kind of support do social enterprises need
Source: Own calculation.

CONCLUSIONS

Implementing the strategy "Europe 2020" in Bulgaria, a National Reform Programme is developed. There are four priority areas: better infrastructure; competitive youth (reducing the share of early school leavers, increasing the number of young graduates, encouraging young scientists realization of young people in Bulgaria); better business environment (higher employment, more investment, incl. in innovation); more trust in state institutions (protection of interests of citizens and businesses, social justice and security).

The concept of social entrepreneurship is relatively new, both as a theory and as a practice, and is entirely determined by the economic and cultural context in Bulgaria.

There is a need key legislative changes to be taken in order the measures set in strategic and political national documents to become real mechanisms to support social entrepreneurship in Bulgaria. The successful development of social enterprises requires the creation of sustainable partnerships between business, NGOs and the public sector - partnerships in which each of these actors recognizes its role to achieve socially important objectives and is willing to invest resources in that.

Social enterprises in Bulgaria carry out their activities in different sectors, with the most significant participation being in delivering of social services; recruitment of people with disabilities; mediation in finding employment of unemployed people; provision of health services; activities in the field of education, etc. [9].

The challenges for Bulgaria regarding the development of social enterprises can be formulated as follows:

-Need for sectoral reforms;

-Opportunities for capacity building;

-Opportunities for startup funding available;

The need for social entrepreneurship and the challenges faced by Bulgarian social enterprises develops new models of active social support and involvement, in which users and customers are encouraged to assume greater responsibility.

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WEEDS MANAGEMENT ON A PREMIUM WHEAT CROP (JOSEF VARIETY) IN MONOCULTURE AND IN A 4 YEARS CROP SYSTEM, IN BURNAS PLAIN (ROMANIA)

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Abstract

In a trifactorial experiment, crop rotation x years x treatments, performed in the south of Romania, on the leached chernozem soil from the Burnas Plain, some concrete results have been obtained. There is a negative correlation between the degree of crop weeding and the level of Josef wheat yield. In monoculture, after 10 years of experimentation, about 40 t weeds biomass/ha have been registered (5 → 40). Over the same period, yield decreased from 62 q/ha to about 23 q/ha (–39 q/ha). Carrying out two herbicide treatments (autumn and spring) reduced the weeds quantity to 15 t/ha, ie three times lower, and the yield from 62 to 35 q/ha (–27 q/ha) at the end of the research period. Herbicide treatments performed on the farm model have been ineffective in wheat monoculture. In crop rotation, decreases in yields without treatments, after 10 years, are significant, but without exceeding 10 q/ha. Under treatment conditions, in the 4-years crop rotation (peas-wheat-rape-wheat = P-W-R-W) the harvest level remains uniform or slightly increases, from 61 to 63 q/ha (insignificant). The lack of herbicides reduces yields twice as much in monoculture, compared to crop rotation. Monoculture also reduces the effect of herbicide treatments. In addition to the accumulation of a much larger biomass of weeds, there are also hard-to-fight species, such as Cirsium, Convolvulus, Matricaria. *The density of annual and even perennial grasses (*Avena fatua, Setaria glauca *and* Sorghum halepense*) also increases.*

Key words**:** *: wheat, monoculture, crop rotation, weed biomass, Burnas Plain*

INTRODUCTION

Wheat is the second largest crop in the world and is the main food of mankind, the product being demanded for consumption in increasing quantities, due to the exponential growth of the world's population (Berca et al., 2012; Lyon & Medlin, 2010) [4, 12]. Currently, there is a tendency to reduce the land areas allocated to wheat and other crops. At least in developed countries, genetics has also reached its limits (van Frank et al., 2020) [17], the possibilities for increasing the production of varieties being extremely close to the species' limits (Balfourier et al., 2019) [3]. Under these conditions, Romanian and international agriculture has only one solution, namely searching on the technological chains of the links that, through optimization, still allow an increase in yield's quantity and quality (Adkhamovich et al., 2020; Liebman & Dyck, 1993) [1, 11]. One of these links is weed management in wheat crop, formulated by more and more authors (Gaweda & Kwiatkowki, 2012; Legere and Stevenson, 2002; Shahzad et al., 2016; Weiner et al., 2001) [7, 10, 16, 18]. In the perspective of the cited authors, in monoculture weed control becomes problematic due to the continuous use of the same herbicide, which led to the emergence of resistance and/or to changes in the spectrum of species.

Many studies are also showing that the need for herbicides application in crop rotations is much lower than in monoculture, easily observed in agricultural practice. Are mostly recommend three-year crop rotations, with a legume (Khan et al., 2013) [9] or, alternatively, with rape (Naeem et al., 2012) [14]. In this case, the estimated costs are up to

35% lower for herbicides and nitrogen, 26% for primary energy, while the net margin is 12% higher (ARVALIS, 2018) [2].

In a long-term study (29 years) performed by Wozniak A. (2019) [19] in southern Poland, a cereal monoculture was compared with a pea – wheat/triticale rotation, concluding that the number and weight of weeds were higher by 57.1% and 75%, respectively, and the yield was 32% lower in monoculture, compared to the used crop rotation system.

In the Romanian space, Bogdan et al. (2007), Ionescu (2011), Petcu & Ioniță (1998) [6, 8, 15] demonstrated that the reduction of weeds in wheat are positively correlated with the 3-4 years crop rotation and with the specific works applied to the soil (MacLaren et al., 2021) [13].

In this context, the purpose of the paper was to analyze weeds management on a Premium wheat crop (Josef variety) based on a trifactorial experiment, crop rotation x years x treatments, performed in the South of Romania, on the leached chernozem soil from the Burnas Plain. The research work is a continuation of the experiments made in the previous years (Berca et al, 2020) [5].

MATERIALS AND METHODS

In the present paper, in a 10-year experience, the evolution of weeding and of wheat yield in monoculture, compared to a four-year crop rotation with peas - wheat - rapeseed - wheat (P-W-R-W) has been followed.

Starting from the practical needs in Southern Romania, the following parameters have been studied, measured and calculated:

(i)the extent to which the long-term wheat monoculture (10 years) influences the dynamics of the weeding incidence, as well as the change of their componence;

(ii)the effect of a rotation that includes an ameliorating plant (pea) and of a crop rotation type P-W-R-W on the degree of weeding and on the yields level;

(iii)the correlation between the weeding dynamics and the evolution of yields for the Josef premium wheat variety.

The objectives of the research topic were achieved by placing in the field, in the Burnas Plain, an important agricultural area from south Romania, an experience in conditions of production. The result was a multifactorial experience consists of: crop rotation x treatments x years of experimentation, which was statistically processed by dispersion analysis and correlation analysis in 2D and 3D.

Performed calculations were first collected in tables, then presented in the form of graphs and focused on two directions – the yield dynamics and the correlations between weeding degree and yields, depending on the other factors that enter into the equation (herbicide, years of experimentation).

It should be noted that the climatic conditions weren't taken into account, being very different from one year to another and with a very significant influence, in most cases. The comparison was only made concerning the used agrotechnics in the case of wheat cultivation. Because it's well-known in the area, Josef premium wheat variety was used, with which other experiments on nutrition and crop rotation were carried out in the past years. Weighing the weeds in their natural state (weed biomass) was performed every year when the wheat was ripe, in four repetitions, according to the same method used for measuring the production.

RESULTS AND DISCUSSIONS

The determinations carried out showed that in wheat crop, both in monoculture and in crop rotation, the following weeds are present: *Veronica hederifolia*, *Polygonum aviculare*, *Galium aparine* and Avena *fatua*. These species occupy over 65% of the weeding quantity in wheat crop, with the specification that the ratio between species is continually changing, especially in the direction of advancing monoculture from the third to the tenth year. In monoculture, especially after the fifth year, species that are characteristic of other crops appeared, such as *Stellaria media*, *Setaria glauca*, *Polygonum convolvulus*, *Chenopodium album*, *Matricaria* sp. and even the perrenials *Sorghum halepense* and *Cirsium arvense* (Photo 1).

Photo 1. Field cultivated with wheat in monoculture (7 years), treated with herbicides, full of weeds, especially *Sorghum halepense* și *Matricaria* sp. (2010, Alexandria)
Source: Original.

These weeds have also emerged considering the thinning of the wheat crop due to the phenomenon of soil fatigue. It was found, for example, that the *Amaranthus aritis* specie, which usually appears in the late wheat monoculture, in April, it disappears towards the end of May, without fruiting. Instead, perennial species increase their territory in clusters.
Dynamic comparisons regarding the effects of monoculture and P-W-R-W crop rotation system on wheat yield are shown in Figure 1 and Figure 2.

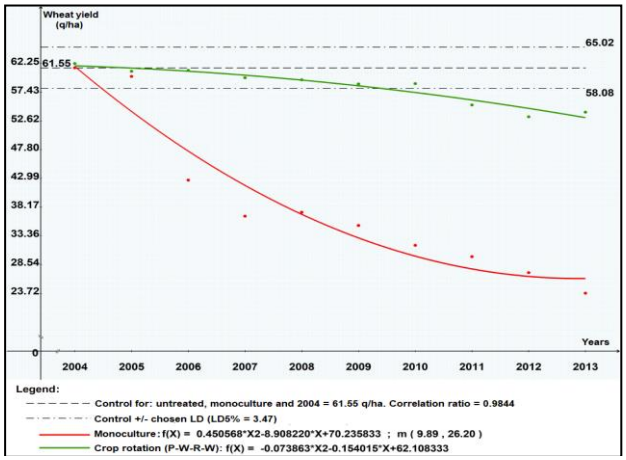

Fig. 1. Dynamics of wheat yield in monoculture and crop rotation, without herbicide treatment
Source: Own results.

Figure 1 is valid for the situation in which no herbicide treatments have been performed. In monoculture, the yield decreases after a quadratic polynomial function, from 61.55 q/ha to 23.72 q/ha, i.e. a very significant decrease of 37.83 q/ha. Relatively, it was a loss of 61.4%.
Under the conditions of crop rotation with ameliorating plant (peas) there is a decrease in yield which, however, remains within the confidence interval for P = 95% until 2010, after which the losses (–6.25 to –8.22 q/ha) become significant. It is necessary to emphasize this aspect because the crop rotation with ameliorating plants maintains the yield level for 5 years, without significant losses.
The herbicide treatment appears to be very necessary after the fifth year of its non-performance, even in the case of P-W-R-W crop rotation (Figure 2). Crop losses in the last three years of cultivation don't exceed 13%.
In monoculture, however, the treatment no longer has the same effect as in crop rotation. After 10 years, the yield loss is 21.5 q/ha, i.e. 34.7%. Herbicide treatment has reduced to half the loss, but it remains far too high, especially in the last 5 years. Prolonged wheat monoculture reduces the yield far too much, making it unacceptable in practice.

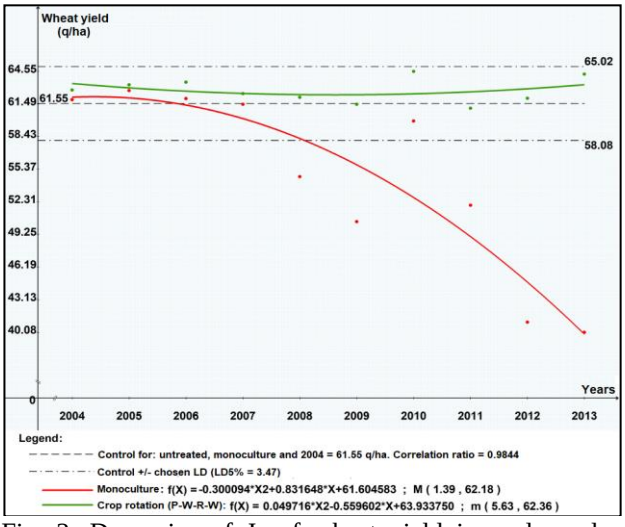

Fig. 2. Dynamics of Josef wheat yield in prolonged monoculture and crop rotation, with herbicide treatment
Source: Own results.

Under a 10-year average, the comparison between the type of crop rotation and herbicide treatment is shown in Figure 3. It follows that the difference between treated and untreated, in crop rotation, is insignificant, so that both options can be used

in agricultural practice. In monoculture, the difference between untreated and treated is close to the ratio of 1/2.

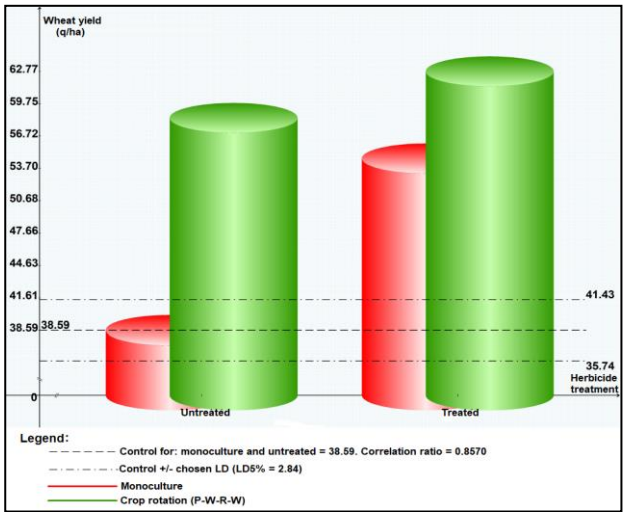

Fig. 3. 10-year average, comparison between monoculture and crop rotation, with and without herbicide treatment
Source: Own results.

Monoculture needs to be abandoned and replaced with ameliorating crops, such as peas, in the presented example – the combination of wheat, peas and rapeseed, which brings benefits on several levels (leaving a large amount of nitrogen in the soil, for wheat). The same can be seen in the dynamics in Figure 4.

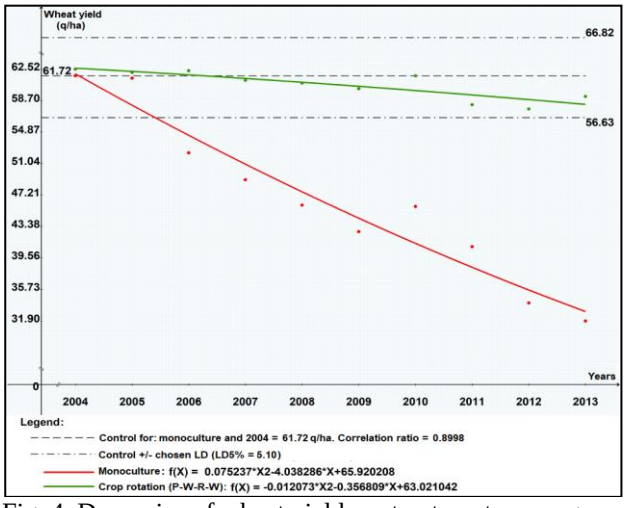

Fig. 4. Dynamics of wheat yield, on treatments average, for monoculture and 4-year crop rotation
Source: Own results.

It's once again emphasized the weeds power and how they destabilize wheat yield, hence the urgent need to give up monoculture. Equally useful is the calculation that shows to what extent the degree of weeding has been correlated with the achievement of the harvest or, better said, with its decrease.

In the case of P-W-R-W crop rotation, both the yields variation and the variation of the weeds were reduced, the correlations being small and insignificant. In contrast, in monoculture the large variation of weeding over the years and the much lower effectiveness of treatments allowed the establishment of correlative parameters presented in Figure 5 and Figure 6.

Figure 5(a) shows, in 2D, a correlation obtained from a 3D variability between the actual weeding (without treatments) and the Josef variety yield in monoculture for 10 years. The starting parameters are: 5 t/ha of raw weeds and about 64 q/ha of wheat yield.

In real conditions, the function looks like this:

$$y = \frac{65.04 - 10.29x + 0.52x^2 - 0.0068x^3}{1 - 0.15x + 0.007x^2 - 5.45x^3}$$

For the next 10 years the function is a NL fraction type polynomial, supported by a correlation ratio $r^2 = 0.99 = 99\%$, very close to determination, proving that the function can be easily reproduced under similar research conditions. The function shows a sudden decrease in yield over the weeding interval 10-15 t/ha and then a relatively constant decrease for the interval 15-40 t weeds/ha.

On average over the entire period the yield loss due to weeding (untreated) is of 62 – 20 = 44 q/ha, i.e. 44 ÷ 40 = 1.1 q wheat/t of green weeds, with variations from 2.9 q wheat/t weeds in the first phase, to 0.6 q wheat/t weeds in the second phase, when yields were low and losses correlated with them.

Figure 5(b), which has been processed in 3D, completes the overall analysis, offering the evolution in dynamics of the wheat crop degree of weeding (t/ha), on herbicidal and non-herbicidal background, being especially emphasized the growing differences year after year. If in the case of herbicide treatment, the degree of weeding stops before reaching the threshold of 15 t/ha, when untreated it reaches up to almost 40 t/ha, so an almost triple value.

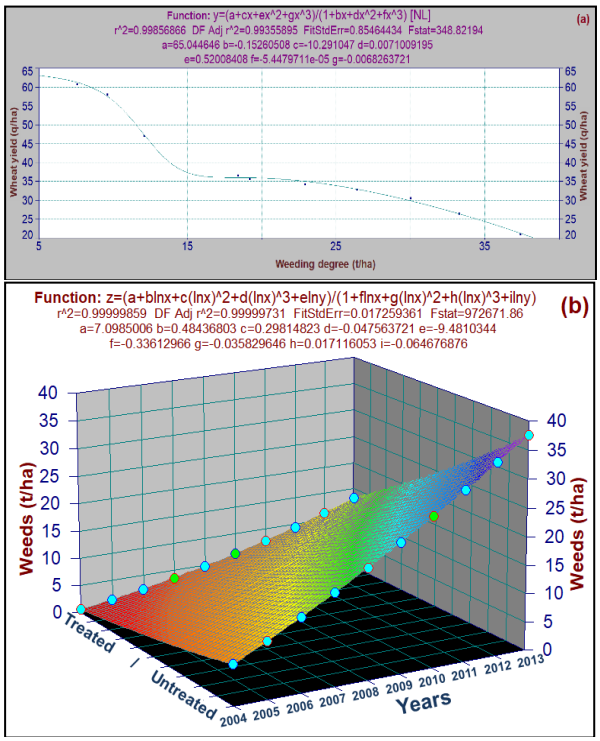

Fig. 5. Correlation between (a) the actual weeding (without herbicide treatment) and wheat yield and (b) the 10-year weeding dynamic, with and without herbicide, both in monoculture
Source: Own results.

Figure 6 shows the correlation between residual weeding (i.e. that remaining after herbicide treatment, as presented in the methodology) and yield loss generated by a low efficacy of treatment in monoculture. The representation function is a complicated, logarithmic one, which looks like below:

$$y = 75.74 + 120.49x - 343.54x^{0,5}lnx + 239.41(lnx)^2 - \frac{137.43}{x^2}$$

The function is ensured by a correlation ratio $r^2 = 0.987 = 98.7\%$ probability of repetition, very significant ratio and close to determination. The appearance of the curve is more uniform, but, as before, yield losses are less pronounced in the area of 2.2-5 t weeds/ha (about 2.1 q wheat/1 t weeds) and higher in the range 5-15 t/ha.
Throughout the experimentation period, the average yield loss, caused by residual weeding is 30 ÷ 15 = 2 q wheat/1 t weeds, difficult to sustain on long term.
Regardless of whether the herbicide treatment was performed or not, the weighted average losses vary around 21.5 q/ha.

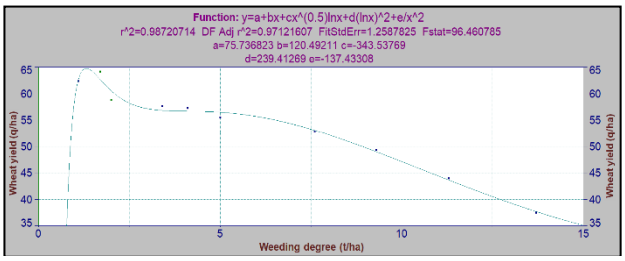

Fig. 6. Correlation between residual weeding (after herbicide treatment) and wheat yield, in monoculture
Source: Own results.

CONCLUSIONS

At the beginning of the experiment, there were four dominant weed species in wheat crop: *Veronica hederifolia*, *Polygonum aviculare*, *Galium aparine* and *Avena fatua*. The spectrum has diversified into monoculture with new species, such as *Stellaria media*, *Setaria glauca*, *Polygonum convolvulus*, *Chenopodium album*, *Matricaria* sp. and perennials *Sorghum halepense* and *Cirsium arvense*. In crop rotation, the change in weed structure was insignificant during the 10 years of research. There is a very close correlation between increasing weeding and reducing yield. About 2 q wheat/ha are lost for each ton of green weeds (biomass).
The loss of wheat yield (Josef variety), determined by monoculture and lack of herbicide, is 38 q/ha after 10 years of research (61.4%). Under crop rotation conditions, even if not treated with herbicides, the losses become significant, but they reach a maximum rating of 8.2 q/ha, i.e. 4.6 times lower. Applying herbicide treatment doesn't preserve yield during the research period, the loss being of 21.5 q/ha (34.7%). The application of herbicides only saves half of the loss caused by long-term monoculture. In the crop rotation with the ameliorating plant (P-W-R-W) the application of the herbicide treatment places the crop on a sustainable curve, with slight increases towards the end of the interval. It is recommended to avoid long monoculture and use the four-year crop with ameliorating plant (peas).

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AGRICULTURAL LANDS SPATIAL VARIABILITY EVALUATION BASED ON AGROCHEMICAL INDICES FOR DIFFERENTIATED FERTILIZATION MANAGEMENT

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Abstract

The study evaluated soil fertility based on specific agrochemical indices, in order to characterize the spatial variability of the agricultural land studied, and for differentiated fertilizers management. The agricultural land under study is located in the area of Tormac, Timis County, Romania. The soil is of the stagno-gleyc preluvosol type, medium loam-clay. Soil reaction (pH), humus content (H%), phosphorus content (P, ppm), and potassium content (K, ppm) were analysed. The values of the degree of saturation in bases (V%) and the nitrogen index (NI) were determined. The pH values varied between 5.40-6.84 ± 0.09, and the degree of saturation in the bases (V%), registered a variation in close correlation with the pH, in the range 51.81-89.02 ± 2.41%. Nitrogen index (NI) registered values between 1.21-2.63±0.08%. Phosphorus content (P) had values between 21.83-111.60 ± 4.88 ppm, and potassium content (K) recorded values between 115.00-341.0 ± 11.97 ppm. There were low values of the coefficient of variation in the case of soil reaction (CV_{pH} = 7.4868) and high values in the case of phosphorus content (CV_P = 44.186). The other agrochemical indices studied had intermediate values in terms of coefficient of variation (CV_V = 16.8066; CV_{NI} = 22.0252; CV_K = 27.3909). Principal Component Analysis facilitated the obtaining of the samples distribution diagram, in relation to the studied agrochemical indices, according to which PC1 explained 87.845% of the variance, and PC2 explained 10.218% of the variance.

Key words: *agricultural land, fertilizer management, soil fertility, spatial variability*

INTRODUCTION

Agricultural land is the main means of production in agriculture [5], and soil is the basic resource through which plants are grown [33], [32].
In conventional agriculture, the soil represents the nutritional media of plants and also through the soil way nutrients are provided for plant growth and development [9], [2].
Soil is characterized by physical, chemical and biological properties, which can be assessed on the basis of specific indices, and in relation to their value is defined and assessed fertility of soil and agricultural land productivity [19], [29].
Soil fertility is a natural trait, supplemented and sustained by man through a series of inputs with a role in the agricultural production process [36], [1].
The spatial distribution of soil properties is uneven, so there is some spatial variability in agricultural land fertility, relative to different influencing factors [35], [12], [3], [16].
Knowing the spatial variability of agricultural land is important for optimizing fertilization and soil improvement works, in order to obtain profitable production and efficiency of agricultural technologies [18], [34], [15], [30].
Different methods and models of analysis are used for the evaluation of agricultural lands, in order to sustainably manage soil resources and agricultural practices [7], [27], [21], [23].
Some methods of soil evaluation are based on chemical analyzes of soil samples, while others estimate the soil indirectly, by imaging analysis of the vegetation cover, as an expression of soil conditions but also of technological influences [10], [13], [17], [31].
Differentiated management of soil resources and agricultural crops, in relation to their

spatial variability, is important in order to optimize agricultural technologies, especially crops fertilization [24], [26], [25], [18], [20], [30].

The purpose of these works, of differentiated fertilization, is to ensure nutrients for agricultural crops in relation to soil supply and production planning, in terms of their quantity and quality [4], [28], [14].

The present study evaluated the soil fertility within an agricultural area, in order to assess the spatial variability of agricultural land for its differentiated fertilization.

MATERIALS AND METHODS

The study aimed to evaluate an agricultural land with an area of approx. 120 ha, in the area of Tormac locality, Timiș County, Romania, regarding the spatial variability of soil fertility. The graphical representation of the reference area, in which the studied agricultural land is framed, is presented in Figure 1, based on the ArcGIS v.10.6 software [8].

Agrochemical indices defining soil fertility were analyzed, such as soil reaction (pH), humus content (H,%), phosphorus content (P, ppm) and potassium content (K, ppm) [6]. The degree of saturation in bases (V,%) was calculated, as a proportionality relationship with the pH. The nitrogen index (NI,%) was calculated in relation to V and H.

The analytical data set of agrochemical indices was analyzed in terms of statistical safety and the presence of variance, through the ANOVA test.

The degree of correlation between the studied agrochemical indices was evaluated and also the interdependence relations and the statistical safety conditions between certain indices were analyzed.

The degree of variability for each agrochemical index was assessed based on the coefficient of variation (CV) and by Diversity profile, as graphical analysis [11].

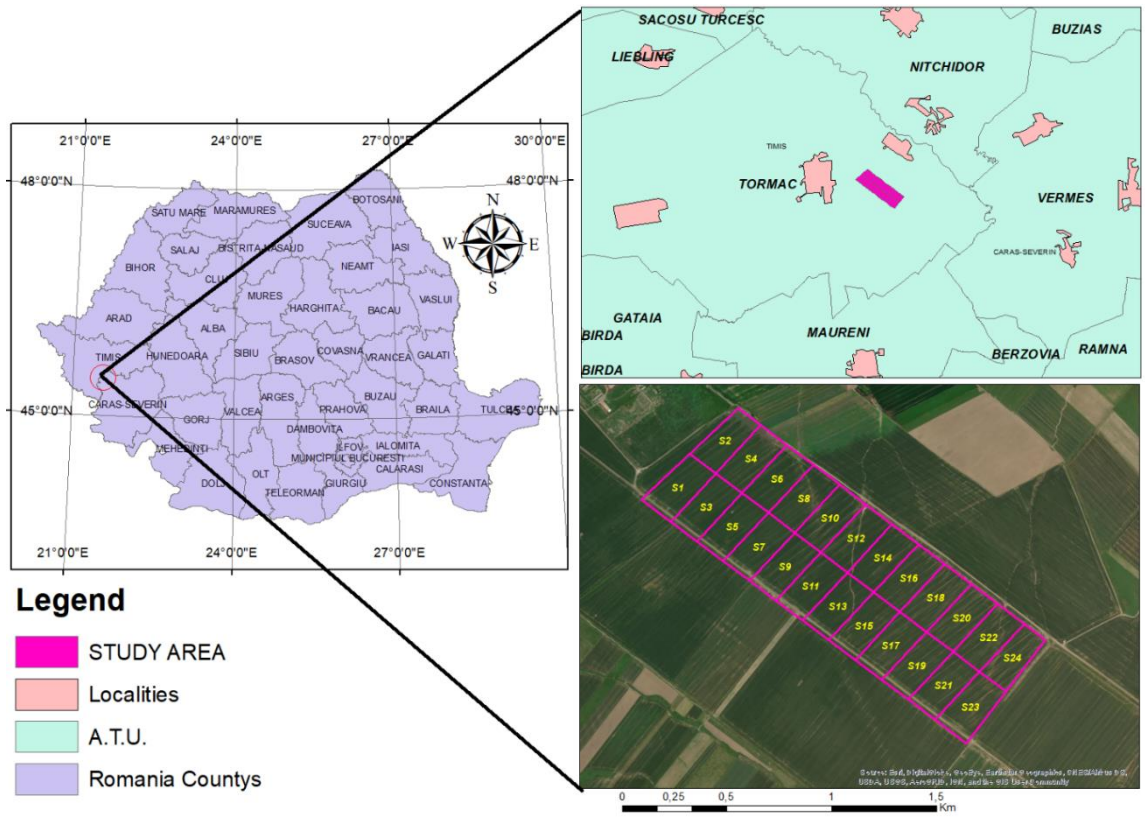

Fig. 1. The location area of the agricultural land under study, Tormac locality, Timis County, Romania
Source: Original figure, created with ArcGIS software.

The analysis and expression of the analyzed surface by quality classes, in relation to each agrochemical index analyzed, was done by percentage reporting (%), with representative graphical distribution.

PCA analysis was used to obtain the distribution diagram of the soil samples in relation to the agrochemical indices (as biplot). Also, in the PCA analysis, the presence of the variance in the analytical data set was explained as a percentage, by PC1 and PC2.

Cluster analysis was used to evaluate the grouping of samples based on Euclidean distances, in relation to the degree of similarity for to the values of the agrochemical indices studied.

RESULTS AND DISCUSSIONS

From the analysis of the soil samples, for the characterization of the studied agricultural land, and by calculations, resulted the values of agrochemical indices with reference to soil reaction (pH), degree of saturation in bases (V,%), nitrogen index (NI,%), phosphorus content (P, ppm) and potassium (K, ppm), (Table 1).

The pH values varied between 5.40-6.84 ± 0.09, and the degree of saturation in the bases (V,%), registered a variation in close correlation with the pH, in the range 51.81-89.02 ± 2.41%.

The nitrogen index (NI) registered values between 1.21-2.63%. The phosphorus content had values between P = 21.83-111.60 ± 4.88 ppm, and the potassium content recorded values between K = 115.00-341.0 ± 11.97 ppm.

The ANOVA - Single factor test confirmed the presence of variance in the data set, as well as the data safety (for Alpha = 0.001; F> Fcrit, p <0.001).

From the analysis of the values of the studied agrochemical indices, in relation to the intervals and limits of significance and classification [22], different distributions levels were found, which shows a spatial variation of the studied agricultural land.

Table 1. The values of the agrochemical indices for the characterization of agricultural land soil fertility in the area of Tormac locality, Timis County, Romania

Nr	pH	V	IN	P	K
S1	6.81	88.24	2.47	63.43	239.66
S2	6.53	81.01	2.27	21.83	215.00
S3	6.25	73.77	2.07	53.96	163.00
S4	6.36	76.61	2.15	68.40	341.00
S5	6.77	87.21	2.44	65.00	227.67
S6	5.40	51.81	1.45	44.48	182
S7	5.91	64.98	1.92	49.78	269
S8	5.67	58.78	1.74	41.36	232
S9	6.84	89.02	2.63	111.60	267
S10	6.22	72.99	2.16	98.58	161
S11	6.15	71.19	2.11	53.74	160
S12	6.73	86.17	2.55	84.65	292.67
S13	5.85	63.43	1.64	68.88	250
S14	6.56	81.78	2.11	79.15	314
S15	6.64	83.85	2.16	77.77	267
S16	5.87	63.95	1.65	40.78	191
S17	5.99	67.05	1.73	29.96	196
S18	5.65	58.27	1.50	52.50	169
S19	5.93	65.50	1.53	31.97	149
S20	5.40	51.81	1.21	24.74	169
S21	5.85	63.43	1.48	25.88	155
S22	6.29	74.80	1.75	34.96	115
S23	5.81	62.40	1.46	34.64	164
S24	5.46	53.36	1.25	41.46	255
SE	±0.09	±2.41	±0.08	±4.88	±11.97

SE – Standard Error

Source: Own data resulting from the analysis of soil samples.

In terms of soil reaction, 8.34% of the agricultural analyzed surface has a neutral pH, 20.83% of the land surface has a weakly acid reaction, and 70.83% of the land surface has a moderately acid reaction (Figure 2).

In relation to the degree of saturation in bases (V), 20.83% of the studied agricultural land area has V <60%, 50.00% of the land area falls within the range of V = 60-80%, and 29.17% of the land has values V> 80% (Figure 3).

The nitrogen index (NI) indicates a part of 41.67% of the surface with low nitrogen supply and 58.33% of the surface with moderate nitrogen supply (Figure 4).

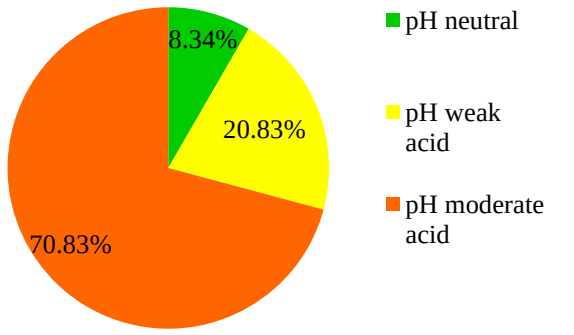

Fig. 2. Percentage distribution of the studied agricultural land, in relation to the soil pH
Source: Figure generated based on analytical data.

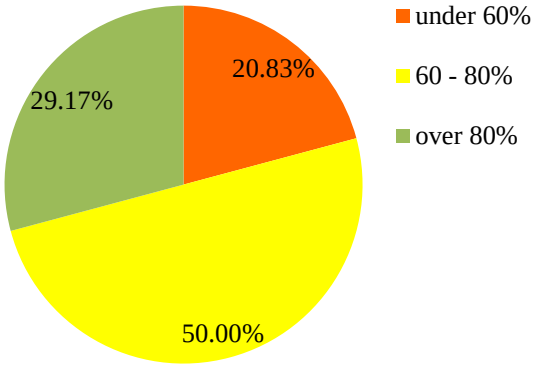

Fig. 3. Percentage distribution of the studied agricultural land, in relation to the degree of saturation in bases (V%)
Source: Figure generated based on analytical data.

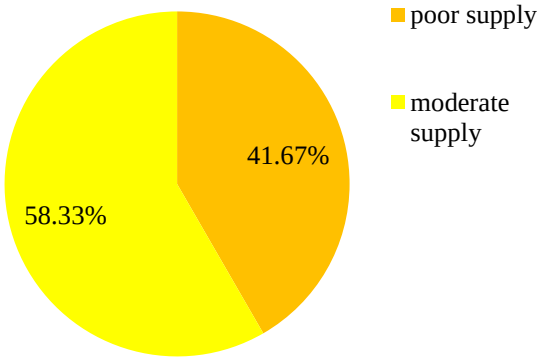

Fig. 4. Percentage distribution of the studied agricultural land, in relation to nitrogen index (NI)
Source: Figure generated based on analytical data.

The values of phosphorus content (P, ppm) indicate that 29.17% of the surface has a poor supply of phosphorus, 50.00% of the surface has a phosphorus good supply and respectively 20.83% of the surface has a very good phosphorus supply (Figure 5). Regarding the supply with potassium, 4.17% of the studied land area has a moderate supply with potassium, 45.83% has a good supply, and 50.00% of the surface has a very good supply of potassium (Figure 6).

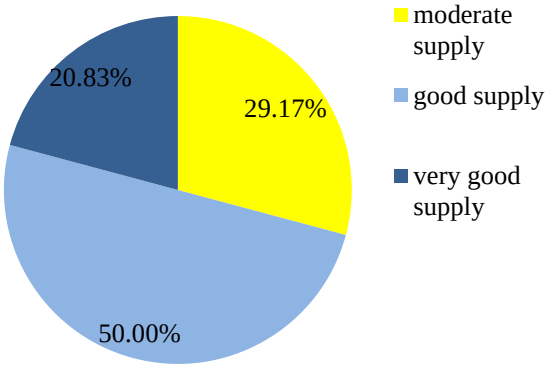

Fig. 5. Percentage distribution of the studied agricultural land, in relation to soil phosphorus content (P, ppm)
Source: Figure generated based on analytical data.

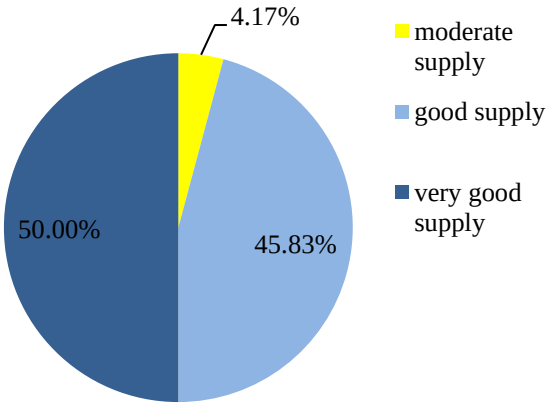

Fig. 6. Percentage distribution of the studied agricultural land, in relation to soil potassium content (K, ppm)
Source: Figure generated based on analytical data.

In the conditions of agricultural use of the studied land, certain balances have been established between agrochemical indices, and from the correlation analysis were

identified very strong positive correlations between pH and V (r = 0.999), between pH and NI (r = 0.934) , and between V and NI (r = 0.937). Low correlations were identified between P and pH (r = 0.601), between P and V (r = 0.608) and between P and NI (r = 0.689). Lower levels of correlation were identified between K and studied agrochemical indices (Table 2).

Table 2. Correlation table between the studied agrochemical indices

	pH	V	NI	P	K
pH					
V	0.999				
NI	0.934	0.937			
P	0.601	0.608	0.689		
K	0.412	0.418	0.470	0.526	

Source: Original values determined based on analytical data.

The interdependence relationship between the Nitrogen Index (NI) and V was described by equation (1), a polynomial equation of degree 2, in statistical safety conditions (R^2 = 0.878, p <0.001). The graphical distribution of NI values in relation to V are shown in Figure 7.

$$IN = 0.0001372x^2 + 0.0135x + 0.2413 \quad (1)$$

where: IN – Nitrogen Index; x – degree of saturation in bases (V%)

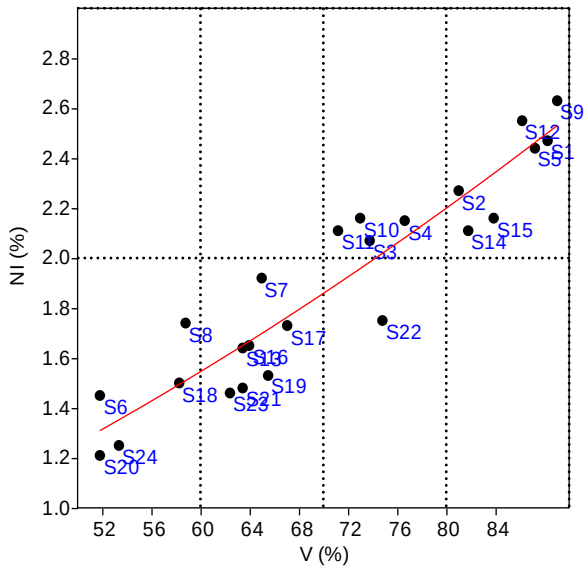

Fig. 7. Distribution of NI values in relation to V, in the conditions of the studied agricultural land
Source: Original graph based on analytical data.

The analysis of the degree of variation of the agrochemical indices values, for the studied agricultural land, was made based on the coefficient of variation (CV). Based on the obtained results, from the analysis of the analytical data set, low values of the coefficient of variation were found in the case of soil reaction (CV_{pH} = 7.4868) and high values in case of phosphorus content (CV_P = 44.186). The other agrochemical indices studied had intermediate values in terms of coefficient of variation (CV_V=16.8066; CV_{NI}=22.0252; CV_K=27.3909).

The analysis of the degree of variation of the agrochemical indices, for the studied agricultural land, was also evaluated on the basis of Diversity profiles, as a graphical analysis (Figure 8). According to the Diversity profiles, there was a small variation in the case of pH values and a high variation in the case of P values. This shows a high spatial variability in terms of phosphorus content (P), followed, in descending order, by potassium (K), nitrogen index (NI), degree of saturation in bases (V) and soil reaction (pH).

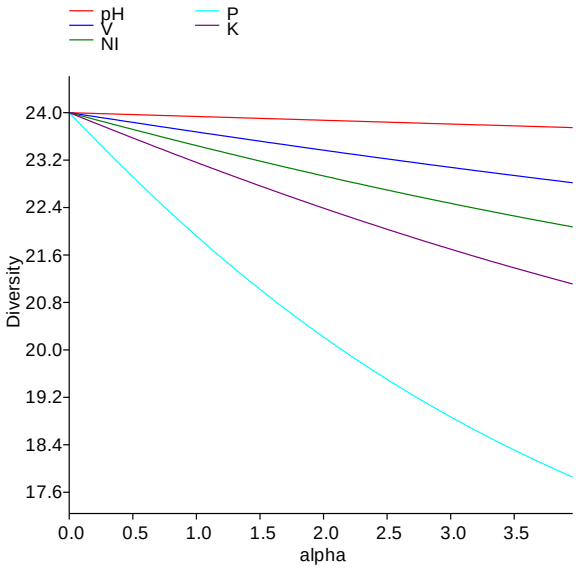

Fig. 8. Diversity profiles of the soil agrochemical indices, in the case of agricultural land studied
Source: Original graph based on analytical data.

Principal Component Analysis facilitated the obtaining of the sample distribution diagram, in relation to the studied agrochemical indices (Figure 9). PC1 explained 87.845% of the variance, and PC2 explained 10.218% of the variance. At the same time, it was found the

distribution of variants in relation to certain agrochemical indices, depending on the analytical values, which express the state of the agricultural land.

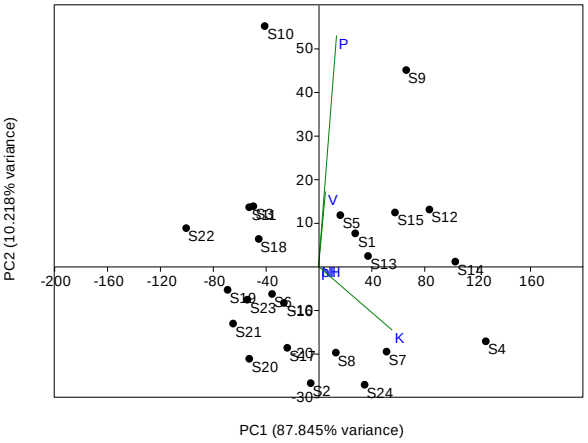

Fig. 9. PCA diagram regarding the distribution of samples in relation to the values of the studied agrochemical indices
Source: Original diagram based on analytical data.

Cluster analysis facilitated the grouping of samples, based on Euclidean distances (Coph.corr. = 0.750), depending on the degree of similarity in relation to the studied agrochemical indices (Figure 10).

The high degree of ramifications within the dendrogram, expresses a high degree of variability of the land, in relation to the studied fertility indices.

Two clusters were outlined, with a large number of subclusters each. From the analysis of Similarity and Distance Indices (SDI) values, the highest degree of similarity between the samples (S3-S11) was found, SDI = 3.9644.

High levels of similarity were recorded between samples (S5-S1), SDI = 12.146, between samples (S16-S17), SDI = 12.317, between samples (S19-S23), SDI = 15.549, between samples (S6-S16), SDI = 15.567, between samples (S6-S18), SDI = 16.587, between samples (S3-S18), SDI = 16.705, and between samples (S19-S21), SDI = 18.237.

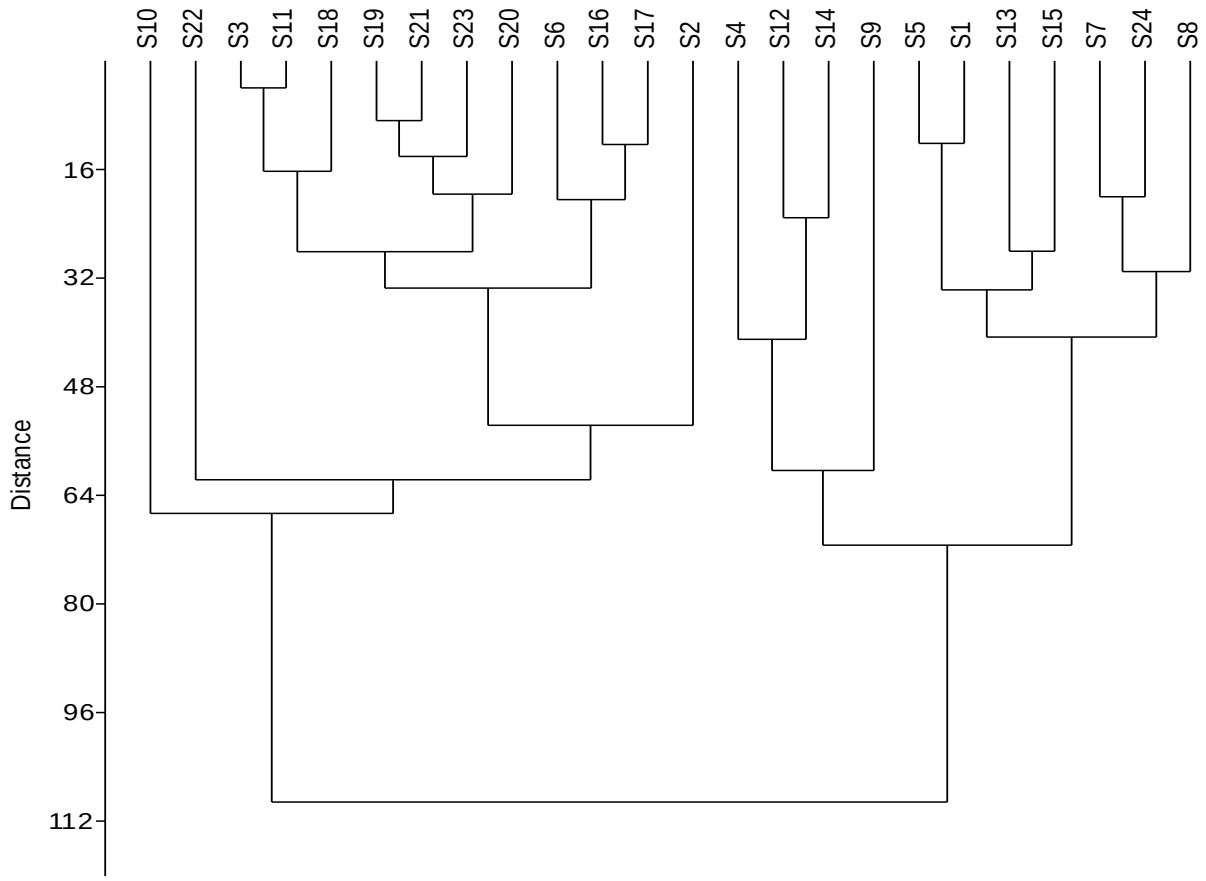

Fig. 10. Clusters diagram regarding the grouping of samples related to the studied agricultural land
Source: Original diagram based on analytical data.

The high degree of spatial variation of the studied agricultural land indicates the need for a differentiated approach, regarding calcarous and fertilizers resources application, in order to ensure optimal plant cultivation conditions.
Thus, in relation to pH, 70.83% of the studied surface has a moderate acid pH, and requires attention for correction with calcareous products. In terms of degree of saturation in bases (V%), an indicator for assessing the need to correct acidity, 20.83% of the studied land area requires an immediate correction of soil reaction by aapplication os calcareous resources.
In terms of the degree of nitrogen supply, assessed on the basis of the nitrogen index (NI), it can be estimated that 41.67% of the surface has a low supply and 58.33% a moderate supply of nitrogen. Therefore, in sizing the assortment of nitrogen fertilizers and doses, the level of the supply soil and the agricultural crops will be taken into account, so as to ensure an adequate nutrition of the cultivated plants.
The level of phosphorus supply of the land can be appreciated as moderate for 29.17% of the surface, good supply for 50.00% of the surface and very good supply for 20.83% of the surface. It is recommended to establish the differentiated doses of phosphorus fertilizers, in relation to the state of land supply and the consumption needs of agricultural crops.
In the case of potassium, according to the analytical values 4.17% of the surface is included in average supply, 45.83% in good supply and 50.00% in very good supply. The sizing of potassium fertilizers is recommended to be done in terms of doses in relation to the condition of the land and the needs of crops.

CONCLUSIONS

From the analysis of agrochemical indices, the agricultural land studied has a high spatial variability in terms of phosphorus content (P), followed in decreasing order, by potassium (K), nitrogen index (NI), degree of saturation in bases (V) and soil reaction (pH).
Due to the fact that the differentiated degree of spatial variability of the studied land, in relation to the analyzed agrochemical indices, it is recommended the differentiated approach of fertilization for each nutrient, respectively the application of calcarous resources, in relation to the concrete situation in the field, given by the analyzed samples.

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MECHANISMS FOR IMPROVING ECONOMIC RELATIONS IN THE MILK SUBCOMPLEX OF THE AGRICULTURAL SECTOR: A CASE STUDY OF UKRAINE

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Abstract

Proposals for the formation of corporate and individual sector strategies are proposed. The dynamics of milk production and processing in Ukraine for 2010-2018 is analysed, where it is noted that the tendency to reduce milk production is still observed, and this, in turn, serves as a significant problem in the dairy subcomplex. The structure of milk purchase by processing enterprises is also considered and characterized, where, according to the requirements of European standards, only grade II milk is received from households for processing. A study was conducted on the author's vision of the development of the commodity dairy sector in rural areas. The main advantages of the participation of the territorial community in the creation and functioning of the procurement organization are investigated. The gradual implementation of measures for the formation of entrepreneurial initiatives in dairy farming in the countryside is demonstrated. There are a number of advantages for the territorial community of the formation of cooperatives, namely the creation of new jobs, increased financial capacity of local budgets due to increased tax revenues, improving the social situation in the united community, the arrival of new techniques and technologies. It was found that the basis for the creation of a production or service cooperative can be a procurement organization formed with the participation of the territorial community or without it. The results of the research on the improvement of organizational and economic relations of milk market participants are demonstrated and substantiated. Perspective directions of development of organizational bases of a dairy subcomplex which allow combining the economic success of business activity of rural households with development of rural territories are considered.

Key words**:** *dairy subcomplex, cooperation, milk producers, dairy cattle breeding, family dairy farms, territorial community*

INTRODUCTION

The development of the milk market is closely linked to the improvement of economic ties between its various elements and areas of production, the conflict of interests of which led to the decline of the entire dairy subcomplex as the material basis of the market. Finding ways to increase the efficiency of the market and the development of its organizational and economic principles, establishing mutually beneficial economic relations in the system "production – processing" of milk, including through the transformation of property relations, strengthening integration and cooperative processes can help eliminate the causes of the crisis in dairy production, and to improve the state of providing consumers with dairy products, which will contribute to the

scientific and practical solution of an important economic task.

Scientific aspects and practical problems of solving this problem are investigated in works of leading agricultural scientists V. Andriichuk, P. Berezivskyi, T. Bozhydarnik, M. Ilchuk, A. Popescu,, H. Cherevko, O. Shpychak, V. Dushka, V. Yakubiv, Y. Yanyshyn, and other researchers [1, 9, 14, 16, 17]. Their research covers the development of the milk market and its organizational and economic foundations, the effectiveness of market relations in the system of production – procurement – processing of raw milk and sales of dairy products, improving the mechanisms of economic relations between rural households and milk processing enterprises and milk market infrastructure.

Problematic aspects of the organizational and economic development of the cooperative movement are studied in the works of Ukrainian agricultural scientists: G. Kaletnik, T. Keranchuk, I. Kostyrko, and others [4, 5, 6].

MATERIALS AND METHODS

The theoretical basis of the scientific article is a dialectical method of understanding the essence of organizational and economic principles of the market, and its methodological basis is a set of methods, techniques, and principles of scientific research of its economic nature and the process of formation and development as an element of transformation processes in the agricultural sector.

Methods of analysis and synthesis, scientific hypotheses, grouping, analysis, system approach, time series, logical method and etc. were also used in the research process.

In the process of research general scientific and special methods and techniques were used, among which: abstract-logical (theoretical generalizations, formation of conclusions and proposals); monographic (identification of components that form the organizational and economic foundations of the formation and functioning of the milk market, form the mechanisms of cooperative relations, motives and incentives for the transformation of organizational and economic relations in the target market and the development of cooperative relations); economic and statistical (study of economic parameters of the target market and performance indicators of its participants, assessment of the dynamics and directions of development of economic relations, assessment of the market environment); tabular and graphical (demonstration of the dynamics of market processes and demonstration of schemes of relationships between the subjects of market relations); systematic analysis (substantiation of proposals for organizational activities for organizational and economic development based on the improvement of integration relations and cooperation in the system of "milk production and processing"). The reliability of the obtained results, conclusions, and proposals is based on a comprehensive analysis of statistical data and scientific generalizations.

RESULTS AND DISCUSSIONS

The milk market begins with the relationship of exchange between milk producers and processing enterprises, so the establishment of their mutually beneficial cooperation is the key to its successful operation.

Milk production is concentrated in two types of farms: agricultural enterprises and households. The dairy industry is an important component [2]. However, milk production and processing volumes in Ukraine tend to decrease from year to year.

Our analysis shows a clear tendency to reduce milk production in Ukraine. Over the last 8 years, production has decreased by 10.53%. Compared to 2017, processing enterprises received raw materials in 2018 less by 3.89% (or -169 thousand tons) (Table 1).

The low quality of raw milk in Ukraine and, as a consequence, dairy products significantly narrow its markets, especially in terms of exports. With the current quality of domestic raw milk, the main consumer of domestic dairy products is still the population of the country [4; 11].

Table 1. Dynamics of milk production and processing in Ukraine

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2018/2010 %**
Milk produced, thousands of tons	11,249	11,086	11,378	11,488	11,133	10,615	10,382	10,281	10,064	89.47
Received milk from processing plants, total, thousands of tons, including:	4,793	4,615	4,716	4,570	4,647	4,251	4,183	4,348	4,179	87.19
From agricultural enterprises, thousands of tons	2,193	2,392	2,684	2,721	2,880	2,744	2,512	2,689	2,720	124.03
From households, thousands of tons	2,544	2,155	2,007	1,824	1,737	1,346	1,198	1,239	1,089	42.80
Marketability of milk, %	42.61	41.63	41.45	39.78	41.74	40.05	40.29	42.29	41.52	–

Source: systematized and built on the basis [10; 12; 15].

Table 2. The structure of milk purchase by processing enterprises

	Agricultural enterprises			**Households**		
	2018	2019 (half-year)	In % to 2018	2018	2019 (half-year)	In % to 2018
Weight of raw cow's milk, t	1,288,674	1,238,635	96.1	572,257	435,455	76.1
in terms of raw milk of the established basic fat content	1,368,423	1,328,495	97.1	582,994	445,837	76.5
including by grades:	X	X	X	X	X	X
Extra	287,735	340,298	118.3	-	-	-
specific weight, %	21.0	25.6	x	-	-	-
of the highest grade	532,841	498,277	93.5	1,366	436	31.9
specific weight, %	38.9	37.5	X	0.3	0.1	X
I grade	463,408	427,143	92.2	68,925	46,328	67.2
specific weight, %	33.9	32.2	X	11.8	10.4	X
II grade	80,558	54,249	67.3	492,672	377,138	76.5
specific weight, %	5.9	4.1	X	84.5	84.6	X
non-grade	3,881	8,528	219.7	20,031	21,935	109.5
specific weight, %	0.3	0.6	X	3.4	4.9	X
Of the total mass of raw cow's milk in kind	X	X	X	X	X	X
cooled to 10ºC	1,106,306	974,406	88.1	310,828	175,724	56,5
specific weight, %	85.8	78.7	X	54.3	40.4	X
Mass fraction of purchased raw cow's milk,%	X	X	X	X	X	X
Fat	3.61	3.65	X	3.46	3.48	X
Protein	3.10	3.12	X	2.96	2.94	X

Source: built and systematized on the basis [5, 7, 13].

Table 3. The influence of the concentration of dairy cows on the efficiency of milk production in agricultural enterprises of the Lviv region, 2019

Indicators	**Group of enterprises by number of dairy cows at the beginning of the year, heads**				**Collectively**
	up to 40	41-100	101-200	201 and more	
Number of enterprises	8	7	7	7	29
The average number of cows per enterprise	24	60	136	408	152
Hopes of milk per cow available at the beginning of the year, kg	2,595	2,886	2,966	5,044	4,285
Costs of milk production per cow, UAH	7,108	8,899	10,755	19,429	16,026
The cost of 1 quintal	273.96	308.34	362.56	385.19	373.92
milk, UAH	392.78	390.50	388.41	478.72	458.62
The sales price of 1 quintal of milk, UAH	3.8	3.8	3.5	18.1	15.0

Source: Calculated according to the data of financial and statistical reporting in the set of agricultural enterprises of the Lviv region of Ukraine, which submit these reports.

Volumes of extra-class milk production by agricultural enterprises increased by 18.3% in 2019 compared to 2018 (Table 2).

Second-grade milk (85% of the total) comes from the population for processing. Which, in accordance with the requirements of European standards is considered unsuitable for processing. And if so far this situation has led to a decrease in the quality of dairy products and increased costs for its production, at the present stage in the face of increasing competition, it poses a threat of failure of the domestic dairy industry to compete with foreign producers.

Concentrations of dairy cows are shown in Table 3.

It is very important as farmers to have high skills to be able to assure a sustainable resources, livestock and production management and benefit of a direct access to markets. Producers associations play an important role in providing low price farm inputs, in accessing the technical services, and in sustaining the delivery of the final products in the market to benefit of the increasing demand [8].

A more obvious trend of the relationship between production costs per unit of the dairy herd and the productivity of cows is illustrated by the graph (Fig. 1).

The results of data processing in the context of enterprises of the Lviv region, which report on the form №50-sg show that there is a well-defined direct link between production costs per unit of dairy herd and productivity of cows.

It is described by the formula:

$$Y_x = 0.2189x + 959.06 \quad \text{.....(1)},$$

where: Y_x - milk yield per cow, kg, x - annual production costs per dairy herd cow, UAH.

According to the results of the study, with the increase in production costs per cow per 1 thousand UAH, milk hopes per unit of livestock increase by 219 kg. The correlation coefficient is 0.82, which indicates a close relationship between the studied traits.

Since the average sale price of 1 quintal of milk by agricultural enterprises of the Lviv region in 2019 was UAH 459, the increase in production costs was covered by an increase in revenue, i.e. it was payback.

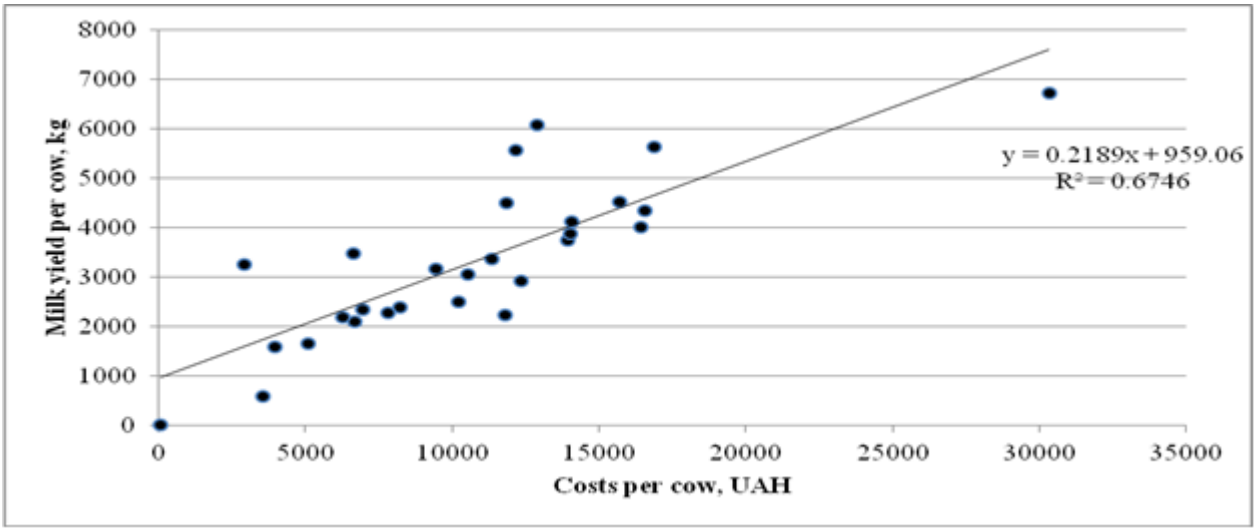

Fig. 1. The impact of costs per unit of livestock on the productivity of dairy cows in agricultural enterprises of the Lviv region of Ukraine, 2019

Source: developed and built on the basis of forms of financial and statistical reporting of agricultural enterprises of the Lviv region of Ukraine.

Having the value R^2=0.6746, we determine the significance of the relationship between the variables X and Y using Fisher's F-test

$$F = \frac{R^2}{1-R^2}\frac{(n-m-1)}{m} \quad \text{.....(2)}$$

The value of F=55.97, where m=1 pairwise regression.

The calculated actual value of the Fisher criterion F is compared with the tabular Ftable. With the degrees of freedom of the numerator (m1-1) = (2-1) = 1 and the denominator (n-m1) = (29-2) = 27 and the accepted level of confidence (1-α) = (1-0.05) = 0.95 Ftable for this model is equal to Ftable = 25.65. Since F> Ftable (55.97> 25.65), this means the significance of the relationship in the econometric model.

As long as the sum of the adjusted Y depending on X is equal with the sum of the empirical values, the parameters a and b of the regression model are correctly calculated.

Socio-economic reorientation of the formation of the model of domestic agricultural development in the process of market transformation of the national economy requires changes in development trends, the institutional environment, and the restoration of the multifunctional nature of Ukrainian agriculture. As a result of the fact that the processes that take place in the external environment are excessively rapid, agricultural enterprises of different types and forms of ownership (especially farms and households) cannot respond to all changes in a timely and appropriate manner. Therefore, due to the characteristics of a stable model of factors of production – land, labour, capital, we bring to the fore organizational and legal forms together with human capital, which are best adapted to external changes. Only cooperation and dissemination of mutually beneficial forms of vertically integrated agro-food formations from family farms and private farms with a harmonious combination of different industries and types of farms (large, medium, and small) will increase the overall level of productivity, competitiveness in the agricultural sector. This combination should open opportunities for rational use of land resources, as well as creating conditions for equal access of producers to technical, technological, and organizational innovations, finance, market infrastructure, benefits from exports and, consequently, maximizing profits and sustainable social development of rural areas and economy of the state as a whole.

In Fig. 2, consider the proposals for the corporate sector, and in Fig. 3.

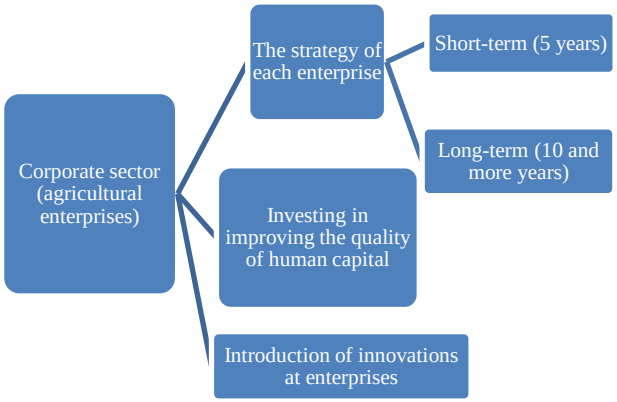

Fig. 2. Proposals for the corporate sector.
Source: own development.

To form a strategy for the development of agricultural enterprises, we make proposals for two groups of agricultural producers – the corporate sector [11], i.e. large agricultural producers, and the individual sector – farms and households.

In the absence of sufficient investment resources, the creation of dairy cooperatives will contribute to the formation of the necessary material and technical base to ensure the proper process of milking and primary processing of milk, which will help solve the problem of milk quality. Agricultural service cooperative is a non-profit organization that operates to provide its members with the services necessary for farming and seeks to increase the amount of their income [8, p. 7].

The operation of such a cooperative takes place on a contractual basis and provides for the sale of milk through a service cooperative. Instead, the service cooperative undertakes to provide services to provide producers with feed at the lowest possible prices, technical support of economic activities, etc. [6].

Modern realities – radical changes in the structure of local territorial communities and budget and tax decentralization – create unique conditions for cooperation between territorial governments and rural households

to legalize business, it's structuring, and streamlining.

As a result of budget decentralization, territorial communities receive significant financial resources that can be invested not only in infrastructure development, including social but also in economic projects [3].

We see the development of the commodity dairy sector in rural areas in the implementation of such a scenario.

First of all, it is necessary to create a business entity controlled by producers or members of the local community, which would be engaged in milk production. This entity must compete with existing buyers, and the purpose of its activities is to regulate the purchase prices of milk by market methods.

Such an economic entity may be created by the efforts of individual producers in the form of a cooperative association or with the participation of a government body – a united territorial community.

The second option, in our opinion, is currently optimal for the local community and individual producers.

On the one hand, sole proprietors will control the activities of the buyer formed with the participation of the territorial community with both economic and political levers. On the other hand, the territorial community is interested in the development of small businesses in the countryside, their legalization.

Typically, small businesses use a simplified taxation system, and the single tax administered under this system remains fully available to local budgets. That is, there are a clear interdependence and mutual interest between the needs of the territorial community and individual producers.

Funds may be allocated from the budget of the territorial community for the repair of premises, bringing them to sanitary requirements, financing the development of production infrastructure, including transport.

At the first stage of its activity, the procurement organization must operate with zero profitability, which will allow adjusting the purchase prices for milk and the profitability of its producers.

We believe that in this case, in the short term, the interest of the local community is not to make a profit, but to stimulate the entrepreneurial initiative of rural households. In fact, the local community will initiate the creation of a structure that in the future can be used as a platform for the formation of a cooperative association.

The participation of the territorial community in the establishment and operation of the procurement organization can be both financial and non-financial.

The territorial community may contribute financial assets to the authorized capital of the procurer or enter the participant as a result of the transfer for use of certain premises and other types of fixed assets.

The territorial community can sell or keep its share in the cooperative association. An unconditional condition for such cooperation is the legal conduct of small businesses, including through the creation of family farms. This is the next stage in the development of the entrepreneurial initiative of the territorial community.

The implementation of this stage will require a number of information and organizational measures, including:

– conducting training seminars;

– provision of consulting and advisory services;

– organization of cooperation with state authorities.

The phased implementation of measures to form a business initiative in the countryside aims to create the necessary conditions for starting your own business, running it on a self-sustaining and self-financing basis, phased development, structuring, etc. (Fig. 3).

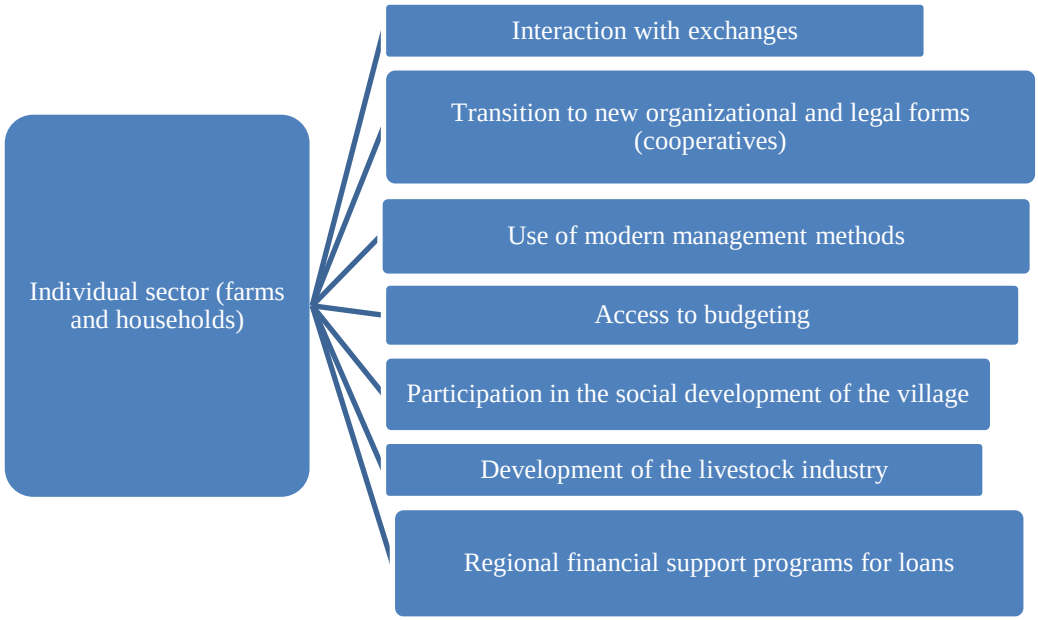

Fig. 3. Proposals for the individual sector
Source: own development.

The primary source of funding for a small business organization may be not so much the own funds of producers, the budgetary resource of the local community, as funds raised in specialized funds. For example, an unemployed small milk producer registers with an employment centre, draws up a business plan for setting up a family dairy farm, submits it to the relevant commission for consideration and approval, and registers as a business entity. Subject to the approval of the business plan, the milk producer is paid a lump sum of unemployment benefits in the amount corresponding to the number of benefits due to him for the entire period. The funds are earmarked and can be used only to start your own business and its development.

The next stages of change aimed at the development of dairy farming in rural areas and the formation of an efficient market for milk and dairy products should be the association of milk producers and other stakeholders on a cooperative basis and/or integration of producers with processors.

If the integration processes are mostly of indirect interest to local communities, they are directly interested in the formation of cooperatives.

The formation of cooperatives certainly has a number of advantages for the local community, including:

– creation of new jobs;

– growth of financial capabilities of local budgets due to increased tax revenues;

– improving the social situation on the territory of the united community;

– innovative way of development of production (a receipt of new technologies, equipment, productive breeds of cattle).

The participation of the territorial community in the creation of cooperatives should be reduced to a stimulating and regulatory role. The territorial community may provide the cooperative association with the necessary premises for production and non-production purposes for temporary use.

It is necessary to provide a mechanism for the gradual growth of rents, i.e. during the first year of operation of the rent of the premises should not be charged, during the second year, the rent should be paid at 20% of its amount and increase in subsequent periods by 20% annually and only in the sixth year reach the level of 100% of the amount.

Another indirect method of supporting the development of a cooperative association, especially if it is established as a service cooperative, may be the transfer to it for temporary use on preferential terms of land from the reserve fund for grazing livestock, the organization of loose camp pasture system in the summer, growing fodder, etc.

In this case, the participation of the territorial community is reduced to facilitating the

receipt of appropriate approvals from public authorities.

We believe that in the context of the financial crisis, the instability of the national currency, the high cost of credit resources, and the difficulty of obtaining them for newly established business associations, it is the territorial communities that should act as generators of entrepreneurial activity in rural areas. At the same time, they should not act as a co-founder of the business entity but perform a coordinating function, implement incentives and regulatory measures. The basis for the creation of a production or service cooperative may be a procurement organization formed with the participation of the territorial community or without it.

The results of our study to improve the economic relations of milk market participants are shown in Fig. 4.

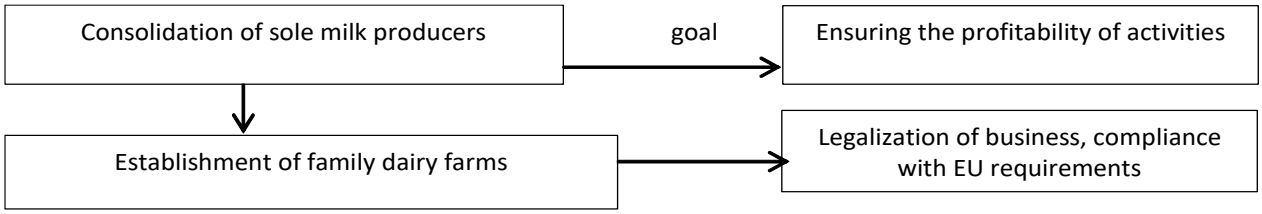

Fig. 4. Initial stages of supporting entrepreneurial initiative in dairy farming
Source: own development.

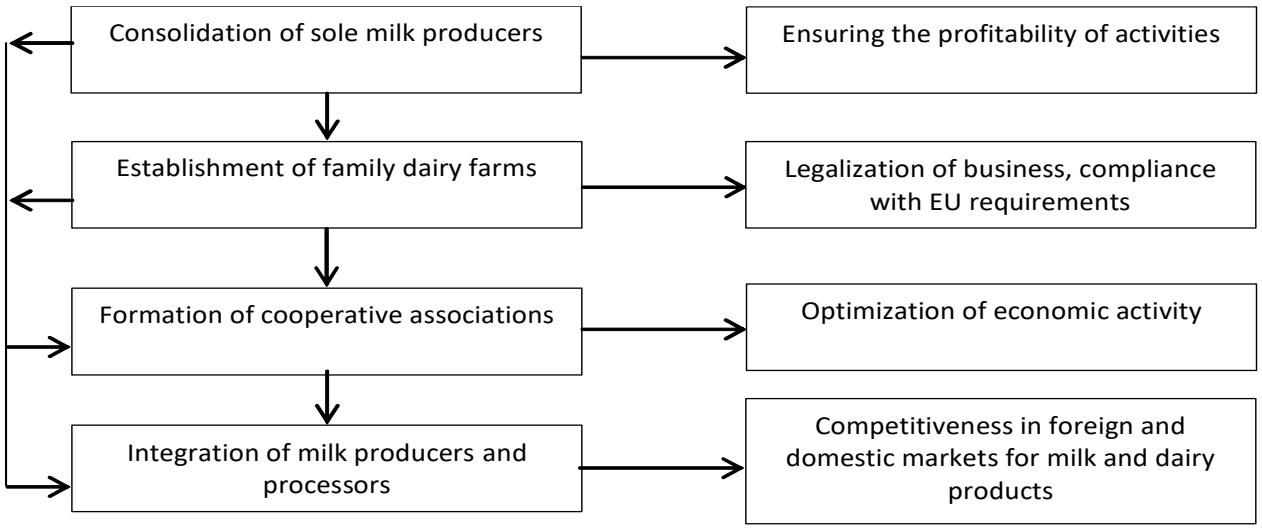

Fig. 5. Stages of improving the organizational and economic relations of dairy entities under the complex of Ukraine
Source: own development.

We believe that in order to be effective in the dairy market, small producers must go through three mandatory stages: consolidation, legalization, and cooperation.

This will allow them to compete with processing plants and procurement organizations, and thus influence the cost of raw materials, i.e. milk. The fourth stage - integration, in particular in the form of an integrated cooperative - will provide raw material producers with additional opportunities, including participation in the redistribution of income of processing enterprises, which are obtained from the sale of final products.

As we can see (Fig. 6), investing in the development of entrepreneurial initiatives will ultimately increase the income of local communities and, consequently, their financial capabilities.

The given scheme can be imposed also on other branches of agricultural production which functioning is economically expedient in the corresponding territory.

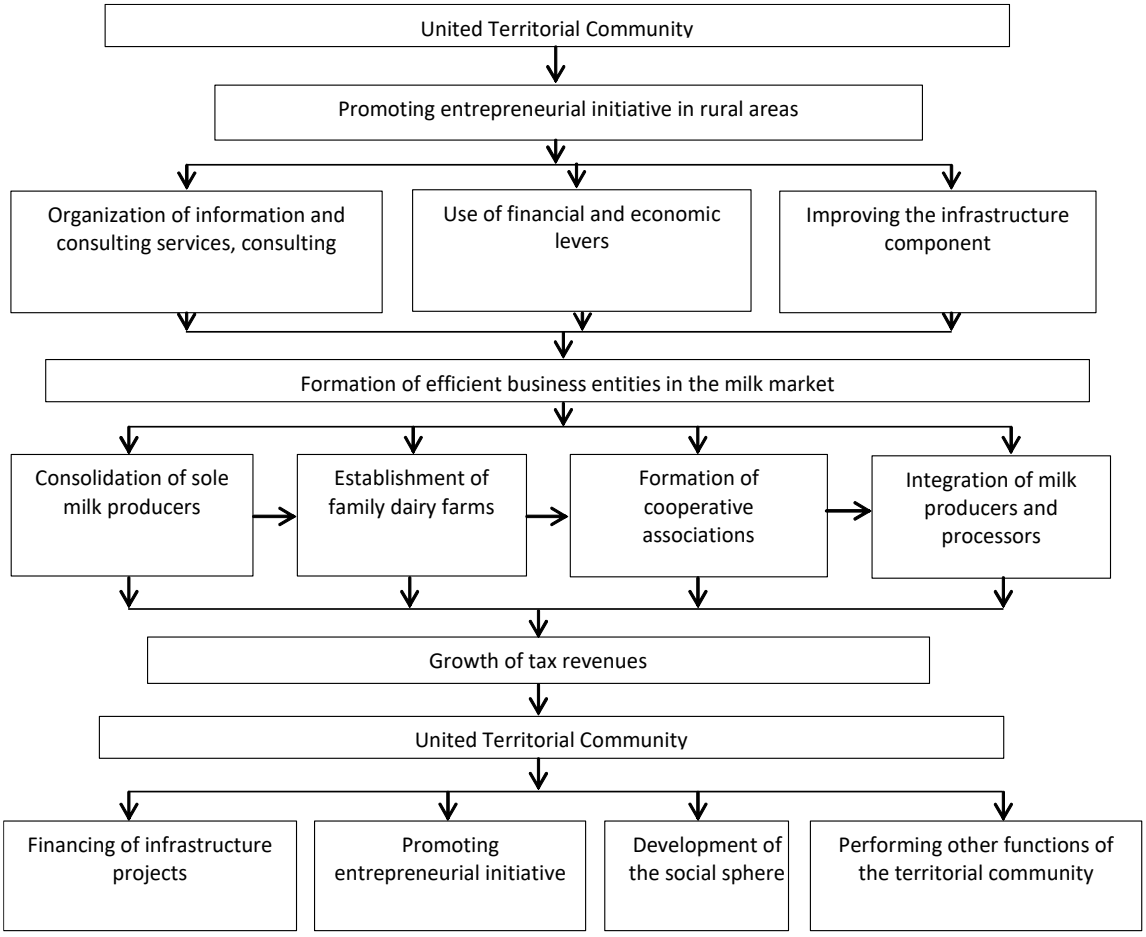

Fig. 6. The expediency of support of milk and dairy products market entities by united territorial communities
Source: own development.

CONCLUSIONS

The most promising ways to develop the organizational foundations of the dairy subcomplex are areas that combine the economic success of entrepreneurial activity of rural households with the development of rural areas. The conceptual organizational basis for the formation of an efficient milk market, in our opinion, is the best adaptation of private farms to modern market requirements through the widespread creation on their basis of small organizational and economic forms of management - family farms.

We believe that only through the organizational development of a set of disparate individual farms through their transformation into marketable family farms can a sufficiently large number of entities and a potentially competitive rural sector be formed, which will be able to stabilize the dairy market.

In order to be effective in the dairy market, small producers must go through three mandatory stages: consolidation, legalization, and cooperation.

This will allow them to compete with processing companies and procurement organizations, and thus affect the cost of raw materials, ie milk. The fourth stage - integration will provide raw material producers with additional benefits, in particular participation in the redistribution of income of processing enterprises, which are obtained from the sale of final products.

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METHODOLOGICAL JUSTIFICATION AND ANALYTICAL SUPPORT FOR CASH FLOW FORECASTING

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Abstract

Based on the industry specifics of the agricultural business and on the basis of the results of the structural and coefficient analysis of the organization's cash flows, the article substantiates the need for rational cash management and forecasting their future flows. To carry out competent coordination of calculations and ensure timely cash flow, methodological approaches to forecasting cash flows based on the use of a multiplicative time series model and a study of the influence of seasonal and random components are proposed. Application of the proposed methodology on the example of a specific agricultural organization led to the conclusion that when using an adaptive model with a seasonal component, the calculated values have significant discrepancies with the actual data. The average value of the relative error exceeded 5%. Checking the randomness of the levels of the residual component based on the turning point criterion made it possible to characterize the constructed model as adequate, make a forecast for the coming year, and identify the main tools for improving the efficiency of cash flow management.

Key words**:** *analysis, forecasting, cash flow, time series model*

INTRODUCTION

Most of the participants in the agricultural business of Russia in their economic activities are faced with the problem of a shortage of funds. One of the reasons for this phenomenon is ineffective cash flow management [11]. For a stable and stable operation of an enterprise, it must have the optimal amount of funds at its disposal. A sufficient volume of money supply ensures the solvency of the enterprise, a high level of liquidity and decent indicators of the efficiency of its work [1, 2, 17]. However, in the agricultural sector of production, the influence of seasonal changes in the levels of expenses and income from the main activity is significant, which inevitably affects the adequacy of funds [3, 5]. «If other factors have a deeper influence on production, either the farmers have to manage much better their business or the level of the acquisition price has to be much higher» [16]. To smooth out the negative impact of the seasonality of agricultural production on the formation of cash flows from current activities, it is necessary to analyze their movement and develop forecasts of their possible fluctuations [8, 12, 14, 17]. This would allow making informed decisions on the use of existing and attracting additional funds, timely identify problematic moments and possible growth points. For competent planning and regulation of future cash flows, a detailed study of their behavior [9, 15] in the past and current periods is necessary using special methods [7, 10, 13].

MATERIALS AND METHODS

In the process of work, the methods used in economic science were used: general scientific (dialectical, analysis and synthesis, comparison and analogy); special (systemic, comparative analysis, economic and mathematical). The information base of the research was the data of official statistics; data of annual financial statements and accounting registers of funds of an agricultural organization of the Penza region; reference materials of specialized publications on the subject under study; materials of our own research; Internet data (scientific articles and works of practitioners, industry portals, economic reviews). In the course of the study, a structural and coefficient analysis of cash

flows was carried out, an indicator of a comprehensive assessment of the quality of cash management was calculated [4]. For short-term forecasting of cash flows, an adaptive model with a seasonal Holt-Winters component was used, based on a combination of a trend with a multiplicatively superimposed seasonal component [6]. With the help of the model, forecasts with expired validity are calculated, that is, those relating to periods in which the actual value of the indicator has already been realized, and real forecasts for a period that has not yet come.

RESULTS AND DISCUSSIONS

The analysis of cash flows and their forecasting were carried out according to the accounting data of a real participant in the agricultural business. For this, an agricultural organization of the Penza region was chosen, which has characteristics inherent in most agricultural producers in the region. A significant share of them is engaged in the production of agricultural raw materials, without providing for its primary or industrial processing.

When analyzing cash flows, the tendency of their changes in the directions of receipt and consumption (Table 1) was determined, their structure was analyzed.

Both positive and negative cash flows of the organization are formed due to current (main) activities.

Table 1. Cash flow structure (%)

Cash flow	Positive cash flow (income)				Negative cash flow (consumption)			
	2018	2019	2020	Changes (columns 2 - 4)	2018	2019	2020	Changes (columns 6 - 8)
1	2	3	4	5	6	7	8	9
Current	92.5	94.6	100.0	7.5	85.60	79.95	96.29	10.69
Investment	-	-	-	-	1.11	9.86	-	-1.11
Financial	7.5	5.4	-	-7.5	13.29	10.19	3.71	-9.58
Total	100.00	100.00	100.00	x	100.0	100.00	100.00	x

Source: Compiled by the authors on the basis of accounting data and financial statements of an agricultural organization.

As of 2020 the entire money supply was received solely from current operations. The share of financial transactions in the organization's expenses was less than 4%.

The coefficient analysis of the quality of cash flows from current activities (Table 2) showed a downward trend.

Table 2. Dynamics of indicators of the quality of cash flows from current activities

Indicator name	2018	2019	2020	Changes (col. 2 - 4)	Baseline growth rate ($T_{pc,\%}$)
1	2	3	4	5	6
Solvency ratio for current activities	1.0748	1.1838	1.0392	-0.0356	0.9668
Ratio of positive cash flow to assets	0.9336	0.9808	0.7621	-0.1715	0.8163
The ratio of the ratio of net cash flow to positive cash flow	0.0696	0.1553	0.0377	-0.0319	0.5413
Net cash flow to assets ratio	0.0650	0.1523	0.0287	-0.0363	0.4417
Revenue-to-asset ratio,	0.8436	0.9603	0.7713	-0.0723	0.9143
The ratio of the ratio of net cash flow to negative cash flow	0.0748	0.1838	0.0392	-0.0356	0.5234
Ratio of positive cash flow to revenue	1.107	1.021	0.9880	-0.1190	0.8925
The ratio of the ratio of net profit and net cash flow	0.2612	0.1105	0.4038	0.1426	1.5461

Source: Authors' compilation based on the accounting data and financial statements of an agricultural organization.

The value of the generalizing quality indicator, calculated as the geometric mean of the growth rates of eight separate indicators, is less than 1.0 ($T_{pc} = (\prod T_p(K_k))^{1/8} = 0.7708$

или 77.08 %). The value $T_{pc} > 1$ indicates an increase in the quality of cash flows. $T_{pc} > 1$, confirms the opposite trend. Thus, the indicator of a comprehensive assessment indicates a decrease in the quality of cash flow management for the period 2018 - 2020. by 22.92%. To improve the efficiency of the use of funds, to determine their shortage or surplus for individual periods of the calendar year, the forecast indicators of cash flows were calculated using the Holt-Winters model. To build the model, data on cash balances at the end of each quarter of the study period were used (Table 3).

Table 3. Cash balances at the end of the period

Period	t	Y(t), thousand roubles	Период	t	Y(t), thousand roubles
Q1 2017	1	474	Period	9	11
Q2 2017	2	654	Q1 2019	10	150
Q3 2017	3	323	Q2 2019	11	9
4th quarter 2017	4	612	Q3 2019	12	42
Q1 2018	5	106	4th quarter 2019	13	17
Q2 2018	6	962	Q1 2020	14	148
Q3 2018	7	1,742	Q2 2020	15	326
4th quarter 2018	8	27	Q3 2020	16	98

Source: Compiled by the authors based on the accounting data of an agricultural organization.

To align the time series the following equation was used:

$$Y_p(t) = a(0) + b(0) \cdot t.$$

To find the values of the parameters a (0) and b (0) required for further calculation, auxiliary Table 4 was compiled.

The values of the parameters a (0) and b (0) were calculated using the formulas:

$$b(0) = \frac{\sum(Y(t)-Y_{cp})(t-t_{cp})}{\sum_{(t-t_{cp})}^{2}} = 44.31;$$

$$a(0) = Y_{cp} - b(0)*t_{cp} = 413.11.$$

Table 4. Auxiliary data for the calculation

	t	Y(t)	$t-t_{cp}$	$Y-Y_{cp}$	$(t-t_{cp})^2$	$(Y-Y_{cp})\cdot(t-t_{cp})$
	1	474	-3.5	-138.5	12.25	484.8
	2	654	-2.5	41.5	6.25	-103.8
	3	323	-1.5	-289.5	2.25	434.3
	4	612	-0.5	-0.5	0.25	0.3
	5	106	0.5	-506.5	0.25	-253.3
	6	962	1.5	349.5	2.25	524.3
	7	1,742	2.5	1,129.5	6.25	2,823.8
	8	27	3.5	-585.5	12.25	-2,049.3
∑	36	4,900	0	0.0	42	1,861.0
Average	4.5	1,477	0	0	5,25	232,6

Source: own calculations.

The linear model for the presented data is:
$Y_p(t) = 413.11 + 44.31*t.$
The results of calculating the value of $Y_p(t)$ in comparison with the actual data are presented in Table 5.
The data in Table 5 show significant discrepancies.

Table 5. Calculated values

T	**Y(t)**	**$Y_p(t)$**
1	474	457.4
2	654	501.7
3	323	546.0
4	612	590.3
5	106	634.7
6	962	679.0
7	1,742	723.3
8	27	767.6

Source: own calculations.

Therefore, to assess the accuracy of the model, it is necessary to calculate a number of indicators: parameters a(t) and b(t), seasonality coefficient F(t), predicted values Y_p, absolute deviations E(t) and relative error. For the value t=0, the parameters a(t) and b(t) would be equal to those calculated earlier, and for t≥1, the values of the parameters are determined by the formulas:

$$a(t) = \frac{\alpha_1 \cdot Y(t)}{F(t-L)} + (1-\alpha_1) \cdot [a(t-1) + b(t-1)]$$
$$b(t) = \alpha_3 \cdot [a(t) - a(t-1)] + (1-\alpha_3) \cdot b(t-1),$$

where: $\alpha_1 = 0.900$; $\alpha_3 = 0.251$.
The values of the seasonality coefficients for negative and zero values of the argument *t* are calculated as the arithmetic mean over several corresponding periods.
The values of the seasonality coefficients for positive values of the argument *t* are determined by the formula:

$$F(t) = \frac{\alpha_2 \cdot Y(t)}{a(t)} + (1-\alpha_2) \cdot F(t-L),$$

where: $\alpha_2 = 0.001$, a L = 4.

Forecasted Y_p values are calculated by the formula:

$$Y_p(t+k) = [a(t) + k \cdot b(t)] \cdot F(t+k-L),$$

where: k = 1.

The absolute deviations of the predicted values from the actual ones is determined as the difference between them:

$$E(t) = Y(t) - Y_p(t).$$

The relative error would be calculated using the formula:

$$ABS(E(t)) \,/\, Y(t)\%.$$

For this indicator, it is necessary to calculate the total and the average in order to assess the accuracy of the model (Table 6).

Table 6. Estimation of the accuracy of the Holt-Winters model

t	Y(t)	a(t)	b(t)	F(t)	Yp(t)	E(t)	Imprecision, %
-3				0.60			
-2				1.36			
-1				1.50			
0		413.11	44.31	0.54			
1	474	754.81	118.95	0.60	275,20	198,80	41,94
2	654	520.11	30.19	1.36	1,188.47	-534.47	81.72
3	323	248.83	-45.48	1.50	825.46	-502.46	155.56
4	612	1,048.08	166.55	0.54	108.98	503.02	82.19
5	106	280.02	-68.04	0.60	730.80	-624.80	589.43
6	962	657.78	43.86	1.36	288.32	673.68	70.03
7	1,742	1,115.49	147.73	1.50	1,052.32	689.68	39.59
8	27	171.66	-126.25	0.54	677.06	-650.06	2,407.63
9	11	21.00	-132.38	0.60	27.31	-16.31	148.29
10	150	88.11	-82.30	1.36	-151.49	301.49	200.99
11	9	5.98	-82.26	1.50	8.71	0.29	3.18
12	42	62.95	-47.32	0.54	-40.86	82.86	197.27
13	17	27.01	-44.46	0.60	9.40	7.60	44.70
14	148	96.16	-15.94	1.36	-23.75	171.75	116.05
15	326	203.64	15.04	1.50	120.31	205.69	63.09
16	98	186.50	6.96	0.54	117.15	-19.15	19.54
						Total	4,261.23
						Average	266.33

Source: Own results.

Any imprecision is considered acceptable if its value does not exceed 5%. It follows from the above calculations that the accuracy condition is not met. It was not possible to establish a clear trend in the change in funds. This is due to large fluctuations in the indicator. As a result, the relative imprecision is many times exceeds the permissible value, which entails inaccuracy of the forecast.
Based on the obtained result, it is required to evaluate the model for adequacy by fulfilling the condition of randomness, the

independence of successive levels (there is no autocorrelation) and the normal distribution of a number of residuals. The randomness of the levels of the residual component is checked on the basis of the turning point criterion. To do this, each level E(t) is compared with two adjacent ones. If it is more or less than both adjacent indicators, the point is considered a turning point, 1 is set, otherwise 0 is set.

Table 7. Intermediate calculations to assess the adequacy of the model

T	E(t)	Turning point	$E(t)^2$	$(E(t)-E(t-1))^2$	E(t)*E(t-1)
1	198.8011	—	39,521.9	—	—
2	-534.4745	1	285,662.9	537,693.1	-106,254.1
3	-502.4596	0	252,465.6	1,025.0	268,551.8
4	503.0205	1	253,029.6	1,010,990.2	-252,747.5
5	-624.7995	1	390,374.5	1,271,978.1	-314,287.0
6	673.6839	0	453,850.1	1,686,059.4	-420,917.4
7	689.6793	1	475,657.6	255.9	464,625.9
8	-650.0605	1	422,578.7	1,794,902.8	-448,333.3
9	-16.3123	0	266.1	401,636.8	10,604.0
10	301.4895	1	90,895.9	100,997.9	-4,918.0
11	0.2864	1	0.1	90,723.3	86.3
12	82.8554	1	6,865.0	6,817.6	23.7
13	7.5994	1	57.8	5,663.5	629.7
14	171.7481	0	29,497.4	26,944.8	1,305.2
15	205.6882	1	42,307.7	1,151.9	35,326.6
16	-19.1493	1	366.7	50,551.9	-3,938.8
Total	487.5963	11	2,743,397.4	6,987,392.1	-770,242.9

Source: Own calculations.

The data in Table 7 confirm the presence of 11 turning points. For further calculation, it is required to determine the value of q by the formula:

$$int\left[2\cdot(N-2)/3-2\sqrt{\frac{16N-29}{90}}\right]$$

This formula means that only the whole part is taken from the obtained value:

$$q = int[2\cdot(16-2)/3\ -2\sqrt{\frac{16\cdot16-29}{90}} = int[6.1570] = 6.$$

The condition of randomness of levels is satisfied if the number of turning points is greater than the value q. Thus, the fulfillment of this condition has been established.

The absence of autocorrelation can be checked using the d-Durbin-Watson test:

$$d = \frac{\sum(E(t)-E(t-1))^2}{\sum E(t)^2} = \frac{44{,}169{,}636.0}{28{,}875{,}148.4} = 2.5470.$$

The forecast values are calculated as follows:

If the obtained value is greater than 2, the value of d requires clarification by subtracting it from 4. Based on the results of calculating the value of d, the revised value was:

$$d = 4 - 2.5470 = 1.4530.$$

The refined value of the d value showed that the levels of a number of residuals are independent, and the constructed model is adequate, therefore, it allows us to make a forecast for the next year or 4 quarters (t =17 to t=20). The predicted values of the indicator can be determined by the formula:

$$Y_p(t+k) = [a(t) + k\cdot b(t)]\cdot F(t+k-L).$$

for $Y_p(17)$ k=1, для $Y_p(18)$ k=2, $Y_p(19)$ k=3, for $Y_p(20)$ k=4.

The forecast values are calculated as follows:

Y_p (17) = [a(16) + 1 · b(16)] · F(13);
Y_p (18) = [a(17) + 2 · b(17)] · F(14);
Y_p (19) = [a(18) + 3 · b(18)] · F(15);
Y_p (20) = [a(19) + 4 · b(19)] · F(16) [2, 7].

The results of calculating the forecast values of cash are presented in Table 8.

To compare the actual and calculated data for previous periods and determine the general trend in the behavior of the predicted indicator in the next four quarters of 2021, the results of the calculations are presented graphically (Figure 1).

The graphical display of the forecast values of cash flows has visible discrepancies with the actual indicators only in the first half of the time series. The subsequent behavior of the calculated and actual data, despite the low level of forecast accuracy, does not show significant fluctuations.

At the same time, the predicted values of the indicator for the coming year characterize the diminishing dynamics of funds with small fluctuations throughout the entire period. The amount of money supply will be sufficient to carry out current activities, but it is necessary to take measures to manage cash flows.

The main tools for improving the efficiency of cash flow management can be:

- an increase in cash flow due to an increase in sales, improving the quality of manufactured products, conducting effective advertising to attract new customers, implementing measures to collect accounts receivable, etc.;
- reducing the outflow of funds by optimizing the costs of production and sales of products, prioritizing when planning purchases, rationing stocks, high-quality legal support when concluding contracts, tax planning.

Table 8. Forecast of cash flows from current activities for 2021

t	Y(t)	Yp(t)
1	474	275.20
2	654	1,188.47
3	323	825.46
4	612	108.98
5	106	730.80
6	962	288.32
7	1,742	1,052.32
8	27	677.06
9	11	27.31
10	150	-151.49
11	9	8.71
12	42	-40.86
13	17	9.40
14	148	-23.75
15	326	120.31
16	98	117.15
17		116.35
18		272.72
19		311.07
20		114.83

Source: Own results.

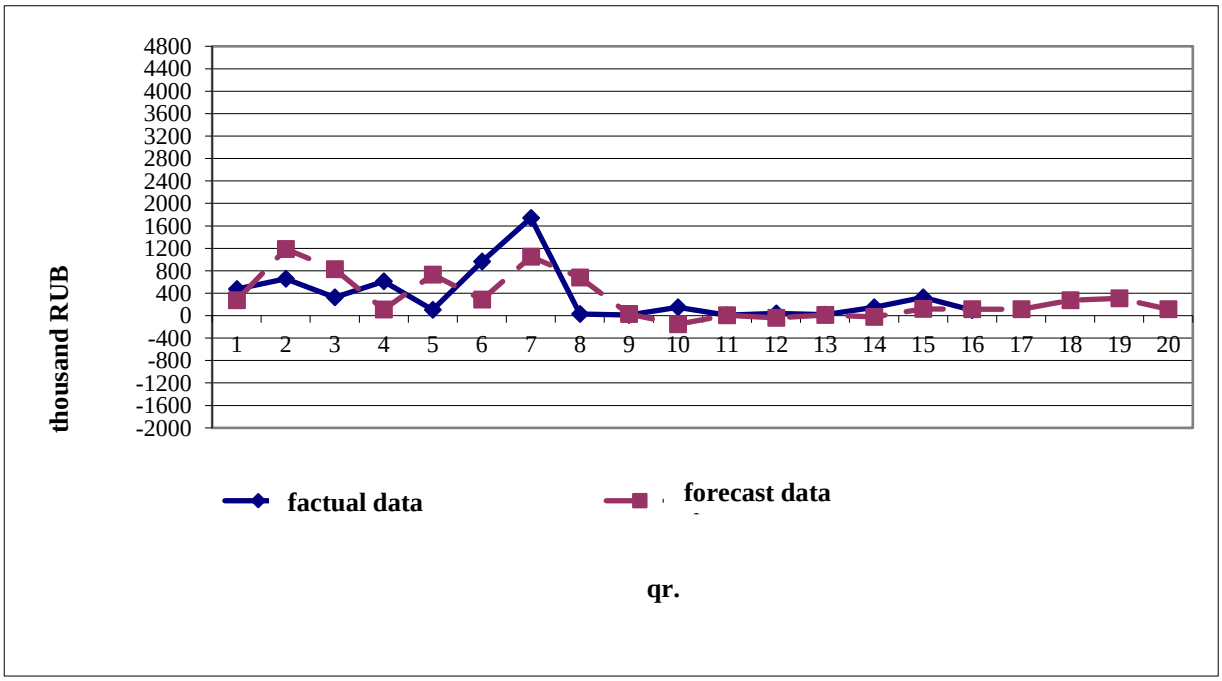

Fig. 1. Dynamics of cash flows according to actual and forecast data

Source: Authors' results and design.

CONCLUSIONS

Effective cash flow management is one of the most important problems of modern agricultural business, the solution of which cannot be based only on the intuition and business qualities of a manager. Such decisions should be preceded by a business case and well-conducted analytical procedures.

The use of the Holt-Winters model to predict the cash flows of an agricultural organization made it possible to study the influence of the seasonal component on their dynamics. As a result of the calculations, a clear dependence of the volume of cash flows on this parameter was not revealed, but checking the randomness of the levels of the residual component based on the turning point criterion confirmed the adequacy of the constructed model and made it possible to form a cash forecast for the coming year. The constructed forecast identified the primary tasks in cash flow management, aimed at their more rational use for the further development of production and increasing competitiveness, as well as the timely adoption of economically sound management decisions for the future.

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THE IMPACT OF COVID-19 CRISIS ON THE SUSTAINABLE DEVELOPMENT IN THE RURAL AREA AT THE LEVEL OF GALAȚI COUNTY, ROMANIA

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Abstract

This paper intends to address the impact of the COVID-19 crisis on the development of rural areas in Galati County, after the application of the state of emergency in Romania. The article is based on the interpretation of the change of certain economic indicators in rural areas and their impact on the population, economic environment, industry, and agriculture. Supplementary research has been conducted by interpreting the changes triggered by the COVID-19 crisis on the decisions of local and regional authorities to develop certain strategies and projects before and after the end of the present crisis. At the same time, it is analyzed that rural areas were perceived as providing a defense wall against this pandemic, motivating the population in urban areas to seek shelter in rural areas, thus contributing to the development of the economic environment. However, in reality, rural areas have been the hardest hit, unable to provide the infrastructure needed for such a human wave. In the context of those presented, the paper is an analysis of economic and social factors but also of how the COVID-19 crisis has influenced the current situation in rural areas of Galati County. To reach the result of this analysis, research methods were used based on reports, studies, papers and specialized publications both online and offline. As a main result of this paper we can mention the identification at regional level of changes in social, demographic and economic factors with considerable impact on the rural economy in the coming years. Thus, agriculture will feel a decline due to this pandemic, after 2022.

Key words**:** *COVID-19, pandemic, sustainable development, rural area, Galati County*

INTRODUCTION

The year 2020 begun with the emergence of the COVID-19 pandemic that spread immediately in most countries of the world, causing numerous damages and a huge negative impact on the economies of the affected countries. This pandemic has motivated the entire community to find solutions and demonstrate that there are a number of ways that action can limit the economic impact of COVID-19 on the development of the world economy. However, practice still shows us that economic indicators oscillate between changes with considerable impact both nationally and globally. The decisions at national level have greatly influenced the actions implemented in rural areas in Romania, so that the impact is unexpected.

COVID-19 has changed the dynamics of rural development. It has taken over potential implementation of interventions on food security, education, employment generation and poverty reduction [3].

Since it requires achieving a stable economic balance, which is negatively influenced by the disruptions caused by the COVID-19 pandemic, sustainable rural development is one of the most problematic and complex issues of the current situation.

Although in most countries of the world, the direct impact of the Covid epidemic19 was mainly on the urban environment, the economic impact spread immediately to rural areas as well. A large majority of people who are on the brink of poverty and hit by food insecurity, live in rural areas where they still remain vulnerable to the considerable impact of the pandemic even if there is a high degree of physical detoxification, isolation, food

production. This process can only lead to a result called economic contraction. Thus, we can mention that rural areas, especially in economically developing countries, are too ill-prepared to deal with the direct and indirect impact of the crisis that will follow the pandemic.

The follows left by the pandemic have emphasized the components that contrarily impact the prosperity of individuals in rural area. The connection between enthusiastic prosperity, access to education, parental contribution in children's life and the family's economic weakness is clear. Those who have lost all or part of their income due to the crisis or those who are socially assisted are also those who do not have access to education, although they say that education would mean survival and the only chance for children to get out of poverty.

MATERIALS AND METHODS

To achieve the objective of the paper, specific research methods were used to analyze the social and economic development of Galati County during the pandemic. Also, we used a descriptive analysis based on measures of sustainable development in the rural areas identified in a series of reports, studies, works, statistics and publications Eurostat, INS - County Department of Statistics Galati and at the National Institute of Statistics of Romania, carried out in the fields: demography, employment, economic sector, specific statistics on agriculture.

The analyzed data were collected from specialized literature in the sustainable development and agricultural field. The framework included primary statistical analysis of the data, with the software Microsoft Excel serving as a tool for quantitative analysis. The data used in this analysis ranged from 2018 to 2021.

RESULTS AND DISCUSSIONS

The pandemic caused by the new coronavirus has had a huge impact on the EU and even on the global economy and has had very serious socio-economic consequences. Economic activity at European level fell sharply: in the first half of the year, real GDP fell at double-digit rates in both the euro area and the EU. Employment has also fallen more than ever, albeit less than might have been expected, thanks to massive policy support from Member States and the EU. GDP in some countries was hit much harder than in others, falling three times more in the hardest hit than in the fewest.

Such extreme and frequent changes make economic forecasts even more difficult than usual. First, it is clear that the future course of the pandemic will play a key role in determining the future path of economic growth. This is why the autumn forecast is largely based on technical assumptions and analyzes alternative scenarios for the evolution of the pandemic and its economic impact.

Second, the economic impact of the pandemic and future recovery prospects will be very different across the EU. Romania's economy will return after a decrease in production in the first half of the year due to the COVID crisis19.

Although the contraction in 2020 does not appear to be as severe as initially expected, given the latest developments in the pandemic, uncertainty remains high and actual production will not return to pre-crisis levels before the end of 2022.

Table 1. Main features of Romania forecast

	Bn ron	Annual percentage change				
		2018	2019	2020	2021	2022
GDP		4.5	4.2	-5.2	3.3	3.8
Private Consumption		7.7	5.5	-8.8	4.9	5.8
Public Consumption		3.3	6.0	5.9	-0.1	1.7
Exports (goods and services)		5.3	4.0	-13.1	6.6	7.6
Imports (goods and services)		8.6	6.5	-10.6	8.5	9.7
Employment		0.1	0.0	-2.6	0.3	1.2
Unemployment rate (a)		4.2	3.9	5.9	6.2	5.1
Trade balance (goods) (b)		-7.5	-7.8	-8.8	-9.4	-10.1

(a) as % of total labour force. (b) as a % of GDP
Source: Own calculation on the basis of data from https://ec.europa.eu/info/business-economy-euro, [11].

The budget deficit will increase significantly, as the fiscal effort needed to deal with the crisis has added to the past fiscal recession (Table 1).

There are numerous researchers who have already insisted on the consequences brought by pandemics on the economy, especially on the product distribution systems [12, 5, 6, 14, 7]. Some of these support the idea that such sanitary crises were followed by economic growth as a direct consequence of the increases in consumption [9, 21], while others say that on the contrary, the effects are negative for the human activities [13, 8, 4], especially for agriculture [19] and [10].

Sustainable development of the rural area in Galati County is one of the most problematic and complex issues of the current situation, due to the fact that it involves achieving a stable economic balance, negatively influenced by the barriers created by the COVID-19 pandemic.

From this point of view, this pandemic has created new factors of economic denigration on the rural environment in Galati County. Confronting so far with a deficit in terms of the number of rural population, the year 2020 brought a decrease of approx. 1,400 people (Table 2). Considering the tendency of the urban population to withdraw to the rural area due to the fact that the safety in terms of the spread of the virus is much higher, here that the statistical data do not reflect this. The rural population was the most affected by this pandemic, this being unknown to the inhabitants of urban areas.

Table 2. Population of Galati County

Years	2018	2019	2020
Urban	358,699	359,342	362,164
Rural	269,577	268,159	266,746
Total	628,276	627,501	628,910

Source: Own calculation on the basis of data from Tempo on line data base for 2020, NIS [15].

The values of poverty and social exclusion in Romania's rural areas are two times higher than in the cities. According to the statistical data analyzed in Romania, in the last ten years, it has been concluded that one in two inhabitants of Romania is exposed to a high risk of poverty.

The unemployment rate increased in the first half of 2020 but stabilised over the summer, due to policy measures limiting job losses. It is projected to reach almost 6% in 2020 and continue increasing somewhat in 2021 due to a delayed downturn reaction of the labour market. In 2022 unemployment is expected to decline again but stay above 5%. Nominal wages are projected to increase moderately over the forecast horizon after several years of double-digit growth [16].

At the level of Galati County, based on the studies carried out, the members of the farmers' households sum up total incomes below the poverty line.

This fact can only confirm the fact that the impact of the pandemic was felt especially on the rural population and that we are taking part in a phenomenon of economic decentralization.

This phenomenon of rural poverty is severe and the COVID-19 crisis may exacerbate it, making it possible for the rural impact to be permanent.

Technical unemployment or job loss (Table 3) in small rural businesses both during and after the emergency will have a negative impact, including a decrease in the income of families.

Table 3. Unemployed registered in January, Galati County

	2018	2019	2020	2021
Total registered unemployed	14,875	11,698	10,414	11,856

Source: Own calculation on the basis of data from Tempo on line data base for 2021, NIS [15].

Analyzing the business environment in rural areas before, during and after the pandemic, we can see that the data on the number of businesses in rural areas indicate that the business environment is in a continuous decline (Table 4).

Table 4. Structure of companies of Galati County

Structure of companies according to the number of employees	2017	2018	2019	2020
Micro (0 – 9 persons)	11,257	11,665	11,774	11,541
Small (10 – 49 persons)	1,066	1,045	1,023	923
Medium (50 – 249 persons)	181	187	180	164
Large (>250 persons)	37	35	38	36

Source: Own calculation on the basis of data from www.galati.insse.ro, 2021 [15].

According to a recent European Commission study, compared to urban workers, people living in rural areas are at the highest risk of in-work poverty. The incidence of the real phenomenon of social exclusion during the pandemic has reached at least twice the national percentage of the share of children at risk of poverty in rural communities, which emphasizes the magnitude of the risk of declining access to children in rural areas. the rural food environment is considerable (Figure 1)

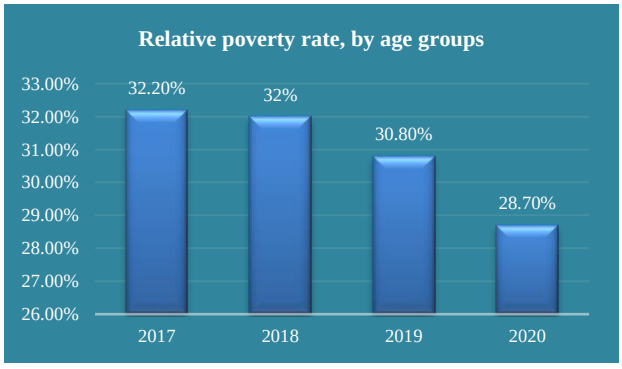

Fig. 1. Relative poverty rate, by age groups
Source: Own calculation on the basis of data from Tempo on line data base for 2021, NIS.

From a social point of view, since the beginning of the pandemic, a number of approx. 800,000 Romanians, according to a SOCIOPOL survey conducted between March 18-23 [20]. About 50% of those surveyed said that the reason they returned to the country was fear of the new virus. Taking into account the fact that half come from rural areas, we can report a clear picture of the dynamics and increase of the level of poverty in rural areas. The lack of jobs in rural areas during the entire period of emergency has only led to an increase in the number of unemployed. The possibility of reintegration into the labor market of Romanians returning to the country is small and their fiscal reserves cannot ensure the long-term survival of their families. The effects of this pandemic can be seen in rural areas and in the field of education. Along with the measures imposed by the authorities to close educational institutions and adopt the online training system, there have also been the negative effects of the education system suffering from the point of view of ICT infrastructure and teacher training in terms of using modern methods. teaching. Given the current situation, young people in rural areas are considered at high risk of dropping out of school, but this is especially true when they cannot participate in direct learning through courses taught in educational institutions during this period when they are closed. In this case there is a vulnerability because a large majority of those in rural areas do not have access to the Internet or IT equipment dedicated to online courses.

Table 5. The share of households that have access to the Internet at home, by area of residence

		2017	2018	2019	2020
Internet access at home (%)	At the national level	68.6	72.4	75.7	78.2
	Urban area	77.5	81	82.5	84.8
	Rural area	56.9	61.5	66.7	69.7
Home computer access (%)	At the national level	65.6	70.1	73.2	75.7
	Urban area	75.9	80.2	86.1	88.4
	Rural area	51.9	56.2	59.3	62.5

Source: Own calculation on the basis of data from Tempo on line data base for 2021, NIS [15].

Thus, we can talk about increasing the dropout rate. The access of urban households to information and communication technology in 2020, according to Eurostat data, shows that approximately 80% of households in Romania had access to the Internet at home and 75% to the computer at home. (Table 5).

Indicators presented differ by area of residence, so that in rural areas the share of households with internet and computer access is much lower than in urban areas (by about 20 percentage points).

When we talk about the impact of the pandemic on rural areas, we automatically reach the impact on agriculture. It is by far the largest economic sector in developing countries with a considerable impact due to the very large number of workers in the field: 880.4 million people (representing 26.5% of the total employed population) is the economic sector on which The crisis generated by COVID-19 did not have an impact at the moment, but the measures imposed along the way brought chain effects in this field. The COVID-19 pandemic, still ongoing, significantly affects the sales of agricultural products by farmers. The main challenges they face are changing consumer patterns - at the consumer level and in marketing chains, changing the relationship between fresh produce - commodities, bottlenecks in farmers' markets and increasing online deliveries, syncope in the agricultural sector. -industrial, the closure of the economic agents from HORECA, but also of the schools, canteens, etc. All these challenges can have the effect, first of all, of the decrease in farmers' incomes accompanied by the decline of agricultural production [2]. The production at the level of Galati County experienced a decrease for certain types of vegetable crops even before the pandemic crisis, an impact that determined a decrease also for the animal production (Table 6). With this crisis, rural farms began to be directly affected due to the radical decrease in the number of workers caused by the measures imposed at national level.

For many small farms, the marketing of agricultural products has been a critical period. Since the beginning of the crisis, part of society has become aware of the need to support, in particular, small local farmers. Consumption from small nearby farms was promoted on social networks. Both online product sales and home deliveries have accelerated [17, 19].

Table 6. Vegetable and animal agricultural production in Galati County

Crop / livestock production	Crop, tons			
	Years			
	2017	2018	2019	2020
Cereal grains	701,395	881,848	735,107	658,973
Wheat and rye	186,493	179,704	179,518	178,643
Corn grain	452,929	639,398	491,551	367,543
Vegetables - total	272,480	276,713	256,102	223,456
	Animal production			
Weight of live animals intended for slaughter for total consumption	Tons of live weight			
	17,480	21,162	16,834	13,567
Milk production - total	Thousands of hectoliters			
	687	593	598	687
Egg production	Millions of pieces			
	199	177	166	199

Source: Own calculation on the basis of data from www.galati.insse.ro, 2021.

The rural economy needs urgent support measures through employment, but also solutions to support the food system, especially those areas and segments managed by small producers, rural associations, service operators and other actors in the value chain.

Based on the measures adopted and the experience of other states, the structure analyzed in the current national economy and the results of estimates of the impact of the pandemic, we can conclude certain measures to be implemented by the authorities since the expansion of this crisis.

Thus, apart from stimulating consumption, useful in the short term in the beginning of the relaunch, stimulating investments is essential for Romania. Until a solid recovery, the government should start large-scale infrastructure investments, which can play a significant propagating (multiplier) role in the economy. Thus, the rising unemployment, by the return to the country of the former Romanian emigrants, could be resorbed, implicitly leading to the increase of the population's income and to additional income to the budget [1].

At the level of rural development in terms of agriculture, the European Commission emphasizes the importance of implementing a temporary measure providing for the granting

of funds to farmers and small enterprises from the remaining funds under national rural development programs. This financial support from the funds of the rural development programs is a unique solution but at the same time a risky one. Such blockages can be avoided by capitalizing on other possibilities of help such as:

-Stimulating the establishment of new enterprises to allow the association of small farmers, thus offering the possibility to increase the degree of technologicalization;

-Digitization of production sales. Small farmers should be supported in the transport of products because the online environment and sales platforms require quite high costs. Also, the implementation of such a measure brings with it their need to be trained on the IT equipment and online platforms used;

-Maintain the safe operation of markets during a pandemic. It is the only measure that offers the possibility to the producers to sell their products. Most producers who sell in markets have a very low level of knowledge so that they can afford to trade online;

-Urgent implementation of an investment program in IT communication infrastructure.

CONCLUSIONS

First, it is clear that the future course of the pandemic will play a key role in determining the future path of economic growth. This is why the autumn forecast is largely based on technical assumptions and analyzes alternative scenarios for the evolution of the pandemic and its economic impact. Second, the economic impact of the pandemic and future recovery prospects will be very different across the EU.

We mention that the effects of this pandemic call into question certain weaknesses of rural development in Romania, vulnerabilities that are not given special attention at the moment due to national agricultural resources and Romania's membership in the EU, but which can become extremely serious. in the situation where we will face an economic or social crisis much more harmful than the COVID-19 pandemic.

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CONSUMER BEHAVIOUR OF PRODUCTS OBTAINED FROM MEDICINAL AND AROMATIC PLANTS: A SEGMENTATION BASED ON FREQUENCY AND PURPOSE OF THEIR USE

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Abstract

The consumption behaviour for products obtained from medicinal and aromatic plants (MAPs) has been little studied, until nowadays, in Romania. In the current context, in which there can be noticed an accentuated increase of these products' supply on the market and the consumers' concern with a healthy lifestyle, this study has aimed at a segmentation of the consumers of MAPs products, according to their frequency, purpose of use and socio-demographic features. The data collection has been carried out in Cluj-Napoca, by administering a questionnaire to the city's residents, consumers of MAPs products. The collected data have been statistically analysed, resulting in three distinctive consumer clusters, namely Cluster 1 - "Heavy users", Cluster 2 – "Rarely users" and Cluster 3 – "Occasional users". Each cluster has been subsequently described according to the significant variables for the performed analysis. Gender, education and income are important predictors of the consumption of these products, and the purpose and frequency of their use differ within the obtained segments. The practical implications of this study are represented by the possibility to adapt the marketing strategies to each segment of consumers.

Key words**:** *medicinal and aromatic plants, consumption behaviour, preferences, herbal products, cluster analysis*

INTRODUCTION

Products derived from medicinal and aromatic plants (MAPs) have dominated the human pharmacopeia for thousands of years [37]. Until the 16th century, they were the main remedies used in preventing and treating several illnesses, their uses being especially based on empirical experience, transmitted from one generation to another [29]. Testimonies of these uses are found in the oldest myths, traditions and writings [24]. The first pieces of evidence on the use of MAPs come from different parts of the world, such as the Middle East, Greece, China and India [18]. Medicinal plants lied at the basis of different traditional medical systems, such as Ayurveda and Chinese medicine [18, 24]. In the European countries, Greeks and Romans had significantly contributed to the development of phytotherapy [15], and in Romania, MAPs had been used since the Thracians' times [40].

Despite their longevity, MAPs continue to influence the life, culture and human history, thus determining the modern civilization to adopt new methods of process and use of medicinal and aromatic plants, as well as of their derivative products [18, 29]. In developing countries, medicinal plants continue to lie at the basis of the medical system, and in some cases they represent the only therapeutical option [41].

A series of intermediary or final products used in the pharmaceutical, cosmetic and food industry can be obtained from MAPs [23].

In the pharmaceutical industry, three categories of MAPs products are being used: allopathic medicines, phytotherapeutic products and botanical supplements. Use indications vary globally, according to the socio-economic and cultural aspects, as well as to legislative regulations [4, 37].

At the European Union level, there are differences among the member states concerning the definition and classification of herbal medicines, the products obtained from the same medicinal plant either being considered food supplements, or herbal medicines in accordance with the legislative regulations [13].

Phytotherapy is part of the complementary and alternative medicine and it is used for the prevention and treatment of certain diseases [34]. Although it is based on traditional medicine, it is sometimes devoid of an adequate scientific validation [7]. Phytotherapeutic products are presented under the form of extracts, tinctures, teas and capsules [23] and most of the times, the effect is not the result of only one constituent [9]. At the EU level, the Directive 2004/24/EC of the European Parliament and Council from March 31st 2004 regulates the traditional medicines based on plants. In accordance with it, before a herbal medicine product is being introduced on the market, it must first be registered in one of the following conditions: full authorization through the same procedure as for a traditional medicine, stage which requires safety and efficacy studies; well-established use marketing authorization application, in case there has been an utilisation of at least 10 years within the EU with an acknowledged efficacy and an acceptable safety profile; traditional use registration, a simplified procedure for the authorization of products which demonstrate a traditional use for the mentioned indication for at least 30 years, of which 15 years must have been within the EU [34, 33]. Botanical drugs are evaluated from the safety and efficacy perspective, just like the allopathic medicines, but the process can be accelerated if there is a safe utilization history [4]. At the EU level, most applications for Traditional use registration are held by the UK (348), followed by Germany (285), Romania being situated on the last places, with only 8 approved registrations since the implementation of the directive until the end of 2016 [10].

The possible interaction between the phytotherapeutic products and the conventional medicines must also be taken into account [16]. Many times, specialists don't ask their patients if they use such products, or patients omit to specify this aspect [9], but the risk of side effects can increase when medicines based on plants are taken concomitantly with the conventional ones [19]. Also, there is the possibility to modify the pharmacokinetics of the conventional therapeutic agents, with the risk to potentiate toxic effects or to diminish their efficacity [38, 16].

MAPs are also found in food supplements, being aimed at completing the diet. Sometimes, the MAPs used in botanical supplements are similar to the ones from phytotherapeutic products, the final product being introduced on the market as a supplement because the process is a lot simplified [23]. Thus, many products have been relabelled as food supplements, which are regulated separately from the Directive 2002/46/EC of the European Parliament and the Council from June 10th 2002 concerning Food Supplements [34]. In the case of supplements, even if there are regulations, the safety and efficacy aspects are the producer's responsibility [9, 5]. Thus, non-compliant products (counterfeit, with denatured composition, labels with false or unproven statements) can be introduced on the market [12], whose side effects and interactions are little supervised [34]). Furthermore, when promoting them, it is forbidden to refer to medical aspects, such as: 'prevents', 'heals', 'treats' [15], except the case when such statements have been scientifically proven in accordance with Regulation no. 1924/2006 of the European Commission [8]. The European and Romanian legislation offer the adequate legal framework for the ethical advertising of botanical supplements, thus ensuring their correct use by consumers and in safety conditions, but nevertheless, there are botanical supplements on the Romanian market which do not follow these provisions [8], which can trigger confusion among consumers concerning the phytotherapeutic products and the botanical supplements.

Regarding the use of MAPs in cosmetic products, the EU regulations state that a

cosmetic product should not produce any harm to human health and the producer is held responsible for the safety of the cosmetic products introduced on the market [27]. There are certain rules and regulations which must be applied in order to declare a product as being a natural cosmetic. In general, natural cosmetics should be certified in order to demonstrate that the product has been produced from natural ingredients and it has been made in a way which does not affect the environment. In Europe, there isn't any common certificate and many countries hold their own certificates [17]. A minimum alternative standard is ISO 16128 part I and part II, which covers the definitions and the criteria for natural and organic ingredients and cosmetic products. The ISO standards are an option for small producers for whom certification is too expensive [6].

MAPs used in cosmetic and personal care products can be processed under the form of vegetable oils, essential oils, plant extracts, floral waters, and dyes. The antioxidant, antibacterian and anti-inflammatory effects are among the reported benefits of their use [32, 1]. The use of natural ingredients in skincare products has also been accelerated by the consumers' demand, who have become more and more interested in natural products [32].

Once raising the awareness of health aspects, the consumption of plant supplements has had a great development in Romania [39], being noticed the consumers' positive attitudine towards MAPs products [28].

The market dynamics of the MAPs products is influenced by consumers' behaviour and by the public policies to support this sector [31]. Thus, the study of this behaviour becomes an objective necessity, especially in terms of educating the consumers on the correct and effective use of these products.

The consumption behaviour for MAPs products – "green herbal products" has been studied in certain developing countries, where traditional medicine is still intensely practised [20, 26]. Thus, [20] have realized an assessment of the influence of the socio-demographic features on the consumption of these products, reaching the conclusion that the segment represented by the young population contains the largest number of users of these products. Nevertheless, the hypothesis according to which the socio-demographic factors (gender, age, education and occupation) are influencing the consumption of products obtained from medicinal plants, has not been confirmed in the case of the forementioned study [20].

[14] has performed a segmentation of the consumers of MAPs products in Turkey, thus obtaining three distinctive clusters of consumers: the first, composed of older and less educated persons, who are skeptical about the consumption of these products, due to the possible side effects, but also to the high price; the second, composed of persons with high incomes and education, strongly influenced by brands and commercials of these products, and third, composed of persons highly sensitive to environmental aspects, health and food safety, at the same time being influenced by religious beliefs.

According to the study results obtained by [22], the main purpose of using the MAPs products is to improve the general health state, their use for a cosmetic purpose being a lot more reduced. In addition, there can be noticed a preference to use MAPs under the form of infusion or decoction [22]. MAPs products, identified by [3] as being at the top of consumers' preferences, are teas, balms/ointments/creams and essential oils, but in the research of [36] infusions score first, being followed by tablets/capsules and creams.

Although the popularity of the consumption of products obtained from medicinal plants is increasing in Europe, not only for preventing and treating certain illnesses, but also for other purposes, [11] have remarked a lack of research concerning the consumption behaviour for such products. The same authors suggest the necessity to realize such studies, especially at pan-European level, which would offer some consumption patterns, as well as an assessment of its risks and benefits.

In this context, the purpose of the present research is to perform a segmentation of the consumers of MAPs products in Cluj-Napoca,

depending on the purpose and frequency of their use, and on the socio-demographic features.

MATERIALS AND METHODS

The study was performed by administering a questionnaire during June-September 2020 among the population of Cluj-Napoca, resulting in 620 valid answers. The questionnaire answers envisaged the use frequency of MAPs products, namely: teas, essential oils, tinctures, maceration extracts, capsules containing herbal dried extracts or powders/tablets/gel capsules with volatile oils, floral waters, juices/syrups, creams/ointments/balms with herbal ingredients, cosmetic products (soap, shampoo, balms, creams, perfumes, etc.) containing herbal ingredients and spices. Another set of questions referred to the purpose of using these products: phytotherapeutic, cosmetic and food. The questionnaire also comprised socio-demographic questions. Descriptive statistics was used to describe the consumers profile. Following, the K-means clustering analysis was performed to classify consumers based on the purpose and frequency of their use, and on the socio-demographic features. ANOVA test was used to identify the variables that best contribute to the construction of clusters. A p-value of 0.05 was considered as statistically significant. All data analyses were conducted using SPSS version 24.

RESULTS AND DISCUSSIONS

Table 1 presents the sample structure, according to gender, age, education, occupation and income. Thus, from the total of 620 participants, 46.1% were women and 53.9% men. The distribution according to age was the following: 19.5% of the participants were under 25 years old, 26% between 25-34 years old, 26.5% between 35-44 years old, 15.3% between 45-54 years old and 12.7% over 55 years old. High school graduate respondents (40.2%), university graduate respondents (32.9%), as well as those with low incomes, between 1,000-4,000 lei, were predominant. Concerning their occupation, more than half participants are employed (58.1%), followed by students (17.6%), self-employed/freelancers (15.5%), retired persons (6.1%) and housepersons/unemployed (2.7%).

Table 1. Sample structure

Variable	No. of consumers	% of consumers
Gender		
Male	334	53.9%
Female	286	46.1%
Age		
< 25 years	121	19.5%
25-34 years	161	26%
35-44 years	164	26.5%
45-54 years	95	15.3%
> 55 years	79	12.7%
Education		
No education	4	0.6%
Professional, vocational school	41	6.6%
High school	249	40.2%
Post-secondary school for masters	28	4.5%
Graduate studies		
Post-graduate studies	204	32.9%
	94	15.2%
Main occupation		
Student	109	17.6%
Houseperson, unemployed	17	2.7%
Retired, unable to work	38	6.1%
Employed	360	58.1%
Self-employed, freelancer	96	15.5%
Income		
No income	13	2.1%
Maximum 1,000 lei	25	4.0%
1,001-2,000 lei	128	20.6%
2,001-3,000 lei	179	28.9%
3,001-4,000 lei	139	22.4%
4,001-5,000 lei	61	9.8%
5,001-6,000 lei	30	4.8%
> 6,000 lei	45	7.3%

Source: Own calculation.

From a gender perspective, as compared to other studies in which, in general, the female respondents are predominant (81%) [36, 3], the sample used in this study is more balanced, 53.9% of the participants being men and 46.1% women. A similar distribution has been observed in the research realized by [22] in which 56.62% of the consumers involved in this study were men and 43.38% women [22].

There can also be noticed a larger preponderance of the age segment between 25-44 years old, similar to the research realized by Sanchez et al. (2020), in which respondents aged between 18-44 years old represent 62.6%.

This aspect can be explained due to the online application of this questionnaire, the old ones

being less active on the socialization networks.

Table 2 presents the questions that generated significant statistical correlations and were further included in the cluster analysis.

Table 2. Questionnaire items used in the analysis

Q1. How often do you use the following MAPs products [teas, essential oils, tinctures, maceration extracts, capsules with herbal dried extracts or powders/Tablets/Gel capsules with volatile oils, floral waters, juices/syrups, creams/ointments/balms with herbal ingredients, Cosmetic products (soap, shampoo, balms, creams, perfumes, etc.) with herbal ingredients, spices] : once or several times a day, once or several times a week, once or several times a month, once or several times a season, once or several times a year, never?
Q2. For what purpose do you use MAPs (multiple answer): for phytotherapeutic purpose (to prevent and/or treat certain illnesses), for cosmetic purpose and/or personal care?
Q3. On a scale from 1 to 5, where 1 means 'to a very little extent' and 5 means 'to a very large extent', to what extent do you use them in order to prevent health problems?
Q4. On a scale from 1 to 5, where 1 means 'to a very little extent' and 5 means 'to a very large extent', to what extent do you use them in order to treat some health problems?
Q5. On a scale from 1 to 5, where 1 means 'to a very little extent' and 5 means 'to a very large extent', to what extent do you use them for personal care and cosmetic purpose?
Q6. On a scale from 1 to 5, where 1 means 'to a very little extent' and 5 means 'to a very large extent', to what extent do you use them to slow down the aging process?
Q7. Do you use MAPs products for the prevention and/or treatment of several illnesses?
Q8. Do you use MAPs products for cosmetic and personal care purposes?
Q9. Gender
Q10. Education (the last graduated school)
Q11. What is your personal income level on a monthly basis?

Source: Own calculation.

Final clusters were reached after 10 iterations. Table 3 presents the final cluster centers based on the standardized scores.

Table 4 shows the number of cases in each cluster.

As we can notice in Figure 1, there have resulted 3 clusters of consumers, according to the statistically significant variables: gender, education, income, purpose of using the MAPs products and consumption frequency of the different products. The three clusters have been named as follows: Cluster 1- "Heavy users", Cluster 2 – "Rarely users" and Cluster 3 – "Occasional users" (Figure 1). Choosing different names for the three clusters was based on the consumers' "intensity" to use the MAPs products.

Cluster 1 "Heavy/green consumers/users" are the ones who most often use MAPs products, the use frequency being weekly or more often. These products are used not only for phytotherapeutic purposes, but also for cosmetic purposes.

Table 3. Final cluster centers

Zscore	**Cluster number**		
	1	2	3
Q1_8. Creams/Ointments/ Balms with herbal ingredients	0.97042	-1.01073	0.12035
Q1_9. Cosmetic products (soap, shampoo, balms, creams, perfumes, etc.) with herbal ingredients	0.89268	-1.03510	0.20048
Q1_2. Essential oils	0.93884	-0.84361	0.00202
Q1_5. Capsules with herbal dried extracts or powders/Tablets/Gel capsules with volatile oils	0.96838	-0.80210	-0.05592
Q1_3. Tinctures	0.95077	-0.82148	-0.02595
Q1_1. Teas	0.87180	-0.80060	0.01656
Q1_4. Maceration extracts	0.87732	-0.74644	-0.03381
Q1_6. Floral waters	0.87922	-0.73996	-0.04079
Q3. For prevention of some health problems	0.92426	-0.64763	-0.15388
Q5. Personal care and cosmetic purpose	0.72566	-0.80321	0.13040
Q4. For treatment of some health problems	0.83153	-0.64037	-0.08925
Q2_2. For cosmetic purpose and/or personal care	0.56145	-0.72632	0.19027
Q6. Slowing down the aging process	0.73929	-0.57996	-0.07030
Q1_7. Juices/Syrups	0.59691	-0.64739	0.09592
Q8. Do you use MAPs products for cosmetic and personal care purposes?	0.48949	-0.69079	0.21495
Q7. Do you use MAPs products to prevent and/or to treat certain illnesses?	0.64582	-0.56537	-0.01135
Q2_1. For phytotherapeutic purpose (to prevent and/or treat certain illnesses)	0.64700	-0.50895	-0.06034
Q1_10. Spices	0.46041	-0.55205	0.11891
Q9. Gender	0.30461	-0.38878	0.09873
Q10. Education (last graduated school)	0.32497	-0.33454	0.03695
Q11. What is your level of personal income on a monthly basis?	0.24833	-0.32225	0.08500

Source: Own calculation.

Table 4. Number of respondents in each cluster

Cluster	Cluster 1	181.000
	Cluster 2	202.000
	Cluster 3	237.000
Valid		620.000
Missing		0.000

Source: Own calculation.

Consumers in this cluster mostly use them for the prevention of health problems, for personal care, for cosmetic purpose, for treating some health problems, and for slowing down the aging process. They declare

that they use, to a large extent, MAPs products for cosmetic and personal care purposes, and to an even larger extent to prevent and/or treat certain illnesses. They are generally women, persons with a high level of education and higher incomes.

Cluster 2 "Rarely users" are the ones who most rarely or never use MAPs products, the use frequency being seasonal or less frequent. They are generally men, persons with lower education and incomes.

Cluster 3 "Ocasional users". They are the ones who occasionally use MAPs products. Products with a pretty high use frequency are creams/ointments/balms with herbal ingredients and soaps. These products are more often used for personal care, for cosmetic purpose, and less often for treating some health problems. In general, consumers belonging to this cluster are of both sexes, with medium education and incomes.

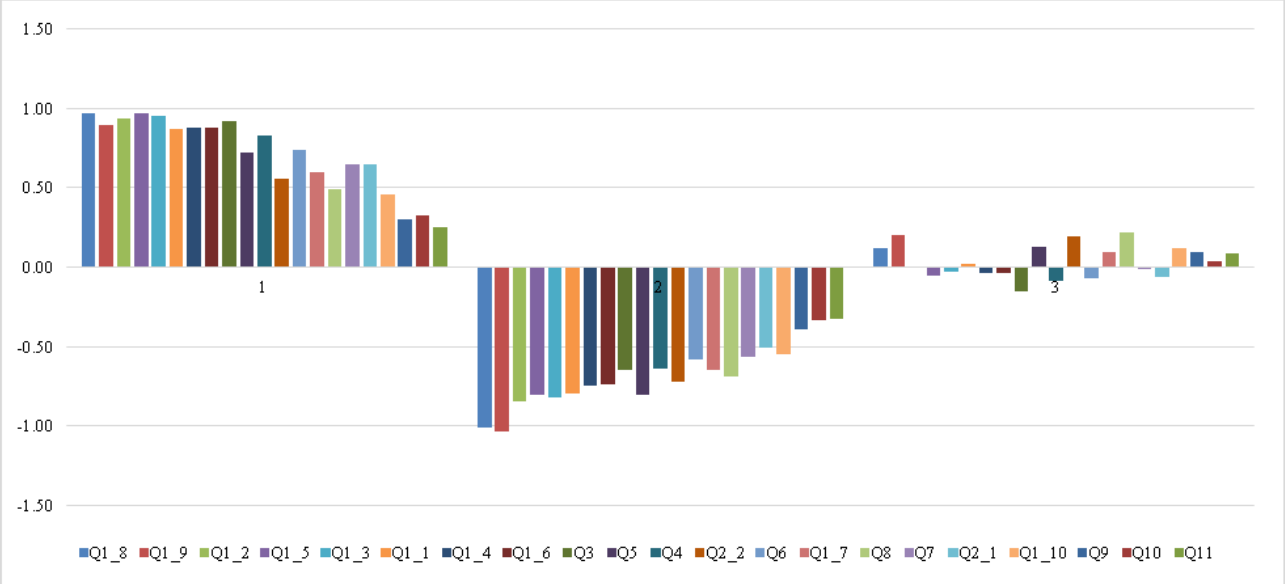

Fig. 1. Clustering results
Source: Own calculation.

The results of this research show that the consumption frequency of MAPs products is influenced by socio-demographic factors (gender, education, income). Thus, the ones who rarely use (at least seasonally) MAPs products, the representatives of cluster 2 are men, persons with lower education and incomes; the ones who use them occasionally are persons with medium education and incomes, of both sexes.

Frequent consumers of such products, the representatives of first cluster are generally women, persons with higher education and a somewhat higher income. Similar associations between the consumption frequency and the socio-demographic features have also been identified in other researches in the field, the consumption being increased along with the level of education and income [30, 35, 21]. Also, both for phytotherapeutic [30] and cosmetic uses [2], women use these products more often, an explanation being their greater concern with health [30].

In addition to the high consumption frequency, there can be noticed, among consumers from cluster 1, the use of a wide range of products, such as: teas, essential oils, tinctures, maceration extracts, capsules with herbal dried extracts or powders / tablets /gel capsules with volatile oils, creams/ointments/balms with herbal ingredients, cosmetics. According to other researches which have studied the consumption of MAPs products, the forms preferred by consumers are generally teas and infusions [36, 3, 22].

Among occasional consumers from cluster 3, there can be noticed a more frequent use of MAPs products for cosmetic and personal use purposes, most frequently being used the

cosmetic products (soap, shampoo, balms, creams, perfumes, etc) and creams/ointments/balms with herbal ingredients. The representatives of cluster 1 use them not only for prevention and treatment, but also for cosmetic and personal care purposes. The results of some similar studies have shown that the main purpose of using MAPs products is to ensure health [22, 25], as well as to prevent or treat certain illnesses [36].

CONCLUSIONS

The results of segmentation of MAPs products consumers indicate the existence of three distinctive clusters, characterized by different behaviours concerning the manner of use and consumption frequency of these products. Gender, education and income are important predictors of consumption behaviour of MAPs products. Thus, women with a higher level of education and incomes are the ones most frequently using these products, not only to prevent and treat certain illnesses, but also for cosmetic and personal care purposes.

The ones who very seldom or never use MAPs products are generally men with a lower level of education and modest incomes. A possible explanation for this behaviour could be the lack of constant preoccupation for a healthy lifestyle, based on "green products" consumption, as well as the lower access to information. The third category of consumers occasionally use MAPs products, especially for cosmetic and personal care purposes. In the case of this segment, we can neither necessarily refer to a gender influence on the consumption behaviour, nor to a preoccupation with aspects connected with health. The practical implications of the results of this research are represented by a better understanding of the consumption behaviour of MAPs products, necessary for creating some corresponding marketing strategies. The study results can serve to a better orientation of public policies in the field, to organise some information and education campaigns for consumers in order to safely and efficiently use MAPs products, as well as to adapt the producers' offer to the consumers' needs.

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THE IMPACT OF THE RESULTS ACHIEVED ON WHEAT CULTIVATION AND THE IMPORTANCE OF EFFECTIVE IRRIGATION SYSTEM ON THE GROSS DOMESTIC PRODUCT PER CAPITA

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Abstract

Romanian agriculture enjoys one of the highest land allocations, with at the level of 2013 the land fund of Romania being made up of about 14.61 million ha of agricultural land (61,30% of the country's surface), each resident returning an area of 0.68 ha of agricultural land and 0,43 ha of arable land. Most of the existing arable land is grown mainly with so-called large crops, namely wheat and maize. In order to emphasize the importance of one of the two crops mentioned, wheat, and of the technological tools used to achieve it on Romania's economy, an analysis of the impact it has on the GDP per capita is carried out. For this purpose, the correlation between the variables considered in an econometric model was determined as follows: Gross domestic product per capita - dependency variable, gross value of wheat production, average wheat yield per hectare and agricultural area actually irrigated. The results obtained show that there is a strong link between the results of agricultural land work and the macroeconomic indicator of gross domestic product per capita.

Key words**:** *agricultural land, GDP, per capita GDP, wheat, production, irrigation*

INTRODUCTION

Agriculture is one of the most important branches of the national economy [8] and multiple functions of biological and ecological nature are attributed to it, being considered the main source of the agri-food supply process, while also playing a role in protecting the environment.

In Romania, agriculture has been practiced in various forms since the earliest times, but only since the second half of the 20th century it has been possible to speak of efficient and intensive agriculture [11].

With the continuous action of developing production forces, agriculture has made fundamental changes to the social fabric, to the technical level, to the structure and distribution of land and crop use categories [15].

In the post-communist period, the share of the results of the agricultural sector in the building of the gross domestic product decreased considerably, to the detriment of other economic sectors, at a slower pace in the first years of the transition from the communist to the democratic regime and much faster after 1997. The transition period was marked by fundamental changes in the agricultural sector, the most important being the shift from cooperative and state ownership to private ownership, based on a number of legislative measures, the most important being: Decree Law 42/1990, Law 18/1991 as amended and supplemented, Law 1/2000.

The post-transition period (2000-present) was and is marked by the influence on the agricultural sector resulting from the adoption and implementation of the common agricultural policies (CAP) [7].

The increased fragmentation of agricultural land, together with subsistence farming, based on the use of low-performing production technologies, has led to a deterioration in soil quality, with direct repercussions on production volume and economic performance.

After 2007, Romania's accession to the European Union and the implementation of the

new common agricultural policies (CAP) [7][14] created a starting point in the process of agricultural development, with numerous non-reimbursable funds being provided to

Romania in the field of agriculture and the sustainable development of the rural environment.

The evolution of the contribution made by the agricultural sector to the building of GDP, compared to trends, for the post-communism period, is as follows:

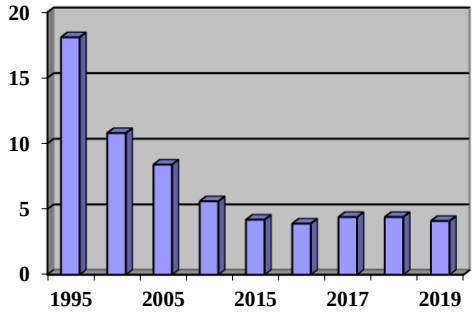

Fig. 1. Evolution of the contribution made by agriculture to the formation of GDP over the period 1995 - 2019

Source: Own representation based on data provided by the World Data Bank (WB), 2021 [13].

It should be noted that, although the contribution of agriculture to GDP formation is decreasing compared to the communist period, or even the period immediately following 90, Romania still has the highest share of the agricultural sector in the GDP structure of all EU Member States, about 3 times higher than the European average [1].

The main branch of agriculture, the one which contributes significantly to achieving economic performance, is the plant one, based mainly on the cultivation of two types of plants: Wheat and maize.

Wheat cultivation is the most important agricultural crop in Romania [3]. It has been known in Romania since the oldest times, with archaeological research showing that this culture dates back to the Bronze age (3000-1000 (before Christ) within the country. The plant is grown on large areas in Romania due to a number of properties including [9]:

-high content of grain in carbohydrates and proteins;

-protein-to-carbohydrate ratio corresponding to the requirements of the human organism;

-long grain preservation;

-convenient storage and transport costs;

-high environmental plasticity,

-the possibility of full mechanization of the crop [12] and the ability to integrate the vast majority of agricultural rotation systems.

During the period 2010-2019, the arable area cultivated with wheat has fluctuated, with relatively low fluctuations, with the values recorded being around 2 million hectares.

The trend in areas under wheat in the period 2010 to 2019 is shown as follows:

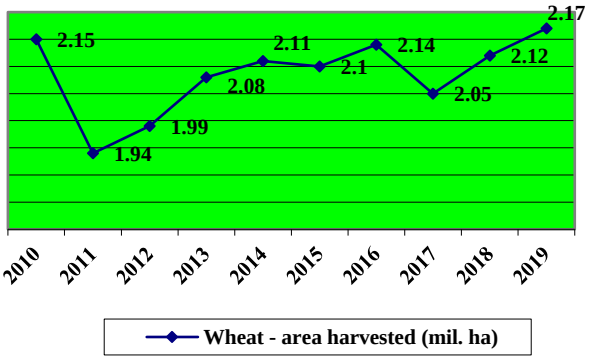

Fig. 2. Development of the area under wheat in Romania in the period 2010-2019

Source: Own representation based on data provided by the Food and Agriculture Organization of the United Nations (FAO), 2021 [6].

A variety of factors are generally involved in wheat production and agricultural production, the most important of which is the climate.

In recent decades, climate change has played an important role in land use, in particular by increasing extreme phenomena (drought, desertification, hail) and the spread of affected areas [10].

Romania presents a considerable risk to climate change, its effects being clearly reflected in changes in temperature and precipitation, mainly. Droughts have a significant impact on the stability of production and national food security, and the lack of adequate infrastructure helps to limit opportunities for economic development despite the potential of agriculture.

The main risks facing Romania in the short and medium term are the significant increase in the average annual temperature, the drop in precipitation and the general occurrence of extreme climate events. The climate change in Romania in recent years, reflected by changes in temperature and rainfall, affects a significant part of the country's agricultural area.

Agriculture is very vulnerable to the impact of climate change when the associated risks are not equally distributed.

Regional differences shall be identified both in terms of the likelihood of extreme events such as drought and episodes with heavy rainfall, and in terms of vulnerability, resilience and adaptive capacity of rural communities to climate change.

The differences are further accentuated by the polarization in the size of farming, typical of Romania. The category most affected is that of subsistence farmers.

Irrigated lands [4] reduce the dependence of agricultural crops on the volume of precipitation and minimizes the risk of drought affecting agricultural production.

At the same time, irrigation can increase the productivity of cropped agricultural land, allowing the spread of cultivated areas in some semi-arid areas.

The drought has a significant impact on the stability of national production and food security, and the lack of adequate irrigation infrastructure helps to limit opportunities for economic development despite the potential of agriculture. Severe soil drought in the southern and eastern areas of Romania, combined with high water consumption between July and August, results in a water supply in the soil most often below the point of wilting on large areas of agriculture. In these areas, complex agricultural drought is a climate hazard phenomenon which has the most serious consequences. The drought can last from a few days to a few months, resulting in a significant drop in agricultural production, especially in those regions with high vulnerability and low adjustment potential, affecting the results of the entire year of agricultural production.

The development of irrigation systems has as its main positive effects for the regions where the following are achieved:

-lead to the exploitation of agro-productive potential at a higher level;

-ensuring safe and high-yield agricultural production;

-reducing the negative effects of limiting environmental factors (prolonged droughts; combating soil erosion);

-improving the microclimate by avoiding soil degradation and supporting growing vegetation in the area.

The purpose of this work is to present the importance of a well-functioning agricultural system resulting from the creation of crop-friendly conditions, particularly wheat, on the volume of agricultural production and the economy of Romania as a whole, by quantifying the impact of the evolution of agricultural wheat production on the development of gross domestic product per capita.

MATERIALS AND METHODS

In order to identify the influence that the gross value generated by wheat production, the average yield of wheat per hectare and the value of the actual irrigated agricultural area have on the evolution of the gross domestic product per capita has been chosen to use the linear regression model.

Since several independent variables are used in the analysis, the linear regression model [2] will be that of multiple linear regression.

The multiple linear regression equation has the formula:

$$y = \alpha_1 x_1 + \alpha_2 x_2 + ... + \alpha_n x_n + \varepsilon \quad .....(1)$$

where:

y = dependant variable;

x = vector of independent variables;

α = vector of coefficients/parameters the model;

ε = variable interpreted as error

The analysis shall include, in order to certify the correctness of the model under consideration, the following assumptions:

P1. The increase in the productivity of wheat crop, expressed as the gross value by which it contributes to GDP, will implicitly also lead to an increase in the value of the gross domestic product per capita macroeconomic indicator.

P2. The increase in average wheat yield per hectare leads to an increase in the value of the gross domestic product per capita;

P3. The extent of irrigated agricultural crops, including wheat, is leading to a significant

increase in the gross domestic product per capita, as a result of the increase in agricultural performance that could be achieved.

RESULTS AND DISCUSSIONS

The econometric model analysed is focusing on the value of gross domestic product per capita. From the analysis of the values recorded by this indicator it can be seen that for the period 2010-2018 it had an upward rather than perfectly linear trend, and there were also year-to-year shifts when small decreases were recorded, but overall the trend is an upward trend.

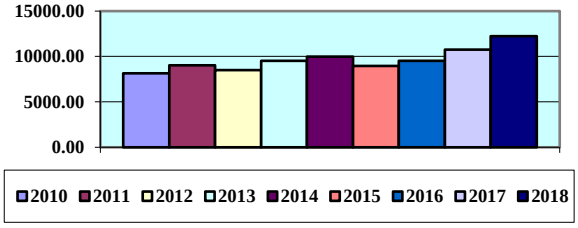

Fig. 3. Values recorded by gross domestic product per capita in the period 2010-2018 (USD)
Source: Own representation based on data provided by the European Commission (EC), 2021[5].

As shown in the graph (Fig. 3), 2010 was the year when the value of this indicator was the minimum of the period analysed, being the year when the recovery period after the economic crisis of 2008 began to evolve, by taking measures to ensure the reduction of budgetary expenditure and the increase of government revenue. At the mid-term of the analysis period, the indicator was around $10 thousand per capita GDP. The last year of the period analyzed, 2018, was the year when the GDP per capita exceeded the 12 thousand dollars per capita terminal. Compared to the reference year of the period analysed, i.e. 2010, the percentage increase reported is around 50%, which means a significant increase in relation to the environment and the economic situation marked by the influences of the various factors in Romania.
The value of the gross production generated by the wheat crop showed oscillating developments during the period under review, with significant influence on it having several factors including: Climate conditions, the economic environment as a whole, the country's external trade policy, the attraction and use of sources of non-reimbursable financing from international bodies, etc.

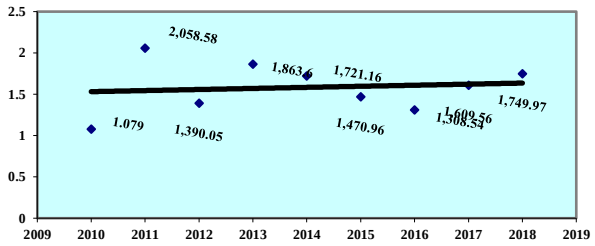

Fig. 4. Development of the gross value of wheat production in the period 2010-2018 (million dollars)
Source: Own representation based on data provided by the Food and Agriculture Organization of the United Nations (FAO), 2021[6].

Analysing the trend in the gross value of wheat production (Fig. it can be noted that the value of this value was based on around USD 1,079 billion in 2010, almost doubled the following year (2011), rising by 90.71%. To be noted are subsequent fluctuations, significant in value, which are to a large extent the result of agricultural policies, the economic orientation toward the development of the agricultural sector and the capacity of the state as a whole to attract and direct European (non-refundable) structural funds to the agricultural sector and to provide the subsidies for agriculture from its own budget.
The trend in the average wheat yield per hectare showed a significant increase in value over the period under review, with the trend being almost entirely upwards compared to the extended period under review, with the exception of the rising rule being the year 2012, when the average wheat yield per hectare decreased compared to the previous year - 2010.
As seen in Fig. 5., average wheat yields per hectare increased in the second year of the review period (2011) and then decreased by around 27.52% in 2012. Since 2013, the average wheat yield per hectare has been on an upward trend, with a maximum of 4.89 tons of wheat per hectare in 2017, and is also favoured by favourable weather conditions in that year.

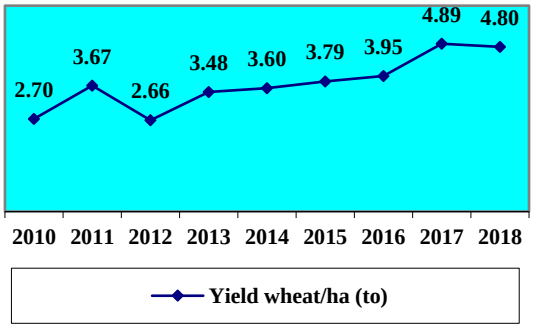

Fig. 5. Development of average wheat yield per hectare in the period 2010-2018
Source: Own representation based on data provided by the Food and Agriculture Organization of the United Nations (FAO), 2021[6].

As for the agricultural area actually irrigated for the period under review, an upward trend can be observed, which confirms and supports Romania's desire to create and support the development of a well-functioning farming based on good technology and techniques.

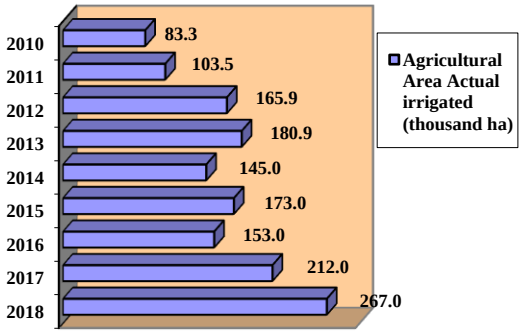

Fig. 6. Development of the agricultural area actually irrigated in the period 2010-2018
Source: Own representation based on data provided by the Food and Agriculture Organization of the United Nations, (FAO) 2021[6]

Starting from a value of only 83.3 thousand hectares irrigated agricultural land, with the help of government policies, programs to support the development of agriculture and as a result of the increase in the absorption of non-reimbursable European Structural Funds through various financing programs (PNDR, PDL).
In order to highlight the relationship between the evolution of the variables whose evolution has been described above, the Plott correlogram is first performed. This diagram shall be plotted on the scatter graph of the intersection points and check that correlation exists between the variables.

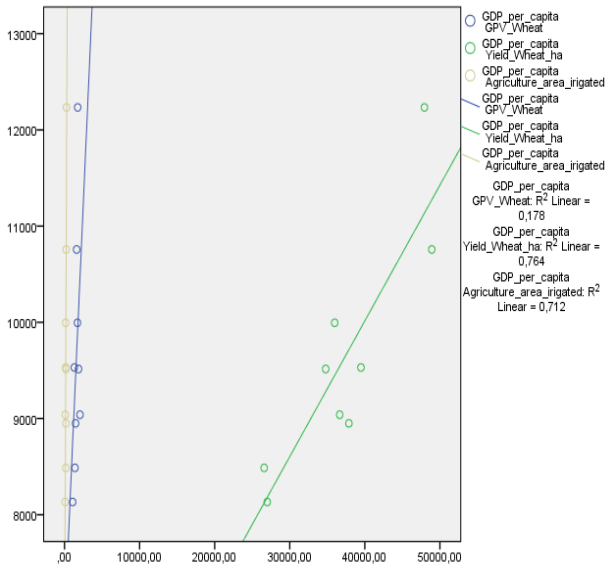

Fig. 7. Plott Chart
Source: Own representation using SPSS statistical program, based on data provided by Food and Agriculture Organization of the United Nations, the World Bank and European Commission (FAO, WB, EC), 2021[5][6][13].

According to the Plottchart, there is correlation between the evolution of the dependant variable and the evolution of the independent variables, so there is also an economic model. By analysing the correlation lines drawn on the graph by the correlation points, it can be concluded that a multiple linear regression relationship exists between the analysed variables.
This relationship is characterized by a regression equation of form:

$$GDP/capita = \kappa + \alpha \cdot GPV_{wheat} + \beta \cdot Yield_{\text{wheat}/ha} + \chi \cdot Agriculture_{Areairig} + \varepsilon \quad \text{.....(2)}$$

where:
k - the free term of the econometric model;
GPV_{wheat} - gross added value brought by wheat production to GDP formation;
$Yield_{\text{wheat}/ha}$ - average wheat yield per hectare;
$Agriculture_{Areairig}$ -area actually irrigated;
ε - variable interpreted as error.

According to the data provided by the statistical program, on the basis of the input values, the model studied is economically valid and is characterized by an R-correlation coefficient value of 0.930. R^2 with a value of

0.866 also shows that the model studied is correct.

By its value of 0.785, adjusted R shows that the variables considered within the econometric model have linear correlation and regression. Safety significance test F change, with a value of 0.013, certifies the validity of the model and a value below the threshold of 0.50 is recorded.

Table 1. Residual statistics of the model under consideration

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	7730,32	11624,54	9626,77	1166,212	9
Residual	-762,916	615,843	,000	459,400	9
Std. Predicted Value	-1,626	1,713	,000	1,000	9
Std. Residual	-1,313	1,060	,000	,791	9

a. Dependent Variable: GDP_per_capita

Source: Own representation using SPSS statistical program, based on data provided by Food and Agriculture Organization of the United Nations, the World Bank and European Commission, (FAO, WB, EC), 2021[5][6][13].

Table 2. The ANOVA test

ANOVA[a]

	Model		
	1		
	Regression	Residual	Total
Sum of Squares	10880404,31	1688389,020	12568793,33
df	3	5	8
Mean Square	3626801,435	337677,804	
F	10,740		
Sig.	,013[b]		

a. Dependent Variable: GDP_per_capita

b. Predictors: (Constant), Agriculture_area_irigated, GPV_Wheat, Yield_Wheat_ha

Source: Own representation using SPSS statistical program, based on data provided by Food and Agriculture Organization of the United Nations, the World Bank and European Commission, 2021[5][6][13].

The descriptive statistics of the analysed model shall show the mean values and standard deviations recorded by the variables considered within it. Thus:

-for gross domestic product per capita, the average recorded value is USD 9,623.77 with a standard deviation of USD 1,253.43;

-for the gross value of wheat production, the average recorded value is about 1,583.49 million dollars, with a standard deviation of 302.43 million dollars;

-for average wheat yield per hectare, the average value is approximately 3.72 to/ha or 3,7246.11 hg/ha, with a standard deviation of 0.77 to/ha or 7,776.65 hg/ha;

-for the area of agricultural land actually irrigated, the average value is about 164.84 thousand hectares, with a standard deviation of 54.70 thousand hectares.

Table 3. Descriptive statistics of the analyzed model

Descriptive Statistics

	Mean	Std. Deviation	N
GDP_per_capita	9626,77	1253,435	9
GPV_Wheat	1583,4910	302,42858	9
Yield_Wheat_ha	37246,1111	7763,64807	9
Agriculture_area_irigated	164,8444	54,69408	9

Source: Own representation using SPSS statistical program, based on data provided by Food and Agriculture Organization of the United Nations, the World Bank and European Commission, (FAO, WB, EC), 2021[5][6][13].

With the coefficients of the econometric model variables, the multiple linear regression equation can be written. It is in the form of:

$$GDP/capita = 4{,}198.65 + 0.436 \cdot GPV_{Wheat} + 0.082 \cdot Yield_{wheat/ha} + 10.310 \cdot Agric_{Areairig} + \varepsilon .$$

Table 4. Coefficients of the econometric model

Model		Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	4198,65	1254,76
	GPV_Wheat	,436	,742
	Yield_Wheat_ha	,082	,041
	Agriculture_area_irigated	10,310	5,471

Source: Own representation using SPSS statistical program, based on data provided by Food and Agriculture Organization of the United Nations, the World Bank and European Commission, (FAO, WB, EC), 2021[5][6][13].

CONCLUSIONS

By analysing the multiple linear regression equation resulting from the analysis, it can be concluded that the developed and analysed econometric model verifies the three

assumptions made when presenting the methods and means used.

Accordingto the value returned by the SPSS statistical program, the coefficient of the parameter entitled *Gross value added of wheat production* has a positive value, which means that a unit increase in wheat results in an increase of USD 0.436 per capita gross domestic product. By efficient agricultural techniques, the development of programs and measures to support the agricultural plant sector, the implementation of programs aimed at training farmers, coupled with the establishment of a well-established anti-calamity system (anti-drought, hail), can lead to an increase in wheat production, which will then be reflected in the value of national GDP and in the value of GDP per capita. The results obtained with this parameter emphasize its importance and verify the first hypothesis of the analysis.

The coefficient of the parameter entitled *Average wheat yield per hectare* also has a positive value, which means that an increase by one single so unit results in an increase of USD 0.082 in Gross Domestic Product per capita. The second hypothesis of the analysis that the increase in the average wheat yield per hectare will also lead to an increase in the gross domestic product per capita is thus confirmed.

The value of the coefficient of the last and most important parameter, accordingto the analysis, entitled actual irrigated agricultural area, has a positive value, significantly higher than for the other two parameters, which expresses its particular importance on per capita gross domestic product, with an increase of one unit resulting in an increase of USD 10.31 per capita gross domestic product. This also checks the third hypothesis contained in the analysis.

The non-reimbursable European Structural Funds, the setting up of irrigation systems managed either by the state, through ANIF, or by private companies, is a real support for the process of developing plant farming equipment, by setting up irrigation systems managed either by the state, through ANIF, or by private companies, by means of partnerships between private persons and the Romanian state. What can be accessed in the various financing programs made available by the European Union to the Member States, in Romania the most important in this field are POR, PNDR, PDL, EAFRD and POPAM.

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CURRENT TRENDS IN THE DEVELOPMENT OF APPLE PRODUCTION IN THE REPUBLIC OF MOLDOVA

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Abstract

Apple production holds a significant share in the horticultural sector in terms of surface and value of production in the total output. The development of this sector has attracted the attention of many specialists and investors, which has contributed to the increase of production between 2005 and 2019 more than twice. The foreign trade in apples of the country is based on a positive trade balance, but there are also some specific risks that are to be investigated in this study. The paper aims to perform an analysis of the situation related to apple production in the Republic of Moldova, as well as the presentation of development trends in the sector. The analytical, descriptive and comparative research methods allowed formulation of conclusions on the current situation in the sector. Despite the decrease of planted area, there is a significant increase in apple production, starting with 2014, as a result of changing planting practices, choice of newer and more productive varieties required on markets. Planting of super intensive orchards in the Republic of Moldova has determined a high productivity in the last 4 years.

Key words**:** *apples, production, Republic of Moldova*

INTRODUCTION

The agriculture sector has a major impact on the Moldavian economy [11], Moldova being one of the countries with significant potential in agriculture, one of the largest areas and farmland as a share of total land [13]. Currently, the agricultural sector is undergoing a significant period of modernization and development, relying on the gradual transition to a competitive agriculture, which implies the existence of advantages, both on the internal and external markets [7]. Agricultural production has a relatively stable growth trend, except for years with severe climate conditions like droughts from 2007, 2012, 2020. Crop production still dominates the structure of the agricultural output, with a share of over 70% in the last 3 years.

Moldova's mild favourable climate and high quality soils determined Moldova's agricultural specialization, particularly in the production of high value crops like fruits and vegetables [12]. Growing multiannual plantations represents a historic activity for inhabitants of the country. In the past, Moldova was one of the largest producers and processors of fruits in the former Soviet Union with most of the production exported to other Soviet republics. For this reason, Moldova was described as the "orchard" of the Soviet Union [6].

Development of fruit growing sector in Moldova at present lies in the efficient operation of orchards' existing potential and their replacement successively with new orchards super intensive type with an assortment of modern and advanced technologies that bring into early bearing, high productivity of fruits during fructification, required quality and competitive in domestic and foreign markets [1].

Previous studies in the field were carried out by [2 and 3] who pay a special attention to super intensive orchards and their benefits for increasing the productivity of the sector. A study on agriculture sector in Moldova developed by JICA carries out a brief examination of apples value chain, pointing on the cost-benefit analysis of apple orchards [5].

A more in depth study on the Moldovan apples value chain was carried out by [6] who analysed production, surfaces, trade, as well

as distribution channels. In the absence of more recent studies in the field and taking into account that apple production holds a notable share in the total agricultural output of the Republic of Moldova, ranging between 2.3% in 2014 to 6.08% in 2017, the paper aims to perform an analysis of the situation related to apple production in the Republic of Moldova, as well as the presentation of the current development trends in the sector.

MATERIALS AND METHODS

Analysis carried out within this paper is based mainly on the data and documents provided by the National Bureau of Statistics of the Republic of Moldova [10] when analysing the surfaces, production and consumption aspects. Trade data has been accessed from UnComtrade [14] and WITS databases [15]. Data on valorization of export quotas to EU were accessed from the official web site of the Ministry of Economy and Infrastructure of the Republic of Moldova [8]. The used data covers the period 2007 – 2019.

The methodological approach is based on the methods particular for the economic research, such as data identification, selection and analysis, comparison, synthesis and formulation of conclusions. The research work is based on a broad quantitative analysis, comprising a descriptive part of the sub-sector and an analysis of the current trends.

RESULTS AND DISCUSSIONS

Apple plantations over the years have occupied a major share in the total of multiannual plantations of fruit, berries and nuts in the Republic of Moldova. If in 2007 they held a share of 58.9%, then in 2019 their segment decreased to 39.9%. This result is due to two major factors: the decrease of apple areas by 13.6% in the analysed period, as well as the considerable increase of the total area of multiannual plantations of fruits, berries and nuts by 27.7% (Figure 1).

Most of the apple plantations belong to the individual sector, their surface having relatively constant values in an average of 38 thousand ha in the last 5 years.

At the same time, there is noted a considerable decrease in the area of apples in agricultural enterprises, from 30 thousand ha in 2007 to 19 thousand ha in 2019.

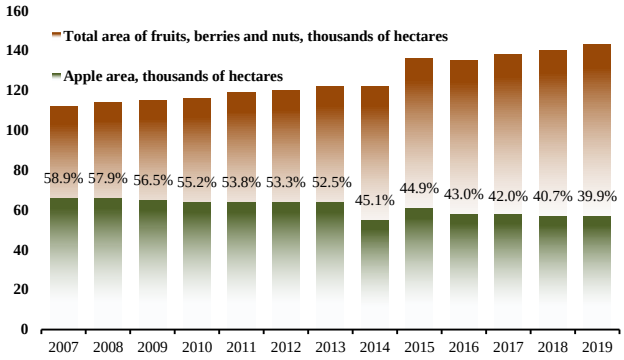

Fig. 1. Total area of fruits, berries and nuts, and area of apples, 2007 -2019, thousand hectares
Source: author's calculations based on [10].

In territorial profile, within the agricultural enterprises and peasant farms that have an area of 10 hectares and over and deal with apple growing, there is strongly observed a regionalization of the location of apple plantations, especially in the Northern region where they occupy an area of approximately 60% of the total fruit, berry and walnut plantations in 2007 and 70% in 2019 (Fig. 2).

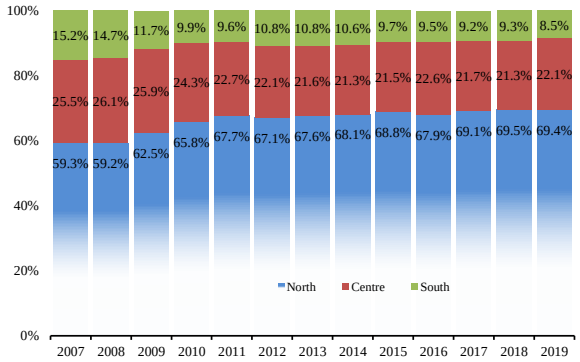

Fig. 2. The total area structured by geographical areas of agricultural enterprises and peasant farms with an area of 10 hectares and more, %.
Source: author's calculations based on [10].

However, this figure is not due to the actual increase of areas in the Northern part of the country, but on the contrary, to the decrease of areas in the Central and Southern part of the country where in the period 2007-2019 apple plantations decreased by 30.8% and 45.0%, respectively.

During the period 2007 – 2019, overall, the apple production in all categories of farms increased by 2.8 times. The individual sector experienced a considerable increase by 3.8 times (Figure 3).

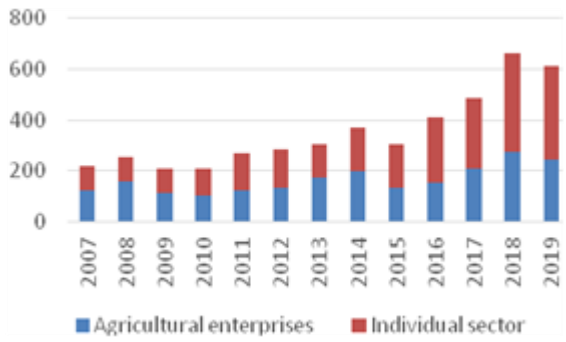

Fig. 3. Total apple production in all categories of farms, thousand tons
Source: author's calculations based on [10].

In agricultural enterprises and peasant farms with an area of 10 hectares and more, although the surface of the given crop decreased between 2007 and 2019, it did not lead to the diminish in production.

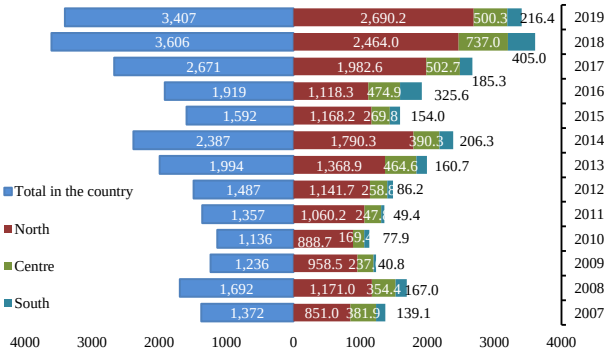

Fig. 4. Apple production structured by geographical areas of agricultural enterprises and peasant farms with an area of 10 hectares and more, thousand quintals
Source: author's calculations based on [10].

On contrary, there is noted a significant increase as farmers start to focus more on the selection of grown varieties, plant protection products and many other aspects that significantly improved the average yield per hectare from 45.2 quintals/ha in 2007 to 158.3 quintals/ha in 2019, which eventually led to an increase in total production in the given period of about 2.5 times (Figure 4).

The main reason of the increase in production and yield, despite the decline in planted area is due to the change in the farming practices, mainly planting of new varieties of apples. According to [2], super intensive orchard apple tree planting material for 2 years with chronic trees allows to get the first crop of 1-2 year after planting with capital spending recovery in 2 years, being characterized by the following advantages: increased productivity of quality fruit per unit of plantation area by 4-6 times; decrease of the prime cost of production essential – by 2-3 times; more efficient use of agricultural machinery, water, mineral fertilizers, etc.

As for apple varieties, according to data from Catalogues of plant varieties for 2014 till 2021, in 2021 there were registered 13 summer varieties of apples (9 in 2014), 16 of autumn varieties (no changes compared to 2014) and 48 of winter varieties (compared to 34 in 2014) (Catalogue of plant varieties, 2021) [4]. The last registration of apple varieties took place in 2016, when 2 new varieties of winter apples have been included in the catalogue. This may represent an important barrier for Moldovan producers of apples as year by year international markets require new varieties which are not registered and approved yet in our country.

The trade balance of foreign trade with apples in the Republic of Moldova has always been positive and during the period 2007-2019 has only increased. Within the commodity group 08 “Edible fruits and nuts”, apples have had a continuous stability, reaching a share of about 24 -25% over the period.

Although there are small quantities of imported apples, the domestic product fully satisfies the local market and preferences of consumers. If in 2015 the self-sufficiency level accounted for 209.8%, then in 2019 it reached the value of 270.5% (Table 1).

Around 80% of apples are sold as fresh product, while the surplus apples and apples of poor qualities are used by the processing industry, mainly to produce apple juice concentrate.

Apples play a predominant role in production, storage, and sales as apple producers and traders have and use the bulk of post-harvest infrastructure.

Table 1. Balance of food resources and uses for apples, 2015 - 2019

Elements of the balance	***Apples, thousand tons***				
	2015	2016	2017	2018	2019
Resources					
Production	308	412	487	665	611
Import	2	3	4	10	4
Stocks variation	6	-10	-5	-164	-66
Total resources	**316**	**405**	**486**	**511**	**549**
Uses					
Export	169	194	296	281	324
Seeds	-	-	-	-	-
Forage	1	1	1	1	1
Processing for non-food purposes	32	39	43	58	55
Losses	5	4	2	6	8
Personal consumption of the population	109	167	144	165	164
Total uses	**316**	**405**	**486**	**511**	**549**
Self-sufficiency level, %	209.8	195.9	256.0	289.9	270.5

Source: author's calculations based on [10].

Nevertheless, sorting and packing lines as well as packaging materials are often missing, which leads to low quality exports [5].
Out of the total apple resources during the years 2015-2019, approximately 50 - 60% were intended for export.

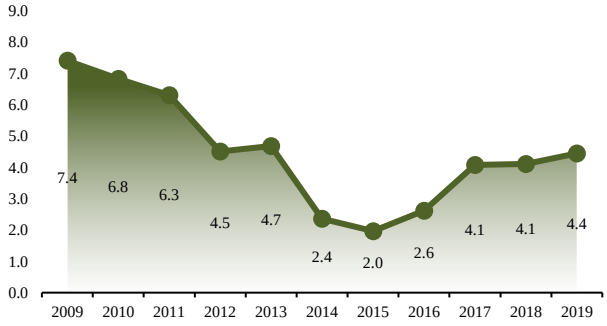

Fig. 5. Share of fresh apples in the total export of agri-food products, 2009 - 2019, %
Source: author's calculations based on [14].

This product has a fairly significant share in the total value of agri-food exports. Even of in 2009 this product had a share of 7.4% and in 2019 - 4.4% of total exports of agri-food products, this does not necessarily mean a decrease in exports. The export of fresh apples increased from 44.7 million. USD in 2009 to 53.7 million. USD in 2019 (Figure 5).
When analysing the export potential of apples through the Revealed Comparative Advantage (RCA) indicator, one can note that the Republic of Moldova holds a significant value of this index. This indicator measures the export of a product with the country's total exports and the export performance of a set of countries. If RCA> 1, it denotes a comparative advantage, for example: the sector in which the country is relatively specialized in the terms of exports [9].
As a result, in the period 2009 - 2019, the RCA values for apples of Moldovan origin underwent a period of decrease, the minimum value being reached in 2015, and subsequently in the last 4 years, a continuous increase of the respective indicator was registered (Figure 6).

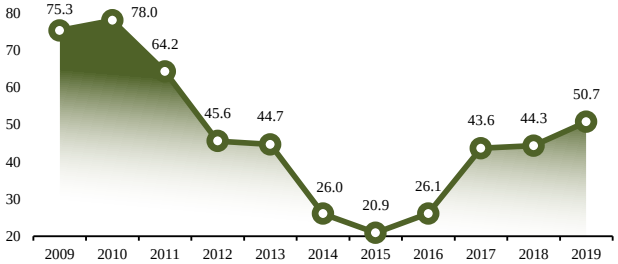

Fig. 6. RCA of fresh apples in relation to the world countries, 2009 - 2019.
Source: author's calculations based on [15].

Although the RCA value for fresh apples is quite high and at first sight demonstrates that apples are quite competitive on the world market, this statement can be questioned following the analysis of exports by countries.
In 2009, the Republic of Moldova had 9 export partners for fresh apples and over the years this number increased significantly to 15 partners in 2019, while the maximum number accounted for 23 partners in 2018. However, throughout the analysed period, the main export partner has always been Russian Federation, who in 2009 imported about 89.2% of the total export of Moldovan fresh apples, while in 2019 this figure reached 97.8% of the total fresh apples exported. Of course, this type of export dependence also involves certain risks, like the ones that occurred in 2014 when agricultural producers suffered losses as a result of political context, the end of which was the imposition of an embargo by the Russian Federation on fresh apples and other Moldovan origin products (Figure 7).

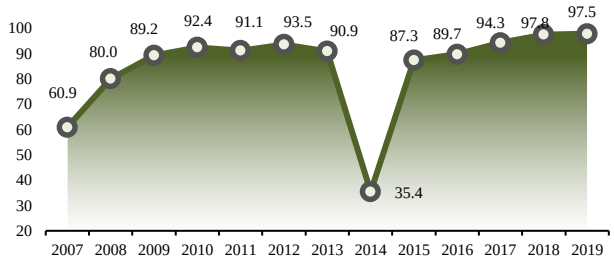

Fig. 7. Share of apples exported to Russian Federation from the total exported fresh apples, 2009 - 2019, %.
Source: author's calculations based on [14].

Certainly, in the nearest future, one solution to overcome the existing dependency problem is to diversify the export markets and minimize these risks. In this regard, a notable aid came from the European Union, which through the Deep and Comprehensive Free Trade Agreement ratified on July 2, 2014 by the Parliament of the Republic of Moldova allows domestic producers to export an assortment of products including apples on the European Union market at a preferential trade relationship. DCFTA set an export quota of 40 thousand tons for fresh apples of the Moldovan origin. Nevertheless, existence of DCFTA has not significantly changed the export directions of domestic apple producers, who during the years 2015 - 2020 valorized the set tariff quotas only in the limits of 5% [8]. However, during the period 2014 – 2020, there is noted a small upward trend in exports to the European Union market. The main EU country that imports Moldovan apples is Romania, with a share of 1.4% of the total exported Moldovan apples in 2019 (Table 2).

Table 2. Valorization of tariff quotas on apple exports to the EU

2015		**2016**		**2017**		**2018**		**2019**		**2020**	
tons	%	tons	%	tons	%	tons	%	tons	%	tons	%
746	1.8	74	0.19	2,191	5.5	1,859	5	2,300	6	1,577	4

Source: based on [8].

One of the main causes that hinders the export of Moldovan fresh apples to EU is related to the high standard of food safety requirements at the European level that still can not be completely reached by Moldovan producers, as well as apple quality overall, including the visual aspects, packaging, etc. At the same time, it is quite difficult to compete on the EU market with their local producer – Poland. EU has a high demand for Polish apples, they being by far the main Polish export fruit. Apples account for over 75 percent of export volume of all fruit shipped from the country to abroad and at the same time over 1 percent of the value of Polish agri-food exports [4].
Most of the improvements regarding the apple cosmetic appeal and the cost per kg can be achieved by the growers in their orchards by: planting intensive orchards using modern varieties with improved coloring; introduction of chemical thinning; improved use of orchard irrigation; improved plant nutrition, based on soil, water and plant-tissue analysis; installation of anti-hail nets and frost protection systems in the orchard; appropriate winter and summer pruning; improved pest management; implementation of appropriate harvesting tools; improved human resource management (training of workers, process planning) and labor productivity [6].

CONCLUSIONS

Apple production has always been treasured by farmers from the Republic of Moldova who are ready to grow a considerable share of multiannual plantations of this product. Farmers, especially from the Northern part of the country, have been working hard on increasing efficiency of plantations and substitution of old varieties with new ones in order to eventually increase the yield per hectare in average by 3 times. The RCA index, as well as assortment of export partners show that Moldovan apples are and further can be quite competitive on the world market. At the same time, a major disadvantage is that up to 97% of apples are purchased by the Russian Federation, which can use this moment as a lever of control in political issues as it was the embargo from 2014. The Deep and Comprehensive Free Trade Agreement offers some advantages for our producers on the EU market, but these opportunities have

not been achieved so far due to various reasons like: lack of capacities to offer high standard products in terms of food safety and quality, including the visual and organoleptic aspects, packaging, etc. Therefore, for the future development of the sector, the following recommendations are proposed:

-Introducing a new model of granting subsidies for all fruit plantations, including apples. The current model relies on post-investment subsidies offered for every action in particular (deforestation, establishment of plantation, installation of anti-hail, anti-rain and irrigation systems, etc.). The new model should focus on the investment object (apple orchard) as an integral object, subsidies being granted for the development of orchard from A to Z.

-Diversification of export partners (i.e. countries from the Middle East, Asia, etc.) that will reduce the strong current dependency on one market.

-Improving the quality of product according to international and EU standards.

-Development of logistic component, like packaging, visual aspects, development of logos and trademarks so that the Moldova apples can be easily noticed abroad.

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AN OVERVIEW OF BUFFALO MILK PRODUCTION AND DISTRIBUTION AT TERRITORIAL LEVEL

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Abstract

The aim of this paper is to present the evolution of buffaloes' number and buffalo milk production, from the perspective of statistical indicators and the topicality at territorial level, also describing the ways of buffalo milk use and distribution. The calculations are based on the operational data provided by Ministry of Agriculture and Rural Development and official statistic data, using statistical indicators such as average, minimum, maximum, annual growth rate, standard deviation, coefficient of variation. Research shows that during 2010-2020, number of buffaloes decreased to 19,596 heads, by 30.3%, with an average annual rate of -3.55%. The majority of buffaloes grow in central and north western Romania, and the largest numbers are in Cluj County (3,470 heads). On October 31, 2020, 199,539 hl of buffalo milk were produced, Maramureș County being on the first place, with 50,976 hl milk. Of total milk production, 58.3% is destined for market, 28% for family consumption and 13.7% for technological consumption on farms. Of the market milk, 64.7% is sold directly on the market and only 35.3% is delivered to milk processing units.

Key words**:** *buffaloes, milk, production, market*

INTRODUCTION

The raising of buffaloes in Romania is a traditional activity, with a mixed production direction, of milk-meat, but these animals are also used as a traction force for some agricultural and transport activities. In recent years, in the context of the lack of support policies in the field of buffalo breeding, the decrease in their importance in milk production, with a low demand on high fat milk, the reduction of animal use for work, coupled with a number of technological factors, there has been a sharp decline in herds of this species in Romania [13].

Currently, the largest share of buffalo herds is found in small farms, where animals of non-specialized breeds are raised, being characterized by a low genetic quality. The current situation of buffalo breeders in Romania is precarious, and the number of Romanian buffalo breeds is declining, raising buffalo for milk being considered an economically inefficient activity, one of the causes of inefficiency being the low productivity per buffalo (approximately 1,700 litres of milk/head) [10].

MATERIALS AND METHODS

The calculations in this paper are based on the operative data from Ministry of Agriculture and Rural Development and also from National Institute of Statistics – tempo online [6, 13].

In order to have an overview of buffalo milk production and distribution at local level, a series of indicators were used, like: number of buffalo stocks at national (during 2010-2020) and county level (October, 2020), number of heifers at county level, number of young buffalos at county level, buffalo milk production and different forms of use at county level.

Also, a series of statistical indicators have been calculated, as follows: average, minimum, maximum, annual growth rate, standard deviation, coefficient of variability.

RESULTS AND DISCUSSIONS

During 2010-2020, the buffalo livestock decreased by 30.3%, from 28,127 heads to 19,596 heads. The minimum was reached in

2018 (18,266 heads), and the average of the period was 20,662.5 heads.
The average annual rate was negative (-3.55%) and the coefficient of variability of 12.84% indicates that the string analysed is homogeneous.
Calculating the equation of the evolution trend of the herd, it can be seen that the value of the coefficient x is negative, which indicates that, on average, annually, the number of buffalo herds decreases by 612.6 heads (Figure 1).

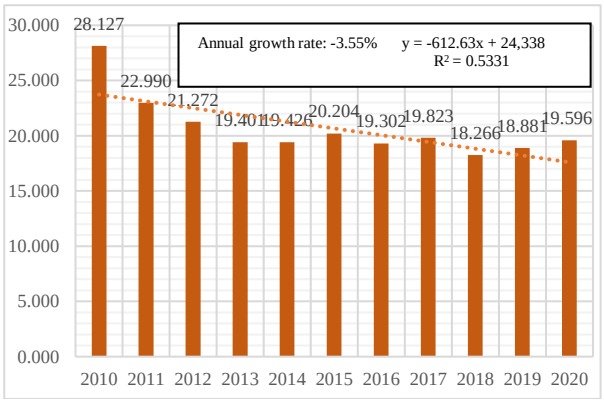


Fig. 1. Evolution of buffaloes' number
Source: Own calculation following MARD data.

According to official statistic data, the number of buffalo cows during 2010-2020 decreased by 34.9%, from 21,422 heads to 13,941 heads. The average of the period was 15,625.3 heads. The average annual rate was negative (-4.20%) and the coefficient of variability of 13.23% indicates that the series under analysis is homogeneous.

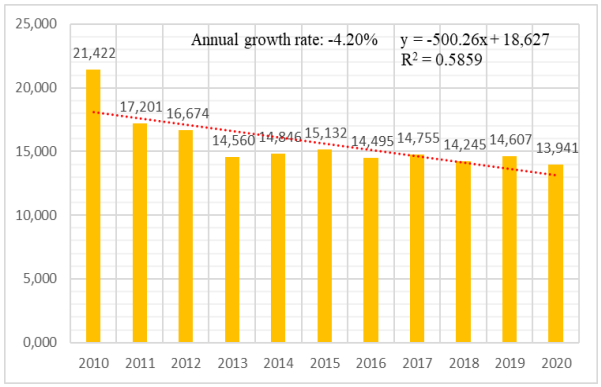


Fig. 2. Evolution of buffalo cows' number
Source: Own calculation following MARD data.

The equation of the evolution trend shows that the value of the coefficient x is also negative, indicating that, annually, the number of buffalo cows' herds decreases by 500.2 heads (Figure 2).
At local level, on October 31-st, 2020, most of the herds are in the centre and north-west of Romania and a few farms in the south of the country. The largest number of buffaloes are in Cluj county (3,470 heads), followed by the counties of Maramureș (3,358 heads), Sălaj (2,488 heads) and Brașov (2,283 heads) (Figure 3).

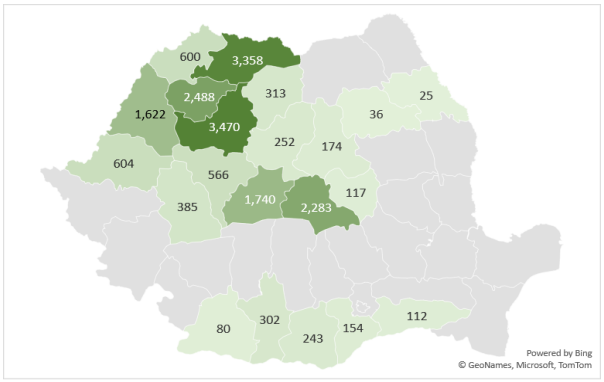
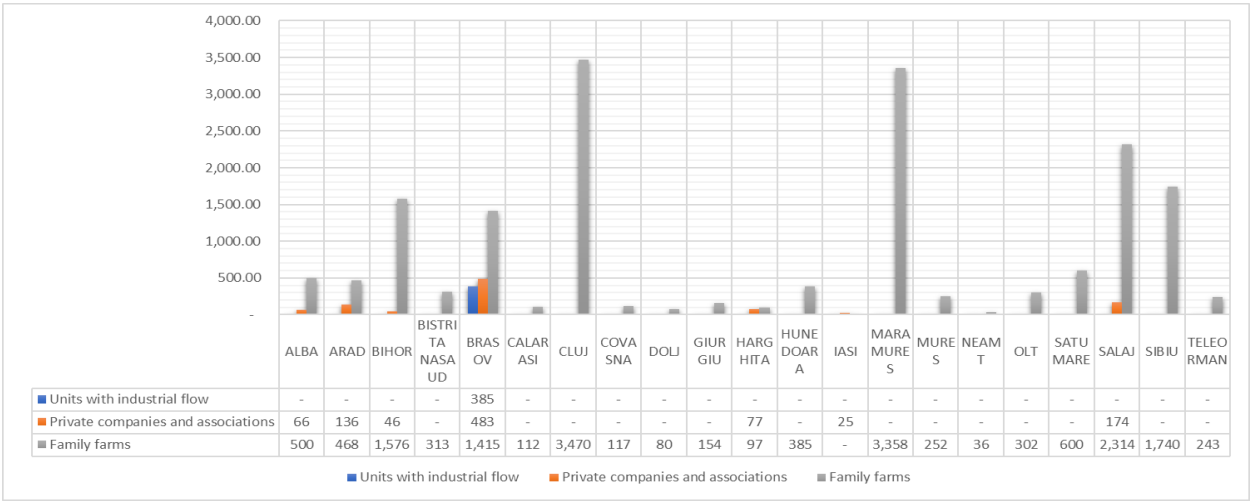


Fig. 3. Distribution of buffaloes at county level
Source: MARD.

These buffaloes are raised in units with industrial flow, private companies, associations and family farms (Figure 4).
We notice that only 2% of the total number of buffaloes are raised in units with industrial flow, namely in Brașov county, and in some counties in the centre, west and northwest of the country, there are several associations, with 5.3% of buffaloes.
Otherwise, most of the herds are raised on family farms (92.6%).
Regarding the distribution of the number of buffaloes at territorial level, at the end of October 2020, the largest numbers were in the counties of Cluj (2,480 heads), Maramureș (2,320 heads) and Sălaj (2,130 heads) (Figure 5). Among them, 1.2% are raised in units with industrial flow, 4.4% in associations and 94.4% in family farms.
The highest share of buffalo heifers at territorial level is also found in the centre and northwest of the country, most being in the counties of Sălaj (257 heads), Sibiu (190 heads) and Maramureș (140 heads) (Figure 6).



	ALBA	ARAD	BIHOR	BISTRITA NASAUD	BRASOV	CALARASI	CLUJ	COVASNA	DOLJ	GIURGIU	HARGHITA	HUNEDOARA	IASI	MARAMURES	MURES	NEAMT	OLT	SATU MARE	SALAJ	SIBIU	TELEORMAN
Units with industrial flow	-	-	-	-	385	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Private companies and associations	66	136	46	-	483	-	-	-	-	-	77	-	25	-	-	-	-	-	174	-	-
Family farms	500	468	1,576	313	1,415	112	3,470	117	80	154	97	385	-	3,358	252	36	302	600	2,314	1,740	243

Fig. 4. Distribution of buffalo herds at county level
Source: MARD.

Of total number, 1.2% are raised in units with industrial flow, 8.9% in associations and 89.8% in family farms.

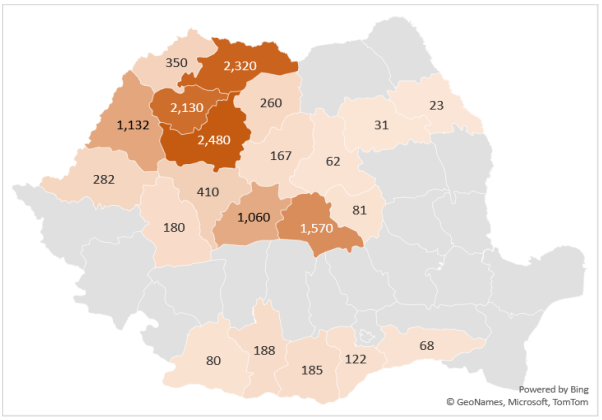


Fig. 5. Distribution of buffalo cows at county level
Source: MARD.

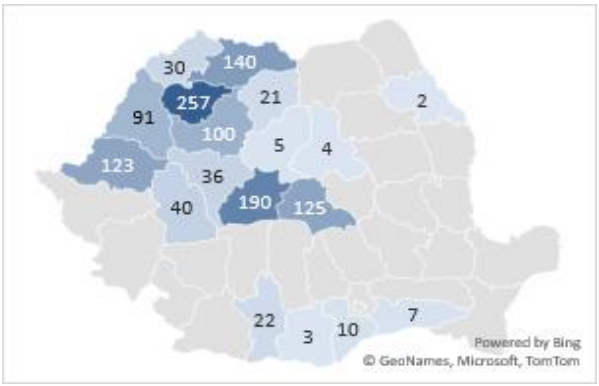


Fig. 6. Distribution of buffalo heifers at county level
Source: MARD.

The buffalo youth is present in only 16 counties of the country, being in number of 6,460 heads, the majority in family farms (91.6%) (Figure 7).

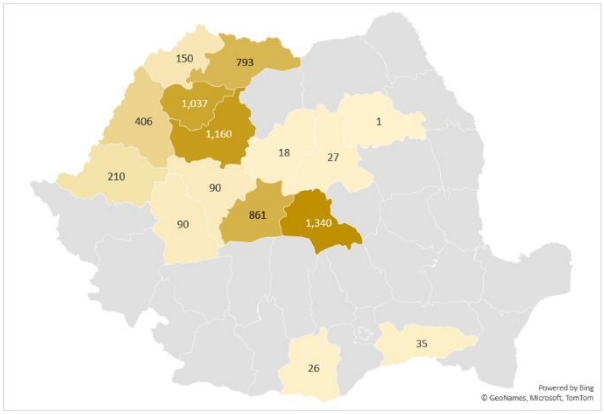


Fig. 7. Distribution of buffalo youth at county level
Source: MARD.

The total production of buffalo milk at the end of October 2020 was 1,995.39 hl, coming from 20 counties, among which on the first place is Maramureș county, with 509.76 hl, followed by Sălaj with 344.41 hl, Brașov with 293.53 hl and Cluj with 242.5 hl (Figure 8).

Of the total production of buffalo milk, 58% is intended for delivery on the market, 28% for family consumption, and the remaining 14% is technological consumption on the farm (Figure 9).

Of the buffalo milk production delivered to the market, 65% is sold directly on the market and only 35% is delivered to dairies (Figure 10).

In the Figure 11, the quantities of buffalo milk are presented, by counties, delivered to the dairy factories.

It is observed that the largest amount of milk delivered (49.2%) is in Sălaj County.

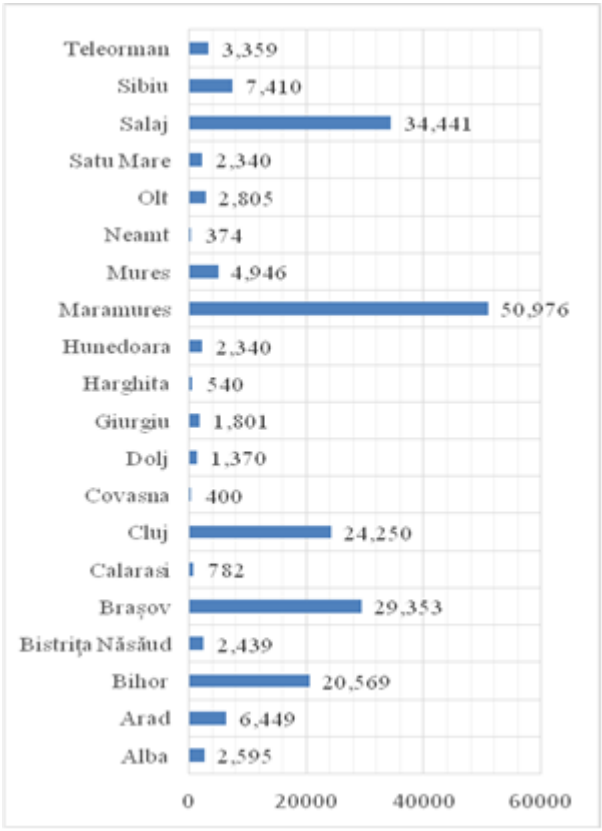


Fig. 8. Distribution of buffalo cow's milk at territorial level (hectolitres)
Source: MARD.

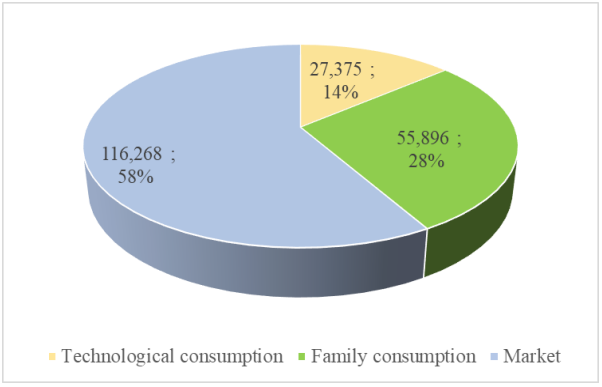


Fig. 9. Destination of buffalo cow's milk (hectolitres)
Source: MARD.

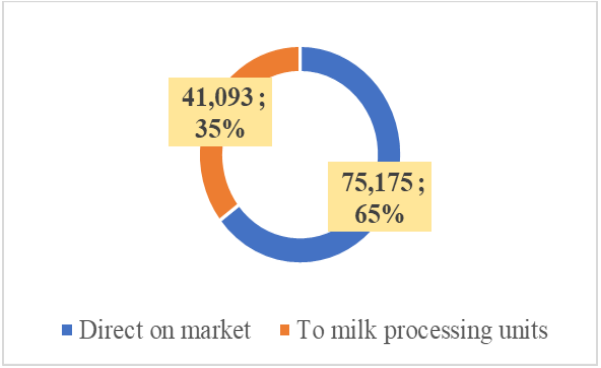


Fig. 10. Distribution on market of buffalo cow's milk (hectolitres)
Source: MARD.

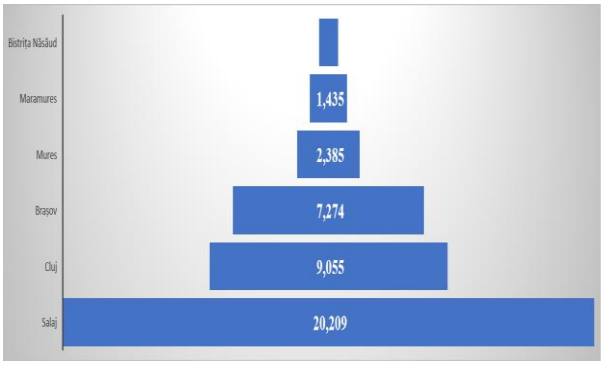


Fig. 11. Buffalo cow's milk delivered to dairies, by counties (hectolitres)
Source: MARD.

The buffalo business is one of the most attractive in animal husbandry.
The breeding of buffaloes is handled by a small number of farmers, most of them positioned in the Transylvania area. Breeders say that is easier to raise dairy cows, than to struggle with buffaloes [12].
Buffalo milk is higher in terms of nutrient content compared to cow's milk [11].
A characteristic of medium-sized farms is that 85% of the milk destined for the market is processed on the farm, which means that it is transformed into buffalo cheese [7].
Although the global trend in buffalo breeding is upward, focused on the development and sustainability of the activity, in Romania, it is declining.
In the past, Romania has been a recognized country in buffalo breeding, with specific natural exploitation conditions. The largest buffalo herd in Romania was met in 1980 (228 thousand heads) [1].
The main causes of the reduction of buffalo herds in Romania, after 1990, are the massive slaughter of animals, the retention of a small number of female youths for technical selection and reproduction works, the abusive trade in animals, the advanced age of buffalo breeders in rural areas, difficult access to credits in order to obtain financing for the establishment of livestock farms [8].
Buffalos are resilient to environmental conditions and they require natural raising environment [5].
In improving buffalo milk production, due to the species' lateness and longer gestation period than in cows, the generation interval is longer and the annual genetic progress is

slower, so it is necessary to integrate the species into longer-term breeding programs.
In Romania, due to the small number of buffaloes compared to cattle, the statistics on cattle also include buffaloes, but they bring an important economic contribution in conditions where other species of cattle are unadaptable or achieve much lower production levels [13].
In terms of competitiveness, cattle meet many qualities superior to buffaloes, but the advantages must be interpreted in terms of technical and economic efficiency, compared to the biological characteristics of adaptability to various conditions of growth and exploitation, in some areas buffaloes being more efficient [3].
Environmental factors, such as geographical area and climatic factors, can influence milk production. They are of particular importance in terms of buffalo farm management.
The use of good practices, combined with a superior animal genetic background, can lead to higher milk production [4].

CONCLUSIONS

In Romania, in Transylvania area, there is a tradition regarding the breeding of buffaloes, and the perspectives of this species are high, but too little exploited.
The current situation of buffalo farms is still quite precarious, with buffalo breeders generally being elderly people who have neither the physical nor the financial resources to continue to raise this species of animal. In addition, there are extremely few buffalo milk processing plants [2].
In this context, the number of buffaloes in Romania is constantly decreasing, being urgently necessary to take measures to support and conserve the species, as well as to improve buffalo milk production.

ACKNOWLEDGEMENTS

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ROMANIAN WINE MARKET AND TRADITIONS

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Abstract

The wine sector is important for the present Romanian economy and has millennial origins in our country. Proving the previous statement, the paper presents the evolution of wine production, by consumption categories and types of colors, obtained in Romania and the analysis of the foreign trade in the category of wines, for the period 2013-present. The data available for 2018 indicated that, of the total production of noble wines (3,369.9 thousand hl), by consumption categories, the highest percentage was held by other wines (without PDO / PGI) - 55%, and by types of colors white wines achieved the largest amount (2,189.7 thousand hl). Moldova Hills represent the most important wine region of Romania, due to the amount of wines obtained here. Complementary to the economic analysis, we also introduced aspects of Romanian traditions related to wine. For the present paper, we took and analyzed data from reference works and sites like Faostat, ITC, NIS and MADR.

Key words**:** *noble wines, Romania, traditions related to wine, wine production*

INTRODUCTION

Why one more paper on wine? By the fact that the vine was one of the first plants cultivated by peoples that preceded remarkable ancient civilizations and that later, from these civilizations (Sumerian, Egyptian, Carthaginian, Greek) date historical sources (bas-reliefs, funerary paintings, tablets) which describe the technique of vine cultivation and wine production (according to [15]), it is attested that the virtues of the bahica liqueur have been appreciated since its obtaining. And the Daco-Getae, well-known grain producers, animal breeders, engaged also in apiculture and fishing, intensively cultivated vines [10] and valued wine, which they consumed in ox horns, jugs and other vessels. during the ceremonies – on our lands wine has been mentioned since the time of Burebista (82 BC - 44 BC), the king who is said to have even ordered the burning of vineyards due to the fact that wine proved to be a stronger fighter than his soldiers when they consumed him in military campaigns. The poet Ovid (43 BC - 17 AD) also recorded in the works written in Tomis about the importance of the vine in the Dobrogea area [1].

To the historical and cultural argument, we associate the medical one and, of course, the economic one, determinant for the present paper.

Consumed in moderation, wine brings health benefits, positively influencing the functioning of the digestive, circulatory and nervous systems, reducing depression, stress, delaying aging through the intake of minerals, vitamins, antioxidants (resveratrol is listed among the most effective natural antioxidants, rated as 4 -5 times stronger than beta-carotene and tens of times stronger than Vitamin E and Vitamin C).

Consumers' preferences (past and present) for this drink support the continuity of the national vine & wine sector and generate jobs, incomes and raw materials for the food industry [21]. Therefore, the main purpose of the study is to analyze, starting with 2013, the situation of wine production in Romania distributed by wine-growing areas, consumption categories and types of colors, the place that our country has from this point of view worldwide and in the EU, Romania's quantitative and value imports and exports of noble wines, wine consumption, while the secondary purpose, complementary to the economic analysis, is to familiarize readers

with Romanian traditions and symbolism relative to wine. The EU itself has recognized the importance of the wine sector in preserving the identity of rural areas, through traditions and by providing jobs for locals in wine-growing areas (most of them without any other economic prospects) and limiting the soil erosion on the versants where the vines are grown. According to The European Landscape Convention, to these are added the conservation of landscapes and their added value by the view of the growing vines [5].

MATERIALS AND METHODS

This paper focused on capturing the main aspects related to the wine production and capitalization sector in Romania, starting with 2013. The paper analyzed several indicators specific to the aforementioned sector, such as: wine production; imports and exports of both value and quantity of wine; average annual wine consumption. Also in this paper, an analysis of the segment related to noble wines in Romania was performed. The data presented and analyzed were taken from various specialized sites, such as: Faostat, ITC, NIS and MADR. In order to elaborate this paper, a series of specialized materials with a rich informational content were studied. Representative data were graphically illustrated in the "Results and Discussions" section.

Considering the transdisciplinary approach, a cognitive approach profitable for both authors and readers, (in this paper too) we opened the economic perspective to the socio-historical "platform" that hosts it, selecting aspects related to wine from the generous and millennial Romanian living traditions and Christian symbolism – appealing to readings and their intellectual processing (analysis, synthesis, comparison, etc.) for this direction of our study.

RESULTS AND DISCUSSIONS

We structure this section into two complementary parts, the first one with economic profile (I), and the second one dedicated to traditions related to wine (II).

I. Economic analysis

According to statistical data taken from Faostat [11], the wine ranked 9th in the world, in the top of most produced commodities, in terms of production (average for 1993-2018) with 27,314,142.38 tones, after beer of barley, sugar raw centrifugal, molasses, cottonseed, oil palm and oil soybean.

Worldwide, wine production (average for 1993-2018) was concentrated on the European continent, which held first place (Figure 1), with 18,121,392.85 tones (66.3% of the world total) and was followed by Americas with 5,261,982.65 tones (19.3% of the world total). For the other continents the wine production obtained represented less than 10%, as follows: Asia (1,699,873.35 tones); Oceania (1,196,677.96 tones) and Africa (1,034,215.69 tones) with the smallest amount (Fig. 1).

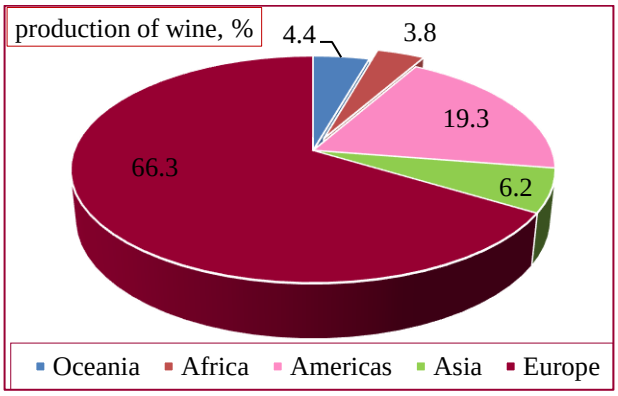

Fig. 1. Distribution of wine production worldwide (%)
Source: [11], 2021.

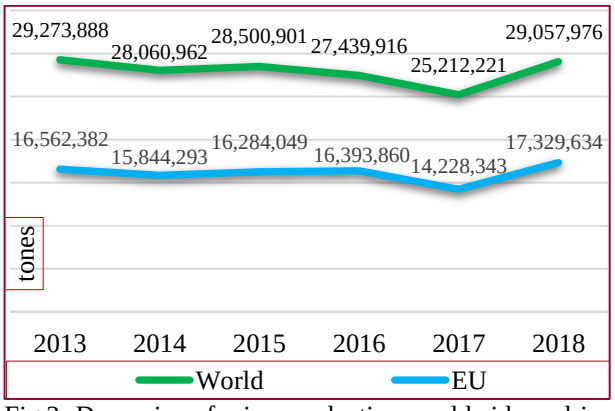

Fig.2. Dynamics of wine production worldwide and in the EU-28, in the period 2013-2018 (tones)
Source: [11], 2021, own interpretation.

Among the top 5 producers of wine worldwide, for the period 1993-2018, were: France (5,053,664.27 tones); Italy (4,946,011.23 tones), Spain (3,493,831.19

tones, United States of America (2,486,006.81 tones) and Argentina (1,417,152.92 tones) [11]. From the data presented it is easy to see that the first 3 places were occupied by E.U. states.

Wine production worldwide, but also, at EU-28 level, between 2013 and 2018, registered variations from year to year (Figure 2). In 2018, worldwide wine production registered an insignificant decrease of only 0.74% compared to 2013. In contrast to the global situation, in the EU-28, in 2018, there was an increase of 4.63% compared to 2013.

For the EU-28, wine was on the 3rd place in the top most produced commodities in terms of production (average for 1993-2018), 16,953,207.54 tones, after beer of barley and sugar raw centrifugal [11].

In 2018, the major EU wine-producing states were, in order: Italy (5,414,983 tons); France (4,888,791 tons); Spain (4,440,000 tons) and UK (2,384,006 tones) (Figure 3).

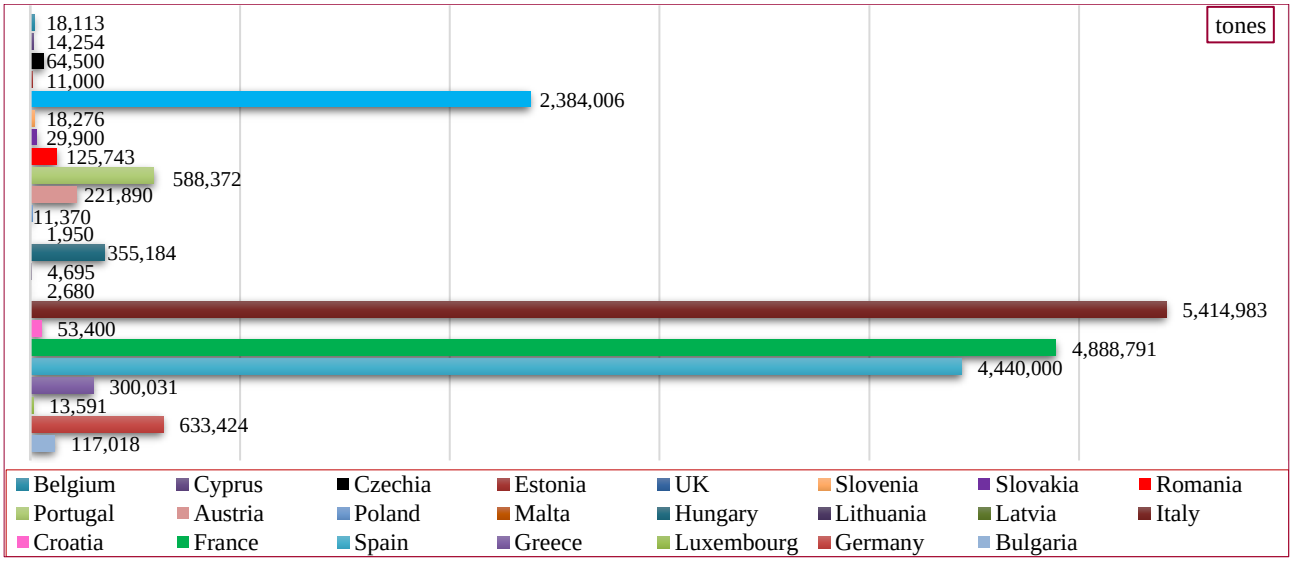

Fig.3. EU-28 wine production in 2018 (tones)
Source: [11], 2021, own interpretation.

As mentioned previously by the authors in the article Production of wine grapes and cultural traditions related to vine in Romanian, 2020, the major grape growers for wine in the EU - 28 were: Spain (923.71 thousand ha); France (745.39 thousand ha) and Italy (629.21 thousand ha). As regards the production of wine grapes, the following situation was recorded in the same year: Italy was first (7,485.53 thousand tones); followed by Spain (6,673.48 thousand tones) and France (6,232.74 thousand tones). In both rankings Romania ranked fifth, with 166.46 thousand ha, respectively 1,069.17 thousand tons [6].

It is necessary to specify an important aspect regarding Romania's position in the ranking of producers for the category "Wine Grapes" and the category "Wine" at European Union level: although Romania holds an important position, both among the top wine grape producers and, in the top wine producers, as production it is at a significant distance from the first ranked countries, because it has not been able to make the most of its wine potential in the analyzed period.

In Romania, total wine production registered a decrease for the period under review. From the data presented it is noted that there was a decrease of 1.00% in 2018 compared to 2013 (Figure 4).

The smallest amount of wine was obtained in 2016 (3,303.7 thousand hl). A sharp decline has manifested from 2014 to 2016, and from 2017 wine production began to increase. From the data presented it is found that a maximum production was reached in 2013 (5,113.3 thousand hl), which could not be reached again during the analyzed period.

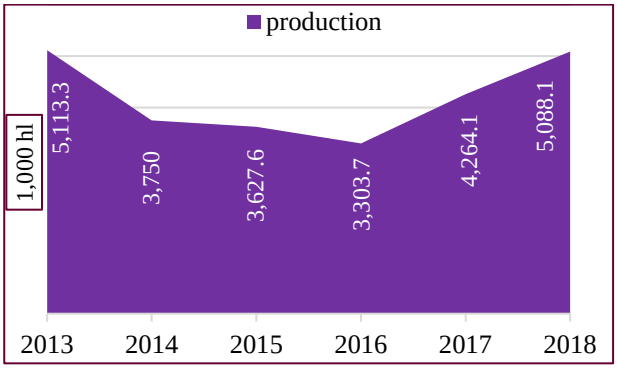

Fig. 4. Dynamics of total wine production in Romania for the period 2013-2018 (1,000 hl)
Source: [19], 2021, own interpretation.

Wine production obtained in 2018 placed Romania 13th in the world ranking [12].
Depending on the variety, vineyard and year of harvest, the wines are characterized as follows: current consumption (with alcoholic strength of 8 - 10,5°) and high quality (alcoholic strength > 10,5°). According to specialized materials, wines of high quality are classified as: wines with a controlled designation of origin (PDO) and PGI wines. Other types of produced wines are: sparkling wines (produced by traditional process of fermentation in bottles); sparkling wines (impregnated with carbon dioxide); aromatized wines (especially vermouths) and Brandy type alcoholic beverages (called "vinarsuri") [24]. According to Law no. 164/June 24, 2015 for vine and wine in the system of common organization of wine market, the wine for current consumption changed its name from table wine to varietal wine [14].
From the point of view of the sugar content, the wines can be: white dry wines (with sugar ≤ 4 g/l), semi-dry (sugar 4 - 12 g/1), semi-sweet (sugar 12 - 50 g/1) and sweet > 50 g/l); red wines (generally dry), aromatic wines, usually made as semi-sweet and sweet wines [24].
Of the total production of 5,088.1 thousand hl of wine (Figure 4), 1,718.2 thousand hl (34%) represented wine from inter-specific hybrids, and 66% (3,369.9 thousand hl) were noble wines (Figure 5).
In the present paper, the analysis of the segment related to the noble wines obtained in Romania was imposed. Regarding the classification by consumption categories for noble wines, the following were registered: the highest quantity (1,839.5 thousand hl), representing 55%, was obtained from other wines (without PDO / PGI); followed by wines with PDO (1,114.3 thousand hl) - 33%, and wines with PGI (265.6 thousand hl) - 8%. The lowest amount was achieved in the Varietal wines category (150.5 thousand hl), with 4%.

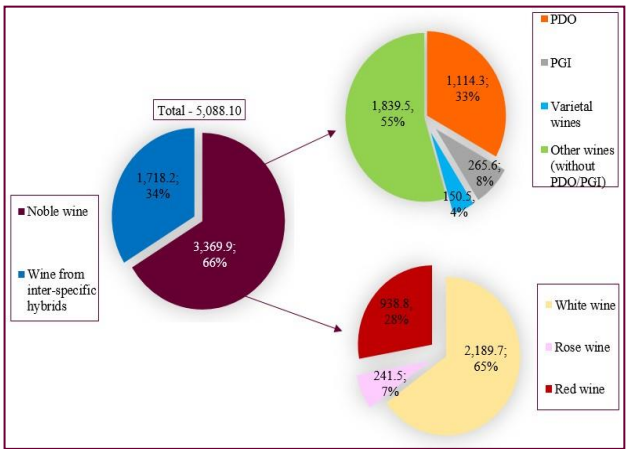

Fig. 5. Wine production in Romania, by consumption categories and types of colors, in 2018 (1,000 hl)
Source: [19], 2021, own interpretation.

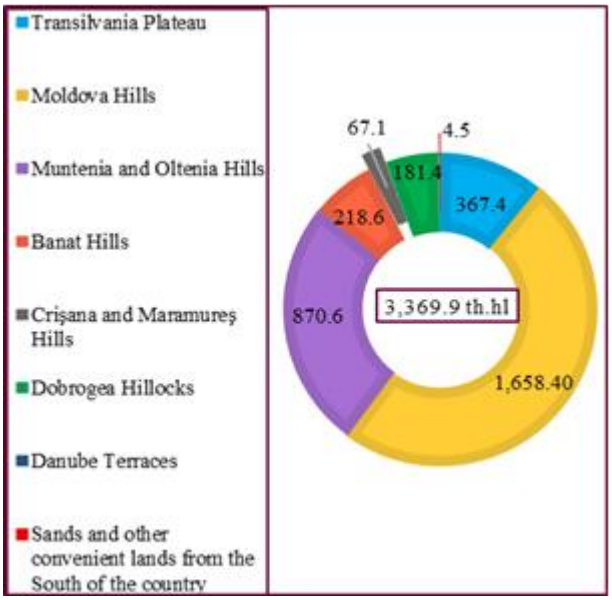

Fig. 6. Wine production in Romania, distributed by wine-growing areas, in 2018 (1,000 hl)
Source: [19], 2021, own interpretation.

From the data presented regarding the production of noble wines from Romania, depending on the color, the following situation was highlighted: white wines, the largest quantity (2,189.7 thousand hl, respectively 65% of the total production), red

wines (938.8 thousand hl, respectively 28% of the total) and rose wines, the smallest quantity (241.5 thousand hl, respectively 7% of the total).

As mentioned in the article *Production of wine grapes and cultural traditions related to vine in Romania, 2020*, Romania has 8 wine regions, 37 vineyards and wine centers [6]. The distribution of noble wine production by these regions was as presented in Figure 6.

Corresponding to the largest vineyard area [9] - holding almost 70,000 ha - the most productive was the Region Moldova Hills, where 49.21% of the total production of noble wines was obtained (1,658.4 thousand hl). In the other wine regions, the following quantities were obtained: 870.6 thousand hl (25.83%) - Muntenia and Oltenia Hills; 367.4 thousand hl (10.90%) - Transylvania Plateau; 218.6 thousand hl i.e. (6.49%) - Banat Hills; 181.4 thousand hl (5.38%) - Dobrogea Hillocks. Smaller productions were also registered for the 'Noble wines' categories, such as: 67.1 thousand hl (1.99%) - Crişana and Maramureş Hills; 4.5 thousand hl (0.13%) - Sands and other convenient lands from the South of the country and 1.9 thousand hl (0.07%) - Danube Terraces.

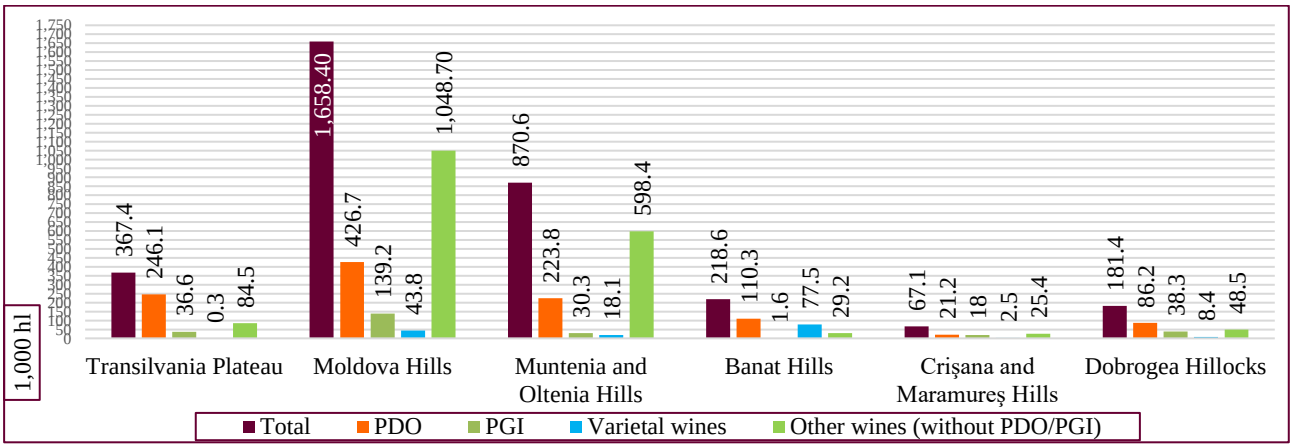

Fig. 7. Production of wine from noble varieties by quality categories and wine-growing regions, in 2018 (1,000 hl)
Source: [19], 2021, own interpretation.

Figure 7 shows the production of noble wine obtained in the main wine-growing regions, by quality categories. Thus, in the Transilvania Plateau, 66.98% of the production was represented by wines with PDO. Other Regions where PDO wines had the highest share were: Banat Hills (50.46%) and Dobrogea Hillocks (47.52%). In the other wine-growing regions, the highest share was recorded by other wines (without PDO/PGI): Moldova Hills (63.24%); Muntenia and Oltenia Hills (68.73%) and Crişana and Maramureş Hills (37.85%).

It should be mentioned that in the Wine Region - Sands and other convenient lands from the South of the country the 4.5 thousand hl obtained are from the category other wines (without PDO/PGI), and on the Danube Terraces of the 1.9 thousand hl obtained, 89.47% represented PGI wines.

In conclusion, the Regions with the highest PDO and PGI wine productions are:

-Moldova Hills (426.7 thousand hl) PDO wines and 139.2 thousand hl PGI wines; -Transilvania Plateau (246.1 thousand hl) PDO wines and 36.6 thousand hl PGI wines.

Varietal wines are produced in larger quantities in the Banat Hills regions (77.5 thousand hl) and Moldova Hills (43.8 thousand hl), and other wines (without PDO/PGI) in the regions Moldova Hills (1,048.70 thousand hl) and Muntenia and Oltenia Hills (598.4 thousand hl).

Figure 8 presents the production of noble wine obtained in the main wine-growing regions, by types of color.

In all regions white wines predominate, but the highest quantities were obtained in the Moldova Hills (1,189.1 thousand hl) and Muntenia and Oltenia Hills (384.4 thousand hl). Rose wines in larger quantities were produced in the Regions: Muntenia and Oltenia Hills (132.1 thousand hl) and Banat Hills (37.4 thousand hl). The major regions

producing red wines are: Moldova Hills (435.5 thousand hl) and Muntenia and Oltenia hills (354 thousand hl).

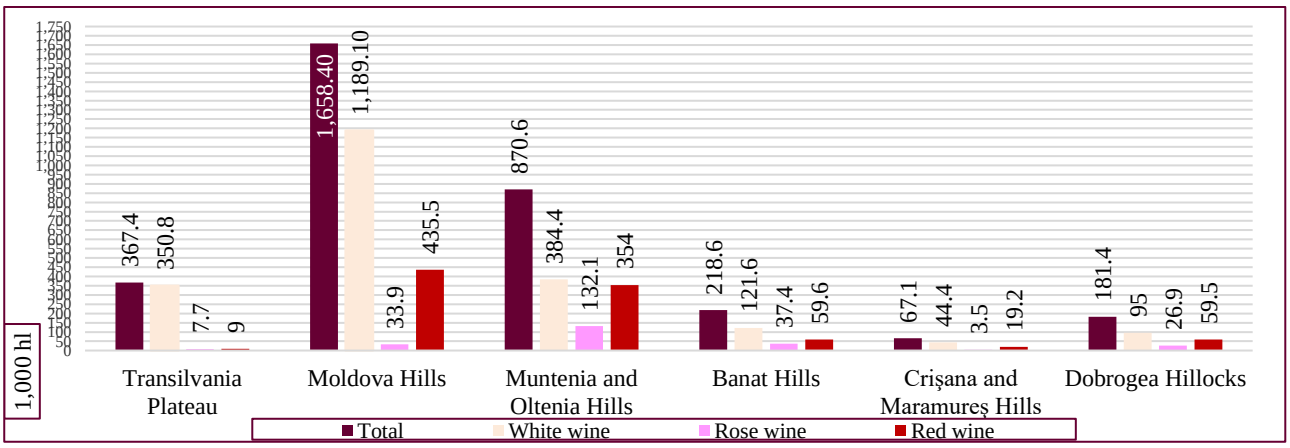

Fig. 8. Production of wine from noble varieties, by types of color and wine-growing regions, in 2018 (1,000 hl)
Source: [19], 2021, own interpretation.

In the main wine-growing regions (in terms of the quantities of wine produced) the share of wines obtained, by color, was as follows:
-Moldova Hills - white wines (71.7%), rose wines (2.0%) and red wines (26.3%);
-Muntenia and Oltenia Hills - white wines (44.2%), rose wines (15.2%) and red wines (40.6%)
-Transilvania Plateau - white wines (95.5%), rose wines (2.1%) and red wines (2.4%).
Romania has numerous wineries, distributed throughout the country, as shown in Figure 9.

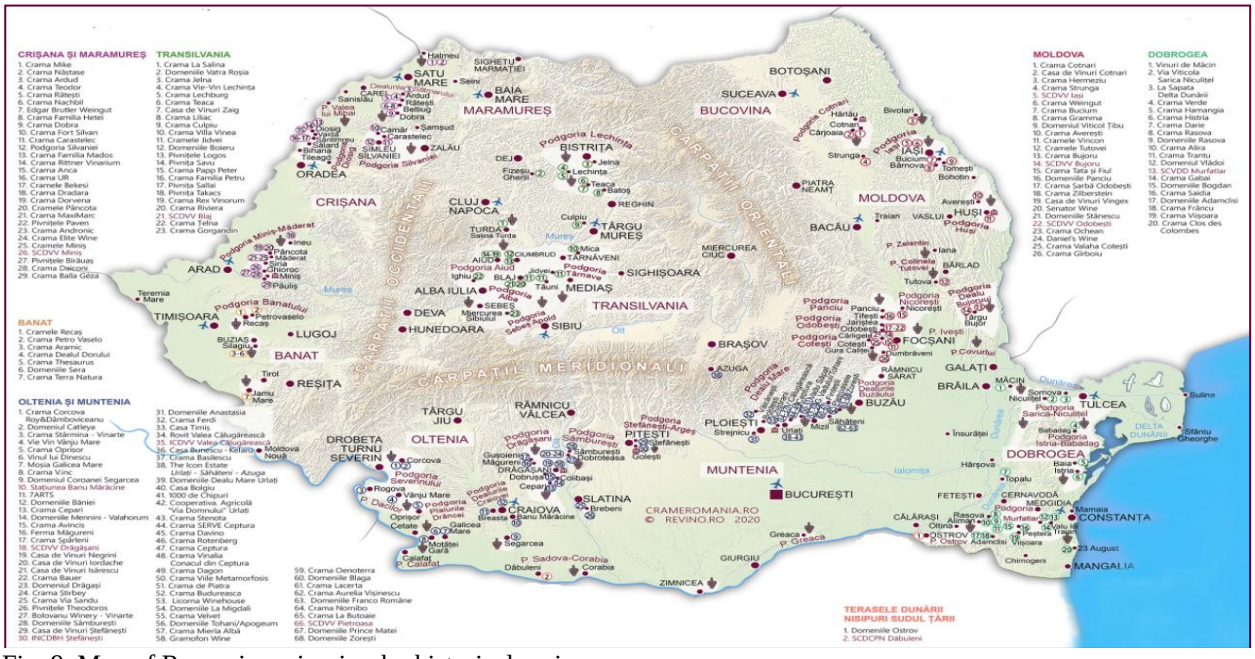

Fig. 9. Map of Romanian wineries, by historical regions
Source: [7], 2021.

From the classification made on the historical regions of the country, we notice that Oltenia and Muntenia Region, which occupies a large part of the south of the country has 69 wineries, followed by Crișana and Maramureș Region - 26 wineries, and Moldova Region - 23 wineries. The smallest number is found in the Danube Terraces and in the Sands and other convenient lands from the South of the country, where only 2 wineries are mentioned. The quality of Romanian wines is known and appreciated worldwide, which has directly and

unequivocally contributed to the awarding of numerous medals obtained in specific international competitions. It is necessary to mention some of the most famous wines and the places where they were established: Galbena de Odobești is the symbol of Odobești Vineyard; Panciu Vineyard was profiled on obtaining dry white wines, used for sparkling wines; Dealu Mare is famous especially for its red wines; Jidvei's company is the largest producer of white wines in the country; the old Cotnari Vineyard (mentioned in 1450) was identified with Grasa de Cotnari; and Murfatlar is especially appreciated for sweet and semi-sweet wines [3].

It is worth mentioning the "academic" wines obtained at the Didactic Research and Development Station for Viticulture and Pomiculture Pietroasa - Istrița, Branch of the University of Agronomic Sciences and Veterinary Medicine in Bucharest.

The activity of the development sector, which also includes the wine farm, was appreciated at important wine competitions in the country and abroad, where Busuioaca de Bohotin, Tămâioasa românească, Grasa de Cotnari, Merlot, Fetească Neagră, Cabernet Sauvignon and the dry white wine resulted from Aromatic White 2019, won gold and silver medals [23].

The ranking by counties, corresponding to the turnover achieved on the wine market for 2019 is presented in Table 1. Alba County was on the first place, with a turnover of 279.9 million. Lei (16.0%). In this county, there are 4 of the most important vineyards in Transylvania.

Table 1. Ranking of counties according to the turnover achieved on the wine market, in 2019

Specification	Turnover (lei)	% of the T.O
Alba County	279.9 mil.	16.0%
Vrancea County	260.3 mil.	14.8%
Prahova County	243.6 mil.	13.9%
Timiș County	243.0 mil.	13.9%
Bucharest	193.8 mil.	11.0%

Source: [17], 2021.

The companies placed in the Top 5 local wine producers together achieved almost 54% of the sector's profit in 2019 (Table 2). From the presented data, the leader of the ranking is represented by "Cramele Recas" with 199 million lei turnover and a market share of 11.3%. At the opposite pole of the ranking is "Zarea S.A." with a market share of 5.7% [17].

Table 2. Top 5 local wine producers in 2019

Specification	% of market share
Recaș Wineries	11.3%
Jidvei S.R.L. Alba Branch	10.9%
Cotnari S.A.	8.2%
Ceptura Vineyard S.R.L.	5.8%
Zarea S.A.	5.7%

Source: [17], 2021.

Romania's quantitative and value imports for the "Wine" category fluctuated during the period under analysis (Figure 10). In 2014, the lowest quantitative imports of wine related to Romania were registered (34.1 thousand tons) and also the lowest value of imports of 33.2 million. Euro. In 2018, the quantitative imports of wine increased, by 5.4%, compared to 2013. Value imports increased by 64.7% in 2018, compared to 2013.

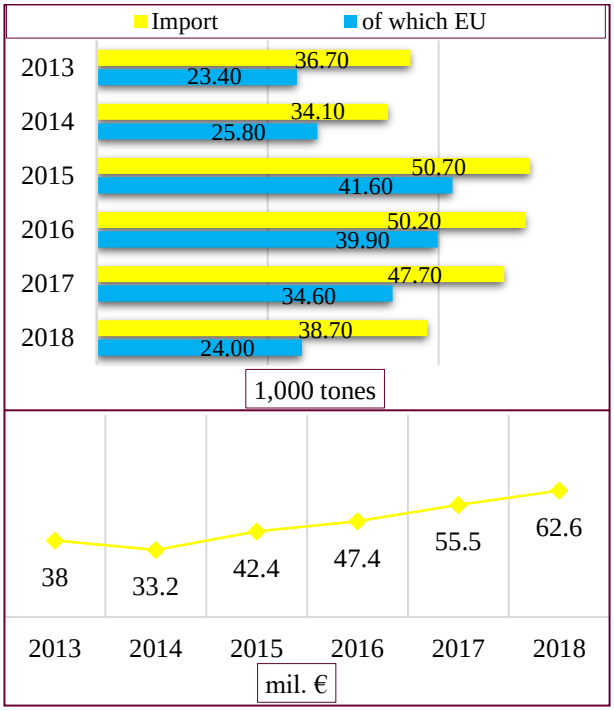

Fig. 10. Quantitative and value imports of wine for Romania in the period 2013-2018
Source: [19], 2021, own interpretation.

From the statistical data presented and analyzed it can be seen that the value imports far exceeded the quantitative imports of wine

for the same period, resulting in the fact that the prices for wine on the international market increased significantly. It is necessary to specify a significant aspect, namely that over 50% of Romania's wine imports come from European Union countries.

According to the published statistical data, Romania, in 2018, was ranked 38th in the ranking of wine importers worldwide [16].

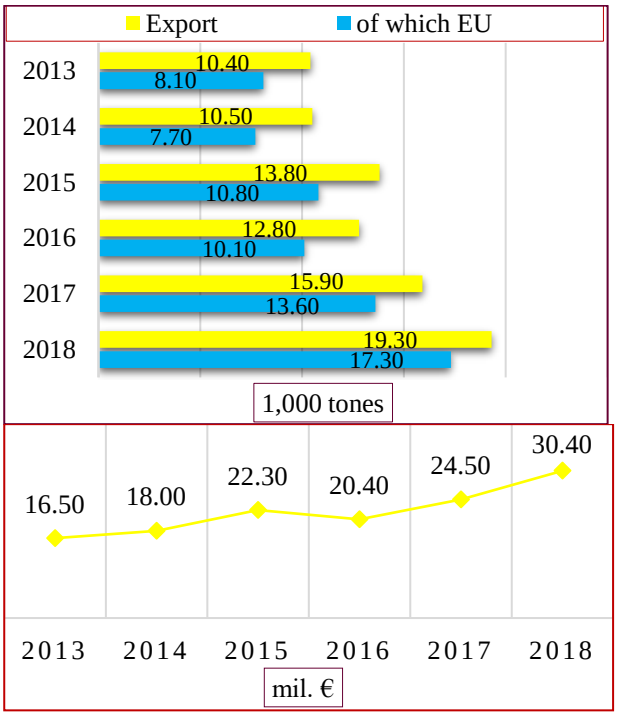

Fig. 11. Quantitative and value exports of wine from Romania in the period 2013-2018
Source: [19], 2021, own interpretation.

Romania is not a major exporter of wine [16], being ranked 33rd in the top wine exporters worldwide for 2018 (Figure 11).

Quantitative wine exports increased by 85.6% in 2018, compared to 2013, from 10.4 thousand tons to 19.3 thousand tons. It is noted that more than 50% of the exported wine was destined for EU Member States. In terms of value, exports increased in 2018 by 84.2%, compared to 2013.

In Romania, wine consumers are interested on the one hand, with local wines, and on the other hand, with imported wines. During the analyzed period, the average annual wine consumption at national level varied, reaching a minimum in 2016 (18 liters / inhabitant), and a maximum consumption of 23.8 l / inhabitant (2018). From the presented data it is observed that the average annual consumption for wine increased in Romania, by 9.7% in 2018, compared to 2013. Wine consumption is influenced by several factors, among which we mention: consumer preferences; the wine offer on the market; price level; consumer incomes, etc. Romania was ranked 13th worldwide in terms of wine consumption, with 4.5 million hl, in 2018, while the world consumption was of 246 million hl. In the European Union, Romania ranked seventh in the list of wine consumers [12]. From the data presented above, we can draw an obvious conclusion, namely, in Romania wine is appreciated and consumed by the population.

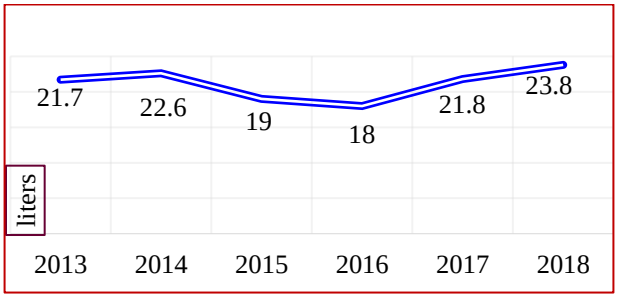

Fig.12. Average annual consumption of wine and wine products per inhabitant (l)
Source: [20], 2021, own interpretation.

It is necessary to remember that Romanian consumers prefer also other alcoholic beverages besides wine. Consumer preferences for alcoholic beverages differ depending on several factors. One criterion that underlies the consumption of beverages is the environment of residence. According to a survey conducted online by Profit.ro, in urban areas, wine ranked 2nd in the preferences of Romanians, after beer. Wine consumption was associated with holidays (58%), birthdays (35.2%), tastings (24.3%) and socializing in the city (17.7%). This survey showed that wine is considered an elegant drink, for socializing, for seduction and gastronomy [22].

After the accession to the EU, a series of transformations appeared in the Romanian wine sector, due to the National Support Program in the wine-growing sector. With a financial allocation of EUR 47.7 million per year, the Program is a support for wine producers, who can access funds for: the promotion of wines in Member States and in

third countries; restructuring and conversion of vineyards; harvest insurance; investments; by-product distillation [19].

For the development of the wine sector, Romania will have to make better use of the new type of tourism, wine tourism and to introduce in this circuit, other areas, besides the well-known Dealu Mare vineyard [2].

Also, the increase of wine sales can be done through a better promotion, a pronounced emphasis on quality and a good rapport quality-price [18].

Another opportunity for Romania would be the production of organic wines and the entry on this market, which registers an increasing trend at European and worldwide level [8].

II. On Romanian Wine Traditions and Symbolism

For Romanians, the month of September (called in folklore *Viniţel* or *Vinimeriu* from the Romanian word *vin* for the English *wine*) is the month of wine as it is the time to pick the vines and squeeze the grapes for wine; these activities go on on October, while in November the wine ferments and clears in barrels. Vitiviniculture is intertwined with the history of the Romanians and of the traditional Romanian village, the folk calendar recording relative agricultural works, traditions, customs and legends that we partially mentioned within the work *Production of wine grapes and cultural traditions related to vine in Romania* [6]:

Fig. 13. Customs and rites related to vine preserved in the Romanian folklore until today
Source: own interpretation

We forward approach this theme on two directions:

- Romanian folk aspects related to wine;
- the symbolism of wine together with the properties/sorts of liturgical wine in Christian-Orthodoxy, which is the major religious cult of the Romanians.

Romanian folk aspects related to wine:

- **The legend (probably of Dacian origin) of the power-giving wine** narrates that an emperor, dissatisfied with the negative impact of drunkenness on his subjects, ordered the destruction of the vineyards. His descendant, on the hunt, chases a bear to the hut of a hermit “old as Father Noah”, who, hearing the noise, comes out and without fear begins to pull the bear by its ears. The emperor's astonishment does not stop when the old man confesses that he cultivates vineyards, makes and consumes wine - and, as a result, the new emperor restores viti-viniculture but also introduces the measure for consumers: “drink only as much as to be strong enough to grab a bear by ears” (according to Butură apud [15], p.110).
- **The ritual drunkenness on the day of *Măcinici***. On the 9th of March, the Christian feast of the Holy 40 Martyrs of Sevastia overlapped with the beginning of the traditional agricultural year and generated the feast of the Martyrs (*Măcinicii* in Romanian) when men, each according to “own forces”, drink or taste or let themselves be sprinkled with wine from 40 (or 44) glasses, wine that symbolizes the blood of these martyrs and which, in popular belief, turns over the years into blood and labor power for the consumer [15], p.78.
- **The inn as a mundane micro-universe**. Animated all the time as a shelter and tavern for hikers of all ranks, the inn offered accommodation, had stables for animals, often even workshops for repairing carts and, last but not least, wine cellars. The Moldavian space with its rich fruit of the vineyards is memorably immortalized in the collection of stories written by an well-known Romanian author and entitled *Hanu Ancuţei* (Ancuța’s Inn), in which this famous inn is described as a fortress that hosts travelers feasted with Moldavian wine drunk from a new pot of red

clay: "Such walls like a fortress, such a lattice, such a cellar, such a wine in another place is impossible. And also unmatched are the sweetness, the good cheer, and the black eyes of Ancuța, the innkeeper lady". (Sadoveanu apud Ghinoiu, p.343)

The Christian-Orthodox symbolism of wine (wine put together with the prosphora within the cult) rejoins three major converging meanings: life, the whole creation and the union of the believers in the Church [4]. More, the essential properties of the **liturgical wine** are to be made from grapes (preferably from chemically untreated vines), to have a preferably sweet taste, to have a natural smell, not to be vinegared and / or mixed with other drinks or additives - the most suitable being therefore the red wine, pure and sweet.

Examples of liturgical wine: in Orthodox Churches such as the Greek or Russian, the use of special, clean, very sweet and strong red wines, such as Roussos and Mavrodafni, with the specification "nama", became widespread; in Bessarabia it is produced a wine with a quality similar to the Greek ones called Kagor with the specification "pastoral" is produced; you can also use the Carmel Jewish wine with the specification "for Passover" intended for the ritual meal of Easter – or similar wines (an advantage of these wines is that, being very strong, the proportion usually recognized when mixed with water 2/3 wine and 1/3 water can be reversed, 1/3 wine and 2/3 water). As liturgical wine can be also used some Romanian wines such as the local variety Busuioacă de Bohotin (although it does not have the sweetness and the strength of the above wines) or artisanal wine, made in the household, if it meets the conditions listed above [4].

CONCLUSIONS

Following the analysis of the wine production and capitalization sector at national level, the following can be deduced:

-In 2013, the largest wine production was achieved, of 5,113.3 thousand hl;

-In 2018, there was a decrease in wine production by 1.00, compared to 2013;

-Romania, in 2018, positioned itself in the top of wine producers worldwide on the 13th place;

-At national level, wines for current consumption and wines of superior quality are produced;

-High quality wines are of two categories - 1) wines with controlled denomination of origin (PDO); 2) PGI wines;

-In 2018, in the Moldova Hills Region, the highest production of noble wines was achieved (1,658.4 thousand hl), representing 49.21% of the total of this wine category;

-In 2019, Alba county ranked first in the top of counties according to the turnover achieved on the wine market, with 279.9 million Lei (representing 16.0% of the total);

-The largest quantitative imports for the "Wine" category were registered in 2015 (50.70 thousand tons);

-In 2018, the value imports for the "Wine" category increased by 64.7%, compared to 2015;

-Quantitative wine imports are higher than wine exports for the entire period under analysis;

-The largest quantitative wine exports were made in 2018 (19.30 thousand tons);

-In 2018, the most significant value exports for the "Wine" category were registered, namely, of 30.40 million euros;

-The highest average annual consumption of wine and wine products was in 2018 (23.8 l / inhabitant);

-In Romania, producers in the wine sector can benefit from financial support through the "National Support Program" in the wine-growing sector 2019 - 2023.

In order to increase the competitiveness of the wine sector in the medium and long term, it is aimed on the one hand, the increase of wine production, and on the other hand, the increase of wine exports with PDO / PGI.

Referring to wine traditions and symbolism, the Romanians kept through their history and spirituality precious folk believes, rituals, legends - somehow proving that, as wine improves with age, they can also improve themselves with (a proper quality and measure of) wine.

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AGRICULTURAL SUPPORT POLICY IN MOLDOVA: A KEY FACTOR TO AGRICULTURAL DEVELOPMENT?

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Abstract

Governmental support policy is important to achieve growth and sustainable development of important sectors for the economy. The requirements of such an involvement is based on frequent cases of market failures. Agricultural subsidizing policy is an important mechanism through which the government can support this sector. One of the main instruments of intervention in the agricultural sector are subsidies. Subsidies aim to influence or improve food/agricultural prices/costs, food supply, farm profits and incomes. The aim of this paper is to analyze the evolution of the current support/subsidizing policy, through the allocation and distribution of farm subsidies in Moldova as main economic incentives to support the development of the agricultural sector. The research is based on secondary data analysis related to the amount of allocated subsidies, number of beneficiaries and their distribution provided by the Agency of Interventions and Payments in Agriculture. Also, some specific macroeconomic data related to the agricultural sector performance from National Bureau of Statistics was used. The referred time series analysis belongs to 2010-2019. Despite the fact that agriculture is an important sector for economic development in Moldova, the financial resources allocated for its support are limited. Subsidized policy should target new aspects related to improving the access to information, introducing annual assessment of the efficiency of allocated funds to support agriculture and rural development, value chain development.

Key words**:** *agriculture, agricultural policy, farmers support, farm subsidies*

INTRODUCTION

Governmental intervention into the economy helps to stabilize markets and ensuring the efficient allocation of resources. Traditionally the agricultural sector is highly exposed to different hazards, mostly due to climate factors causing a greater risk uncertainty for farmers. Thus the state support to agricultural sector is highly discussed and often justified among economists.

Through the mechanisms used by government to manage and support the agricultural sector of the economy are agricultural subsidies. Developed countries use support policies to support farmers' incomes and increase their wellbeing, correcting inefficiencies related to market failures or even benefit consumers [14]. Subsidies represent a policy instrument used by government to influence or improve food/agricultural prices/costs, food supply, farm profits and incomes.

Governmental support policy implies a number of programs/objectives and incentives aimed not only at supporting farmers' incomes or compensating costs of production, but ensuring country's food security, employment and income support for rural population, sustainable development of rural areas. Initially, this support aims to ensure the economic development, "but as the country obtains a higher level of development, agriculture becomes a net beneficiary of an interventionist agricultural policy"[5, pp. 82].

The state support policy for farmers can contribute to improve the economic performance, particularly small farmers that have less financial possibilities. Thus is important "to allocate the scarce subsidies funds to the farms that would contribute to obtain the highest return in terms of increasing viability of farms and sustainable development of rural areas" [9].

Different opinions exist regarding the positive and negative impacts of subsidies allocations [4, 9, 12, 13]. Many believe that farms subsidies can contribute to the increase of competitiveness and farm profits, while others believe they generate distortions in the level of their costs of production [13]. In the same

time subsidies allocations can positively impact the output levels particularly regarding some activities that are risky [9]. Others believe that "subsidies can help to maintain direct resources for more productive use in response to new technologies or changing market environment" [9].

In Moldova among the main tools of government regulation in the agricultural sector are farm subsidies. Despite the fact that agricultural subsidies are the most famous tool among economic incentives for the agricultural sector, not the largest amount of funds are directed for this purpose.

The aim of this paper is to analyze the evolution of the current support/subsidizing policy, through the allocation and distribution of farm subsidies in Moldova as main economic incentives to support the development of the agricultural sector.

MATERIALS AND METHODS

The research is based on secondary data analysis related to the amount of allocated subsidies, number of beneficiaries and their distribution provided by the Agency of Interventions and Payments in Agriculture. Also, some specific macroeconomic data related to the agricultural sector performance from National Bureau of Statistics was used. The referred time series analysis belong to 2010-2019. In this paper will be discussed the legal framework of farmers support policy which includes a number of governmental decisions and policy documents.

RESULTS AND DISCUSSIONS

Agricultural sector is important for Moldova's economic sustainable development. Over the last ten years it had a contribution of about 12 percent in GDP, and 45 percent of total exports belong to agricultural and food products. Moldova's overall trade balance is negative during the whole period, mainly because of large amounts of imported electricity and gas resources. Nevertheless, Moldova is a net food exporter (Table 1).

Table 1. Main macroeconomic and agri-food sector specific data

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average value
Gross domestic product per capita, million MDL	41,615.48	46,810.83	48,951.50	54,780.10	61,754.67	67,001.29	73,553.60	80,605.15	86,562.14	-	62,403.86
Agricultural share in GDP, %	13.2	13.4	11.5	12.4	12.6	11.7	11.8	12.2	10.9	13.2	12.29
Agricultural share in total employment, %	24.24	21.20	20.28	14.05	14.12	13.96	14.10	14.24	13.63	13.04	0.16
Trade balance, million MDL	326,733.5	394,208.6	612,413.5	783,360.3	1,201,373.1	1,642,822	2,349,474	3,307,649	1,995,289.1	2,313,802	1,492,712.5
Agri-food trade balance, million MDL	140,688.80	229,318.50	135,541.40	231,749.90	346,025.40	327,912.40	337,429.28	425,665.59	393,004.31	395,242.21	296,257.78
Agri-food products share in total exports, %	47.50	41.37%	40.65	41.82	45.54	46.50	46.24	46.63	43.14	43.58	44.30

Source: own calculations based on National Bureau of Statistics data.

Both the agricultural share in GDP and in total employment had decreased over the last decades. Despite the fact that the agricultural share in GDP is relatively constant over the last ten years (on average 12 percent), its share in total labour force employment decreased almost twice. Moldova is a net food exporter, the main traded commodities being oil seeds and oleaginous fruits, cereals, edible fruit and nuts, and beverages.

Moldova's government policy for agricultural sector experienced different changes in its forms and methods of regulation. The agricultural policy in Moldova is aimed at enhancing the sustainable development of the agricultural sector and rural areas. Despite the fact that the government always supported the agricultural sector, most of these interventions were based on allocating financial support for certain programs aimed to support farmers, insurance risks, development of wine sector etc, often with the absence of a long-term strategy. Often financial support was offered for compensating the fuel price increase or subsidizing fall plowing works aimed to give immediate expected results/impact.

The legislative framework that regulates agricultural sector in Moldova is on the following normative and legislative acts [1, 6, 7, 8, 10, 11]: Law nr. 1353/2000 concerning the farm holdings; Law nr. 312/2013 concerning the agricultural producers and their associations; Law nr. 243/2004 concerning the subsidized risk insurance in agriculture; Governmental decision nr. 217/2005 to approve the Regulation for subsidizing risk insurance in agriculture; Law nr. 276/2016 concerning the subsidizing principles for developing agriculture and rural areas; Governmental decision nr 455/2017 to approve the financial resources distribution of the National Fund for Agricultural and Rural Areas Developing; Governmental decision nr. 507/2018 to approve the Regulation concerning the conditions and the procedure to offer subsidies in advance for start up projects from the National Fund for Agricultural and Rural Areas Developing; Governmental decision nr 476/2019 to approve the Regulation concerning the subsidies allocations for improving the living and working conditions in rural areas from the National Fund for Agricultural and Rural Areas Developing. Financial resources aimed to support the agricultural sector are allocated based on the yearly approved governmental budget law.

The financial support for farmers was allocated from governmental budget through different programs and actions, including from external sources. Traditionally, the financial support was mostly administrated by the Ministry of Agriculture and Food Industry, (now Ministry of Agriculture, Regional Development and Environment), about 60-70 percent of all funds. Other participating institutions in managing the resources allocated in the subsidizing fund were: Ministry of Finance; Governmental agency "Apele Moldovei", State enterprise "Moldresurse". The financed directions to support farmers were variable not allowing a long-term planning activity for agricultural producers [2, 3].

A unification of all former support programs was attempted in 2010 by consolidating all resources into farmers subsidizing fund and the establishment of only one managing institution only – the Agency of Interventions and Payments in Agriculture (AIPA) (established through GD nr. 60/2010). In the same time, the conception of farmers subsidizing fund was adopted (GD nr. 1305 /2008) aiming at: increasing the agricultural productivity and competitiveness; stimulating technological transfer and extensions services; increasing farmers' incomes and reducing poverty; efficient use of natural resources and protecting the environment.

The dynamics of allocated financial support to farmers shows an almost constant evolution until 2015 (Table 2). During the following five years the amount of the allocated subsidies increased considerably. During the last ten years the amount of allocated subsidies constituted on average 606 million MDL. The amount of farmers that received a subsidy fluctuates considerable, the more beneficiaries being registered in 2018 (6538), while the lowest number was in 2010 (93). The amount of subsidy in calculation to a farmer was the highest in 2010-2011, then decreased due to an increased demand from farmers. Over the last five years it was basically unchanged, registering the maximum amount in 2019 (295 thousands MDL). The amount of allocated subsidies remains extremely low considering its share in total government expenses (around 5 percent). Its share in the gross agricultural output (GAO) was 2.15 percent over the last ten years (Table 2).

Table 2. Dynamics of allocated subsidies

Main target	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Total subsidies allocated, million MDL	300.0	400.0	400.0	400.0	500.0	610.0	700.0	900.0	900.0	950.0	606.0
Number of subsidy recipients	93	1,010	4,364	3,877	2,865	3,539	4,028	5,211	6,538	3,231	3,475.6
Amount of subsidy per recipient, thousands MDL	3,225.8	396.03	91.65	103.17	174.5	172.36	173.7	172.7	141.5	294.02	494.54
Agricultural expenses in governmental budget, million MDL	982.7	829	1,253.8	1,359.7	2,009	2,173.4	1,350	2,073	2,135.1	2,051.82	1,621.75
Share of agriculture in total expenses, %	4.1	4.5	5.8	5.7	6.8	7.2	4.5	3.5	3.5	4.7	5.04
Share of allocated agricultural subsidies in GDP, %	0.5	0.4	0.37	0.38	0.42	0.41	0.43	0.5	0.5	-	0.43
Share of subsidies in GAO, %	1.51	1.77	2.01	1.68	1.83	2.24	2.31	2.64	2.76	2.75	2.15

Source: own calculations based on data from National Bureau of Statistics, AIPA, Ministry of Finance.

Taking into account that the main objective of the existing policy is enhancing competitiveness in agriculture the share of subsidizing funds in GDP is less than one percent (0.43 percent on average). Moreover, one third of these expenses are directed to research, extension, education and food safety services [4].

During 2010-2015 the main subsidized directions by government were the following: loans and risk insurance; establishing multiannual plantations; producing vegetables on protected ground; purchasing agricultural equipment and machinery; developing ecological agriculture; livestock farms renovation; purchasing of breeding animals; developing post-harvest and processing infrastructure; compensating irrigation costs; subsidizing the use of phytosanitary products and fertilizers.

The aim and objectives of allocated farmers support during 2015-2020 were based on the National Strategy for agricultural and rural development for 2014-2020 and adjusted according to the European experience within ENPARD project. According to this the allocated subsidies were directed towards three main priorities: increasing competitiveness of the agri-food sector through restructuration and modernization; insuring sustainable administration of natural resources; and increasing investments in infrastructure and services from rural areas [7, 8, 10].

Despite the fact that the three priorities were established for 2015-2020, some of previous subsidized measures can be included into first or second target. Subsidies include recurrent and capital expenditures and are characterized by a high concentration rate.

The largest amount of the allocated subsidies to farmers is included into the first support policy priority “increasing competitiveness of the agri-food sector through restructuration and modernization”. The subsidies allocated within this target increased and constituted on average over 500 million MDL or about 90 percent (Figure 1). The policy priority “Increasing competitiveness of agri-food sector through restructuration and market modernization” includes two main subsidized measures: Investments in agricultural explorations to restructure and adapt to European Union standards; and investments in the processing and marketing of agricultural products (Table 3).

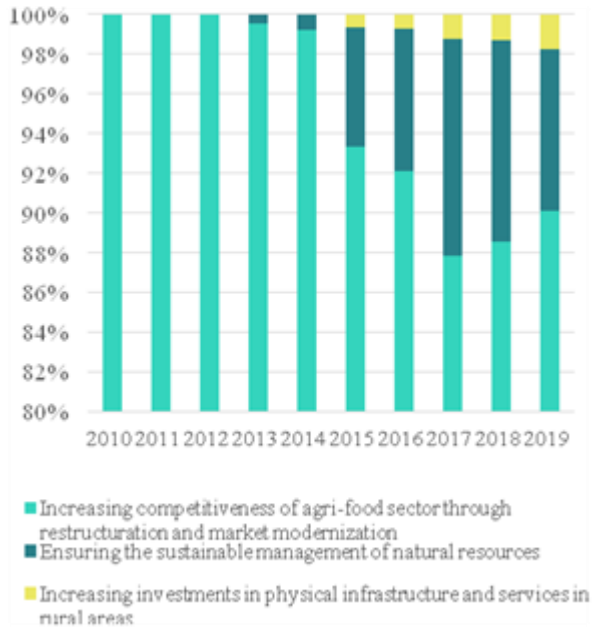

Fig. 1. Allocated subsidies by main objectives
Source: based on data from the Agency of Interventions and Payments in Agriculture.

The largest part of the allocated funds during 2010-2019 (on average) were directed to the purchasing of agricultural equipment and machinery - 125,7 million MDL (21 percent), investments for establishing, modernization and clearing of multiannual plantations (98,5 million MDL), investments in the development of the processing and post harvesting infrastructure (108,5 million MDL), crediting agricultural producers (36,4 million MDL).

Subsidies allocated within measure 3 "Preparation for implementation of actions related to the environment and rural area" correspond to the second priority and benefited from 32 million MDL during this period, while measure 4 "Supporting investments in infrastructure for agricultural enterprises" and 5 "Consultancy and training services" are found within the last policy priority with the smallest share.

Table 3. Subsidies allocated by measures, million MDL

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Total subsidies	300.0	400.0	400.0	400.0	500.0	610.0	700.0	900.0	900.0	950.0	606.0
Measure 1. Investments in agricultural explorations to restructure and adapt to European Union standards	144.47	193.72	356.59	381.82	413.07	318.65	405.22	460.50	566.85	321.37	356.2
Measure 2. Investments in the processing and marketing of agricultural products	15.6	28.52	43.01	69.82	141.27	155.05	154.17	267.47	387.95	252.04	151.5
Measure 3. Preparation for implementation of actions related to the environment and rural area	0	0	0	2.16	4.41	30.52	43.78	90.81	109.39	45.75	32.7
Measure 4. Supporting investments in infrastructure for agricultural enterprises	0	0	0	0	0	3.4	4.16	8.88	13.09	10.11	4.0
Measure 5. Consultancy and training services	0	0	0	0	0	0	0	1.12	1.00	0	0.2

Source: based on data from the Agency of Interventions and Payments in Agriculture.

The most of farmers received a subsidy under first measure "Investments in agricultural explorations to restructure and adapt to European Union standards" in average 3,157 recipients over last ten years. However the greatest number of farmers (5,841 or 89 percent) received a subsidy under this measure in 2018 (Figure 2). The greatest amount under this measure belong to investments for establishing multiannual plantations, purchasing technique and equipment, the use and technological renovation of livestock farms (43 percent from total subsidies in 2019). Moreover, the subsidies are targeted to support sectors that are already self sufficient and enough competitive with high export shares.

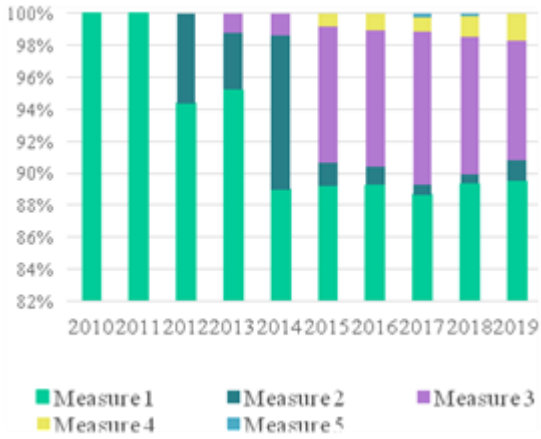

Fig. 2. Number of subsidies beneficiaries by main supported measures
Source: based on data from the Agency of Interventions and Payments in Agriculture.

According to the Law nr. 179/2016 farmers are classified into small, average and large agricultural producers. From all subsidies recipients over half are small producers, while average size and large farms have a share of 25 and 7 percent (based on 2017-2019 data). In 2019 the greatest amount of demanded subsidies came from average size (42 percent) and small size (33 percent) producers. Small farmers have a share on 70 percent in total agricultural output, but receive only 30 percent of subsidies. From total amount of subsidy small farmers requests only 44 percent are approved, while over 60 percent of distributed subsidies were allocated to farms with an area over 100 hectares. Some subsidies directed to purchase of machinery and equipment favorize mostly large producers. Moreover, such subsidized direction as capital expenditures does not support the development of innovative technologies in the agricultural sector as they are mostly directed to the acquisition of tractors (27 percent). Another important direction under first measure to which is allocated about 20 percent of all subsidies are investment in establishing orchards and vineyards. Yet it was mostly supporting larger entities, as only one third of beneficiaries were small farmers. Also this direction should be revised to stimulate innovative practices and disperse the traditional varieties and plantation designs.

The second measure "Investments in the processing and marketing of agricultural products" is the largest according to the amount of allocated subsidies but also according to the number of farmers that received a support (Table 3, Figure 2). Under this measure the greatest part of funds were directed to support post harvesting and processing infrastructure (about 25 percent of all subsidies) and appears to be a positive development for sector modernization and improved market access. This is particular important for fruits and vegetables supply chain development. Despite the fact that from this support benefitted only around 20 percent of small farmers, it is essential for the development and modernization of smaller entities, allowing them to store their production or sell it to the storages and/or packing houses.

Land fragmentation is an important impediment in developing a scale economy in Moldova. It is included in the third support measure "Preparation for implementation of actions related to the environment and rural area" that includes subsidies for consolidation of agricultural land. Unfortunately, little support was allocated for this purpose. The largest share into this measure is maintained by acquisition of irrigation equipment.

The agricultural support policy should be oriented more on targeting innovation, larger market integration and farmer inclusion. Some of the subsidized directions absorb a large

amount of subsidies and benefit mostly large entities. Their aim could be narrowed and instead to promote more modern and innovative programs, targeting small scale farmers. The subsidized farmers crediting program is rather inefficient aimed at subsidizing agricultural inputs and not enhancing competitiveness. This program target to support more small farmers to be sustainable in the long term.

A constant problem of the subsidizing policy is that yearly a large share of the allocated budget funds are directed to repay the subsidies to farmers from previous years that failed to be paid due to limited funds. Thus, previously approved requests are maintained on a holding list and given priority when funds become available in the next year. Nevertheless, this diminishes even more the already limited funds to support farmers.

CONCLUSIONS

The agricultural policy in Moldova is aimed at enhancing the sustainable development of the agricultural sector and rural areas. Despite the fact that the government always supported the agricultural sector, most of these interventions were based on allocating financial support for certain programs aimed to support farmers, insurance risks, development of wine sector etc, often with the absence of a long term strategy. According to the agricultural support policy the allocated funds were directed towards three main priorities: increasing competitiveness of the agri-food sector through restructuration and modernization; insuring sustainable administration of natural resources; and increasing investments in infrastructure and services from rural areas.

Taking into account that the main objective of the existing policy is enhancing competitiveness in agriculture the share of subsidizing funds in GDP is less than one percent (0.43 percent on average). Moreover, the subsidies are targeted to support sectors that are already self sufficient and enough competitive with high export shares.

Small farmers have a share on 70 percent in total agricultural output, but receive only 30 percent of subsidies. From total amount of subsidy small farmers requests only 44 percent are approved, while over 60 percent of distributed subsidies were allocated to farms with an area over 100 hectares. Some subsidies directed to purchase of machinery and equipment favorize mostly large producers. Moreover, such subsidized direction as capital expenditures does not support the development of innovative technologies in the agricultural sector

An important support program are subsidies for post harvesting and processing infrastructure (about 25 percent of all subsidies) that might have a positive impact for sector modernization and improved market access, mainly for fruits and vegetables supply chain development.

The agricultural support policy should be oriented more on targeting innovation, larger market integration and farmer inclusion. Some of the subsidized directions absorb a large amount of subsidies and benefit mostly large entities. Their aim could be narrowed and instead to promote more modern and innovative programs, targeting small scale farmers.

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RESEARCH ON THE EVOLUTION OF FRUIT FARMS IN ROMANIA, IN THE PERIOD 2005-2016

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Abstract

The trade balance in the fruit sector of Romania shows significant deficits, which are accentuated from one year to another. In order to identify the causes leading to these issues, the main source of the problem, namely fruit farms, was analyzed. The aim of the paper is to identify the causes, based on which, the best solution for this problem is the association of fruit growers. In this paper, the fruit farms were analyzed in the period 2005-2016 (being the most recent data available), depending on the legal form, physical size and economic size, using quantitative and qualitative methods of data processing.

Key words**:** *fruit growing, fruit sector, holdings, association*

INTRODUCTION

Agricultural activity, whether it is the cultivation of plants, the establishment and maintenance of fruit and vineyards, or the raising of animals, all have an important influence on the way rural areas are, as well as development prospects. The way agriculture is practiced in rural areas, the attention for the community are elements that can ensure continuity in this space that abounds in traditions and customs and where the identity of a country is best represented [3, 8, 9].

Fruit plantations hold an important place in the total crops cultivate in Romania, on the one hand because both the climate and the soil allow the cultivation of fruit trees on large areas, but also because, from north to south and from east to west, different species of fruit trees can be grown, which could cover the consumption needs of the population [7].

Consumption of fresh fruit has increased significantly in recent times, on the one hand due to the fact that there have been numerous information campaigns on the beneficial effects of eating fresh fruit, and on the other hand consumers around the world have become much more concerned to what they eat and to ensure the necessary intake of vitamins [11, 12].

The easy access of consumers to farm products is extremely important, especially in these times when everything happens very quickly, and consumers are looking for healthy food sources, obtained locally, but to which they have immediate access.

After 1990 and until now, the Romanian fruit sector has been marked by a continuous decline that has impacted, on the one hand, the extent to which rural areas have evolved, but has also had negative consequences on the way of life of communities in these predominantly fruit regions [1, 2].

Given the decline of fruit farms, for the 2014-2020 programming period, through PNDR, the fruit sector had dedicated financial support measures to solve the problems related to both production and storage and sales. The fruit sub-program within National Programeme of Rural Development (NPRD) 2014-2020 created the necessary premises to increase the competitiveness of fruit farms by investing in machinery and equipment, in new fruit plantations and fruit plantations for planting material, the development of research in this field, but also investments in marketing and processing.

Association in agriculture, regardless of the sector, is extremely important, even if the

sector is dominated by large farms or small and medium-sized farms.

The structural challenges related to the small and very small size of fruit farms, but also the influence of climate change and insufficient adaptation of supply to consumer requirements, indicate that association and cooperation in this sector are extremely important to balance the procurement process, necessary for the proper conduct of business on the farm [4].

The organization of small fruit farms in well-organized cooperative structures can help fruit growers to match and improve the production obtained on the farm, in accordance with consumer preferences. Associative forms also play an important role in the process of storage, conditioning and marketing of production [5].

MATERIALS AND METHODS

The data used to conduct the research are part of the Eurostat databases, accessed on 16.04.2021. For this purpose, quantitative and qualitative data processing methods were used, as well as the following coefficients [10]:

(i)The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a series of data around the mean. The coefficient of variation is the ratio between standard deviation and average and is a useful statistic for comparing the degree of variation from one set of data to another, even if the means are drastically different from each other [10].

(ii)A standard deviation is a statistic that measures the dispersion of a data set relative to its average. The standard deviation is calculated as the square root of the variance by determining the deviation of each data point from the mean. If the data points are further than average, there is a larger deviation within the data set. Thus, the more widespread the data, the higher the standard deviation [10].

(iii)Growth is the value of an investment, an asset, a portfolio, a phenomenon or a business that grows over a period of time. The growth rate provides important information about the value of an asset or investment, contributes to understanding how the investment, the phenomenon studied increases, changes and behaves over time. This information is helpful to understand the trend and how the studied phenomenon will evolve [10].

RESULTS AND DISCUSSIONS

The highest rate in terms of the number of fruit farms without legal personality is recorded in the Western region, where in 2016 there were 4,630 farms without legal personality, 3 times more than in 2005 (Table 1).

For the analyzed period, the average of fruit farms without legal personality of 2,770 was determined, a positive rhythm of 32.1% and a coefficient of variation of 44.39%, which indicates a heterogeneous degree of the analyzed data (Table 1).

Table 1. Analysis of the number of fruit farms without legal personality, depending on the development region, in the period 2005-2016

Specifiction	2005	2007	2010	2013	2016	2016/ 2005	Average	Rythm (%)	C.V. (%)
Total	39,370	37,060	62,420	62,680	66,920	70.0	53,690.0	14.2	26.56
North West	7,850	9,460	14,250	13,030	16,510	110.3	12,220.0	20.4	28.90
Center	2,160	1,670	2,160	2,190	2,520	16.7	2,140.0	3.9	14.19
North East	1,500	2,410	3,800	3,050	3,570	138.0	2,866.0	24.2	32.52
South East	1340	1,600	3,270	2,800	2,500	86.6	2,302.0	16.9	35.31
South-Muntenia	17,630	15,250	26,810	28,840	27,970	58.7	23,300.0	12.2	27.29
Bucharest - Ilfov	1,310	360	320	360	260	-80.2	522.0	-33.3	84.75
South West Oltenia	6,060	4,450	9,140	9,230	8,970	48.0	7,570.0	10.3	28.94
West	1,520	1,850	2,670	3,180	4,630	204.6	2,770.0	32.1	44.39

Source: Eurostat data processing, Accessed on 16.04.2021 [6].

Another region where the number of fruit farms without legal personality registered an important evolution in 2016, compared to 2005 is the North-East region, where there were 3,570 fruit farms without legal personality, 2 times more than in 2005. For this region an average of 2,866 fruit farms without legal personality, a positive rate of 24.2% and a coefficient of variation of 32.52% was determined, which indicates a heterogeneous degree of the analyzed data (Table 1).

For the Center development region, the growth rate of the number of fruit farms without legal personality is less pronounced. Thus, if in 2005 there were 2,160 holdings without legal personality, in 2016 these holdings registered an evolution of only 16.7%.

Regarding the average of the analyzed period, for the Center development region resulted an average of 2,140, with a positive rate of 3.9% and a coefficient of variation of 14.19%, which indicates a relatively homogeneous degree of the analyzed data (Table 1).

The number of fruit farms registered significant oscillations during the analyzed period, depending on their physical size. At the level of 2016, in Romania, there were a total of 67,750 fruit farms, increasing by 70.4% compared to 2005, when there were a total of 39,770 fruit farms. During the analyzed period, an average value of fruit farms of 54,396 was determined, with a positive rate of 14.2% and a coefficient of variation of 26.75%, which indicates a relatively heterogeneous degree of the analyzed data (Table 2).

Table 2. Analysis of the number of fruit farms classified by physical size in the period 2005-2016

Specifiction	2005	2007	2010	2013	2016	2016/ 2005	Average	Rythm (%)	C.V. (%)
Total	39,770	37,420	63,500	63,540	67,750	70.4	54,396.0	14.2	26.75
0 ha	0	0	0	0	0	-	0.0	-	-
< 2 ha	29,720	22,860	49,220	48,650	52,370	76.2	40,564.0	15.2	32.86
2 - 4.9 ha	6,900	9,600	10,330	10,660	11,710	69.7	9,840.0	14.1	18.40
5 - 9.9 ha	2,080	2,850	2,720	3,060	2,800	34.6	2,702.0	7.7	13.68
10-19.9 ha	640	1,600	720	830	530	-17.2	864.0	-4.6	49.29
20-29.9 ha	150	160	140	100	120	-20.0	134.0	-5.4	17.97
30 - 49.9 ha	100	190	150	80	90	-10.0	122.0	-2.6	38.18
50 - 99.9 ha	80	80	80	70	60	-25.0	74.0	-6.9	12.09
> 100 ha	100	90	150	90	70	-30.0	100.0	-8.5	30.00

Source: Eurostat data processing, Accessed 16.04.2021 [6].

Regarding the physical size of fruit farms, the most numerous were farms with a physical size of less than 2 hectares. In 2016, 52,370 such fruit farms were registered, 76.2% more than in 2005 (29,720 fruit farms). For the analyzed interval was determined an average value of fruit farms less than 2 hectares of 40,564 fruit farms, a positive rate of 15.2% and a coefficient of variation of 32.86%, which indicates a heterogeneous degree of data analyzed (Table 2).

At the level of 2016, in Romania there were 11,710 fruit farms that had a physical size between 2 hectares and 4.9 hectares, 69.7% more than the values recorded in 2005 (6,900 fruit farms). During the analyzed period, an average value of fruit farms with a physical size between 2 hectares and 4.9 hectares of 9,840 was determined, with a positive rate of 14.1% and a coefficient of variation of 18.40%, which indicating a relatively homogeneous degree of the analyzed data (Table 2.).

The number of fruit farms with the largest decrease is those with a physical size of more than 100 hectares. If in 2010 there were 150 fruit farms with an area of more than 100 hectares, in 2016 their number decreased by almost half, reaching 70. For the analyzed interval was determined an average value of fruit farms larger than 100 hectares of 100 fruit farms, a negative rate of 8.5% and a coefficient of variation of 30%, which indicates a heterogeneous degree of the analyzed data (Table 2).

As fruit holdings with an economic size of less than 2,000 SO show by far the highest share of total fruit holdings, the table below presents and analyzes the situation of these holdings, being relevant for the study in question.

At the level of Romania, in 2016, there were no fruit farms that did not register any income from the activity carried out (economic size of 0 euros) (Table 3).

At national level, in 2016, there were 42,560 fruit farms with an economic size of less than 2,000 euros. Most farms are found in the South-Muntenia development region (18,870 fruit farms with an economic size of less than 2,000 euros). In 2016, compared to 2005, the number of fruit farms in the South-Muntenia region with an economic size of less than 2,000 euros, increased by 39.8%, registering an average of the analyzed period of 16,616 farms, with a positive rate of 8.7% and a coefficient of variation of 30.08%, which indicates a heterogeneous degree of the analyzed data (Table 3).

Table 3. Analysis of the number of fruit farms with an economic size of less than 2,000 euros, depending on the development region, in the period 2005-2016

Specifiction	2005	2007	2010	2013	2016	2016/ 2005	Average	Rythm (%)	C.V. (%)
Total	29,490	21,960	48,960	42,110	42,560	44.3	37,016.0	9.6	29.68
North West	5,460	5,550	11,280	8,580	9,330	70.9	8,040.0	14.3	31.29
Center	1,670	1,130	1,730	1,740	1,850	10.8	1,624.0	2.6	17.47
North East	1,160	1,320	3,120	2,140	2,440	110.3	2,036.0	20.4	39.82
South East	880	550	2,470	1,910	1,720	95.5	1,506.0	18.2	51.90
South-Muntenia	13,500	9,420	21,310	19,980	18,870	39.8	16,616.0	8.7	30.08
Bucharest - Ilfov	1,300	280	320	350	250	-80.8	500.0	-33.8	89.77
South West Oltenia	4,720	3,010	7,200	6,130	5,380	14.0	5,288.0	3.3	29.73
West	800	700	1,540	1,280	2,720	240.0	1,408.0	35.8	57.55

Source: Eurostat data processing, accessed 16.04.2021 [6].

A significant percentage of the total fruit farms with an economic size of less than 2,000 euros are also found in the North-West development region (9,330 farms in 2016). Compared to 2005, the number of these holdings increased by 70.9%, determining an average value for the analyzed period of 8,040 holdings, a positive rate of 14.3% and a coefficient of variation of 29.60%, which indicates a relatively heterogeneous degree of the analyzed data (Table 3).

In the Western development region, the number of fruit farms with an economic size of less than 2,000 euros registered a significant evolution in 2016, compared to the data recorded in 2005. Thus, in 2016 there were 2,720 such fruit farms, with 240 % more than in 2005. For the analyzed period, an average of 1,408 holdings was determined, with a positive rate of 35.8% and a coefficient of variation of 57.55%, which indicates a heterogeneous degree of the analyzed data (Table 3).

A small percentage of the total fruit farms with an economic size of less than 2,000 euros are found in the South-East development region (1,720 farms in 2016). Compared to 2005, the number of these holdings increased by 95.5%, determining an average value for the analyzed period of 1,506 holdings, a positive rate of 18.2% and a coefficient of variation of 51.90%, which indicates a heterogeneous degree of the analyzed data (Table 3).

CONCLUSIONS

The number of fruit farms registered significant oscillations during the analyzed period, depending on their physical size. At the level of 2016, in Romania, there were a total of 67,750 fruit farms, increasing by 70.4% compared to 2005, when there were a total of 39,770 fruit farms.

Analyzing the number of fruit farms classified by physical size, in the period 2005-2016, it can be seen that in 2016 the fruit farms that had a physical size of less than 2 hectares and up to 9.9 hectares are the most representative, covering 98.71% of the total fruit farms in

Romania. Only 1.30% of all fruit farms have an economic size of more than 10 hectares.

With regard to fruit farms where self-consumption exceeds 50% of the production obtained, it can be concluded that most fruit farms with a physical size of less than 2 hectares and up to 20 hectares use the production obtained, in the largest share for own consumption. On the other hand, fruit farms larger than 30 hectares use commercially obtained production and the share in self-consumption is less than 50% of the recorded production volume.

Regarding the number of fruit farms classified according to the development region, in the period 2005-2016 it can be seen that most fruit farms are found in the development regions South-Muntenia (28,130 fruit farms in 2016), North-West (16,670 fruit farms in 2016) and Southwest Oltenia (9,060 fruit farms in 2016). A small number of fruit farms are found in the development regions of Bucharest-Ilfov (260 fruit farms in 2016), South-East (2,570 fruit farms in 2016) and Center region (2,630 fruit farms in 2016).

Regarding the economic size of fruit farms, at national level in 2016, 62.82% of the total fruit farms had an economic size of less than 2,000 euros, 19.42% of the total fruit farms were represented by those farms that had an economic size between 2,000 euros and 3,999 euros, 12.15% were fruit farms with an economic size between 4,000 euros and 7,999 euros and only 3.99% were fruit farms with an economic size between 8,000 euros and 14,999 euros. Less than 1% of fruit farms have an economic size of more than 15,000 euros.

The only solution for the recovery of this sector is the association of fruit growers. Regarding the distribution at county level, of the groups of agricultural producers active in the vegetable-fruit sector, most of the producer groups were registered in the counties of Dambovita (area known for the possibilities of cultivating fruit trees) and Galați (recognized area for the vegetable basins encountered at county level) with 9 and 8 groups of agricultural producers, respectively.

Also, measure 9.1 a. (Which finances the association of farmers in the fruit sector) was not attractive for agricultural producers in the fruit sector, as the number of applicants in the two project submission sessions was quite low. Furthermore, farmers are difficult to persuade to join in groups of producers or cooperatives, so new ways of convincing Romanian farmers to join must be identified.

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RESEARCH ON THE ASSOCIATION OF FRUIT GROWERS IN ROMANIA

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Abstract

Taking into account the fact that the trade balance with fruits, in the case of Romania, presents an accentuated deficit, which worsens from one year to another. The main solution for this sector is the association of fruit growers, but their association is poorly developed. The main purpose of this study is to identify the reasons behind the fact that fruit growers are poorly organized and there is a small percentage of those who are part of an associative form, in order to identify solutions. The questionnaire method was used in this paper, in which 388 fruit growers responded. Also, the statistical interpretation was performed by analyzing the Pearson and Cramer indicators, but also the non-parametric Chi-square test.

Key words**:** *association, fruit growing, fruit sector, fruit*

INTRODUCTION

The variety of links that are established between the agricultural sector and other sectors of the national economy, but also within agriculture (between economic agents and the units of storage, processing and sales of products) determine the relations of association and cooperation [1, 2, 4, 5].

According to Law no. 164/2016, the agricultural cooperative represents an autonomous association of natural and / or legal persons, as the case may be, legal person of private law, established on the basis of the free consent expressed by the parties, in order to promote the interests of cooperating members (according to cooperative principles); of the implementation of agricultural policies to stimulate the association of producers in the field, which is organized and operates according to the provisions of the law [15].

The agricultural cooperative is established and operates with at least five people and carries out an economic, technical and social activity intended for the provision of goods, services and jobs, exclusively or mainly for its members, being composed of two types of agricultural cooperation: grade I (formats from individuals) and grade II (from individuals and legal entities) [3, 6, 7, 11, 12].

Among the main advantages of agricultural cooperatives are: the democratic character, the need for a small capital for their establishment, as well as fiscal facilities, such as taxes, subsidies, but especially facilities in terms of accessing European funds (higher score on selection criteria, in the vast majority of funding sub-measures through the NRDP).

According to Law No 36/1991, producer groups are for-profit legal entities and their own economic management and farmers' associations that jointly sell the products obtained. Production costs can be optimized through producer groups, prices can be set and cultivation practices can be promoted [14].

Producer groups have a number of advantages, ranging from reducing production costs, the possibility of applying modern technologies, to plan and modify production, accessing European funds, to facilitating communication between farmers, increasing bargaining power or better promotion of production on the domestic and foreign market [8, 9, 10, 13].

MATERIALS AND METHODS

In order to determine the current situation of the fruit sector, as well as the reasons behind the fact that fruit growers are poorly organized and there is a small percentage of those who are part of an associative form, a questionnaire consisting of 18 questions was applied. The questionnaire was distributed between March 15 and April 15, 2021, being applied to fruit growers in Romania. The data resulting from the application of the questionnaire were collected in electronic format, and the completion of the questionnaire was not assisted. The questions asked were closed and allowed the respondents to choose a single answer. The response rate was 100%. All data were obtained and processed with the consent of the respondents.

The applied questionnaire allowed the centralization of 388 respondents, and at a probability of 95%, with a margin of error of +/- 5%, the size of the representative sample was determined at a number of 384 respondents.

Data processing in terms of descriptive statistics was done using the Chi-Square, Pearson`R, Cramer V coefficients and the critical value (to highlight the associations between the variables), using the SPSS statistics program (SPSS Statistics 20 (IBM Software Group)), Chicago, IL).

Questionnaire questions:

Q1 - What is your age?
Q2 - What studies do you have?
Q3 - What legal personality do you have?
Q4 - What is the area of the fruit farm you own?
Q5 - What is the system used in your farm?
Q6 - Which fruit species are mainly cultivated?
Q7 - Where do you get most of the input needed to carry out the production activity?
Q8 - How do you capitalize on the production obtained on the farm?
Q9 - Are you considering joining an associative form?
Q10 - What is the main reason why you are not part of an associative form?
Q11 - Do you know the advantages of the association?
Q12 - Do you know the current legislation on the association of agricultural producers?
Q13 - How would you appreciate the following advantages of the association?
Q14 - How do you think decisions should be made at the level of an associative form?
Q15 - In a form of association, do you consider that there should be a policy on expenditure control?
Q16 - In a form of association do you consider that there should be a policy regarding sales prices?
Q17 - Do you think that associating agricultural producers would reduce intermediaries?
Q18 - How should the profit be distributed within the associative form?

Working hypotheses:

I1 - most fruit farms are without legal personality.
I2 - orchards are characterized by their small size.
I3 - most fruit farms use an extensive planting system.
I4 - The most cultivated fruit species in Romania are represented by plum and apple.
I5 - most agricultural producers market their production through intermediaries.
I6 - There is still a reluctance on the part of producers to be part of an associative form.
I7 - Fruit growers do not know the benefits of the association.

RESULTS AND DISCUSSIONS

Regarding the age of the respondents, the most representative are those who are between 40 and 65 years old, representing 52.32% of the total number of respondents to the questionnaire. In a significant percentage, those over 65 years old represent 33.25% of the total respondents, while only 14.43% of respondents are between 18 and 40 years old (Question 1).

Regarding the level of studies of the respondents, it can be observed that most of the respondents have only completed secondary education (47.68%), while 38.92% of the respondents have completed high

school and only 13.40% have completed university studies (Question 2).

Regarding the form of organization of fruit farms, 87.11% of respondents own farms without legal personality, while 8.76% are organized in authorized individuals, sole proprietorships or family businesses. Only 4.12% of respondents have fruit farms organized as limited liability companies or joint stock companies (Question 3).

Regarding the managed area, the most representative are the fruit growers who work an area of less than 2 hectares (77.58%), followed by those producers who have an agricultural area between 2 hectares and 5 hectares (13.66%). Only 5.67% of respondents work an agricultural area between 5 hectares and 20 hectares. Agricultural producers working more than 20 hectares represent 3.09% of the total number of respondents to the questionnaire. The data obtained from the centralization of the answers provided by the 389 farmers regarding the cultivated area show that most of them work an area of less than 5 hectares, while the respondents who exploit an area of less than 5 hectares total 8.76% of the total. The data obtained reflect the reality faced by Romanian fruit growing, where small and very small fruit farms predominate, and they are insufficiently adapted to the market (Question 4).

Regarding the cultivation system used in the fruit farms of those who answered the questionnaire, it is noted that 80.93% of respondents use the extensive, traditional cultivation system, with a distance between the trees and with classic maintenance works of trees. Only 12.89% of respondents have intensive orchards, while only 6.19% of respondents have super intensive orchards (Question 5).

Regarding the structure of the respondents according to the predominant fruit species in the plantation they work, it can be noticed that out of the total of those who answered the questionnaire, 46.65% have plum plantations, 28.87% have apple plantations, 8, 76% have cherry plantations, 4.38% have pear plantations, 3.09% have walnut, hazelnut and almond plantations, only 2.58% have peach and nectarine plantations (Question 6).

Of the total number of respondents to the questionnaire, 57.73% of them buy the inputs necessary to carry out the activity from the phytopharmacies in the area where they operate. 31.96% of respondents procure the necessary inputs through distribution companies, while only 9.28% turn directly to producers to purchase inputs (Question 7).

Regarding the way of marketing the fruits obtained in fruit farms, most of the respondents, 54.64% of them capitalize on production through intermediaries, 26.80% of respondents capitalize on production through their own processing unit, while only 15.46% of respondents sell production directly in fairs and markets. Only 3.09% of respondents capitalize on their production through cooperatives or producer groups (Question 8).

Table 1. Analysis of the structure of the respondents regarding the option to join an associative form, according to their opinion regarding the knowledge of the current legislation on the association of agricultural producers (Q9)

Specification	**U.M.**	**Yes**	**No**	**I do not care**	**Total**	
		No.	**No.**	**No.**	**No.**	**%**
Yes	No.	30	16	0	**46**	**12%**
No	No.	0	221	30	**251**	**65%**
I'm undecided	No.	4	70	17	**91**	**23%**
Total	No.	**34**	**307**	**47**	**388**	**100%**
	%	**9%**	**79%**	**12%**	**100%**	
Chi-Square =	**214.11**	**Critical Value =**	**9.49**			
Cramer's V =	**0.53**	**Pearson's P =**	**0.60**			
P- value =	**3.47E-45**	**Probability level =**	**0.05**			
Degrees of freedom (df) =	**4**					

Source: processing of data obtained from the application of the questionnaire.

Determining a Chi-square value of 214.11 and a critical value of 9.49 (probability of 0.05), regarding the structure of the respondents regarding the option to adhere to an associative form depending on their opinion regarding the knowledge of the current legislation on the association of agricultural producers, there is a very significant association between the structure of respondents regarding the option to join an associative form and their opinion on the knowledge of current legislation on the association of agricultural producers, so we can say that there are very significant differences for those who do not intend to join an association and those who do not know the current legislation on the association of agricultural producers (Table 1).

The Pearson coefficient has a value of 0.60 (Cramer V = 0.53), which indicates that there is a close link between the two variables, varying in the same direction, so we can say that the structure of respondents on the option to adherence to an associative form is influenced by their opinion regarding the knowledge of the current legislation on the association of agricultural producers (Table 1).

Table 2. Analysis of the structure of the respondents opinion on the advantages of the association regarding production planning and modification and facilitating access to European funds (Q11)

Specification	**U.M.**	**Very interesting**	**interesting**	**A little interesting**	**no interest**	**Total**	
		No.	No.	No.	No.	No.	**%**
Very interesting	No.	138	8	0	0	**146**	**38%**
interesting	No.	4	170	4	0	**178**	**46%**
A little interesting	No.	4	16	44	0	**64**	**16%**
no interest	No.	0	0	0	0	**0**	**0%**
Total	No.	**146**	**194**	**48**	**0**	**388**	**100%**
	%	**38%**	**50%**	**12%**	**0%**	**100%**	
Chi-Square =	**538.39**	**Critical Value =**	**16.92**				
Cramer's V =	**0.68**	**Pearson's P =**	**0.76**				
P- value =	**3.43E-110**	**Probability level =**	**0.05**				
Degrees of freedom (df) =	**9**						

Source: processing of data obtained from the application of the questionnaire.

Determining a Chi-square value of 538.39 and a critical value of 16.92 (probability of 0.05), regarding the structure of the respondents opinion on the advantages of the association regarding the planning and modification of production according to the structure of the respondents' opinion with on the benefits of the association on facilitating access to European funds, there is a very significant association between the structure of respondents on the benefits of the association on planning and modifying production and the structure of respondents on the benefits of the association on facilitating access to European funds. Stated that there are very significant differences between those who consider the advantage of planning and modifying production to be interesting and those who say that the advantage of facilitating access to European funds is interesting (Table 2).

The Pearson coefficient has a value of 0.76 (Cramer V = 0.68), which indicates that there is a close link between the two variables, varying in the same direction, so we can say that the opinion of respondents on the benefits of association regarding production planning and modification is influenced by the respondent’s opinion on the advantages of the association regarding facilitating access to European funds (Table 2).

Table 3. Analysis of the structure of the respondents opinion on the existence of a policy regarding the control of expenses within a form of association, depending on their opinion, regarding the existence of policies for selling prices

Specification	U.M.	Yes	No	I don't know / I don't answer	Total	
		Nr.	Nr.	Nr.	Nr.	%
Yes	**Nr.**	327	9	12	**348**	**90%**
No	**Nr.**	4	8	0	**12**	**3%**
I don't know / I don't answer	**Nr.**	4	0	24	**28**	**7%**
Total	**Nr.**	**335**	**17**	**36**	**388**	**100%**
	%	**86%**	**4%**	**9%**	**100%**	
Chi-Square =	**323.30**	**Critical Value =**	**9.49**			
Cramer's V =	**0.65**	**Pearson's P =**	**0.67**			
P- value =	**1.02E-68**	**Probability level =**	**0.05**			
Degrees of freedom (df) =	**4**					

Source: processing of data obtained from the application of the questionnaire.

By statistical testing of the representative respondents, with a Chi-square value of 323.30 and a critical value of 9.49 (probability of 0.05), on the opinion of the respondents regarding the existence of a policy aimed at controlling expenditures in a form depending on their opinion on the existence of sales price policies, there is a very significant association between the opinion of the respondents regarding the existence of a policy aimed at controlling expenditure in a form of association and their opinion on to the existence of policies aimed at selling prices, so we can say that there are very significant differences in terms of those who agree with the existence of spending control policies in an associative form and those who agree with the existence of policies aimed at selling prices, so we can say that the opinion of respondents about the existence of a policy aimed at controlling expenditure within a form of association is influenced by their opinion on the existence of policies aimed at selling prices (Table 3.).

The Pearson coefficient has a value of 0.67 (Cramer V = 0.65), which indicates that there is a close link between the two variables in intensity, varying in the same direction, so we can say that the opinion of respondents with reference the existence of a policy aimed at controlling expenditures within a form of association is influenced by their opinion regarding the existence of policies aimed at selling prices (Table 3).

Regarding the way in which decisions should be taken at the level of an associative form, to a large extent, the respondents are of the opinion that the decisions at the level of the associative form should be taken by the majority of members (50.52%), while 26.03% among the respondents believe that decisions should be taken with the consent of all members. Also, 22.42% of those who answered the questionnaire believe that decisions should be taken by representatives elected by members (Question 14).

Taking into account the answers provided by those who completed the questionnaire, it can be noted that 89.69% of respondents consider it necessary that, at the level of an associative form, to have a policy regarding expenditure control. Only 3.09% of respondents believe that such a policy of controlling expenditure at the level of an associative form is not needed (Question 15).

Asked about their opinion on the existence of a common policy for fixing the selling prices of agricultural products at the level of an associative form, 86.34% of respondents consider that such a policy is necessary, while only 4.38% among the respondents consider that such a policy is not necessary (Question 16.).

The distribution of profit at the level of an associative form is a very important aspect. Regarding this aspect, most of the respondents (43.81%) are of the opinion that the decision on the distribution of profit at the level of an associative form should be taken by the

decision of the majority. 32.47% of respondents believe that the decision on profit sharing should belong to all members. Only 20.62% of respondents believe that the profit recorded at the level of an associative form should be automatically reinvested (Question 17).

CONCLUSIONS

The distribution of respondents according to age reflects the degree of aging of fruit growers and the low percentage of exchange between generations. In order to develop the fruit and agriculture sector in general, support measures are needed to encourage young people to take over family businesses or start their own businesses, improve farm productivity and find new ways to sell production, adapted to current conditions.

The significant share of respondents who completed only secondary school education can be explained by the fact that most fruit growers who answered the questionnaire are elderly and have an average level of education, while farmers with completed high school or university education are 52.32% of the total number of respondents to the questionnaire.

The significant share of extensive orchards indicates the high degree of aging of orchards, in particular because intensive and super-intensive systems are suitable for early fruit species, grafted on medium-vigor vegetative rootstocks and can be implemented for species like apple, pear, peach, plum, cherry and sour cherry orchards.

Based on the answers provided by the fruit growers who completed the applied questionnaire, it is necessary to develop a strategy on the development of the fruit sector - Horizon 2050. The general objective of this strategy is to develop a viable fruit sector to ensure domestic demand for fruit and reduce trade deficit in this segment. The specific objectives should focus on:

-Continuation of financing measures dedicated to the fruit sector, in order to rejuvenate fruit farms.

-Elaboration of new fiscal measures, meant to encourage the association of fruit growers.

-Measures to promote the advantages of joining an associative form.

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HAS TOURISM GONE ON HOLIDAY? ANALYSIS OF THE EFFECTS OF THE COVID-19 PANDEMIC ON TOURISM AND POST-PANDEMIC TOURISM BEHAVIOR

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Abstract

The global tourism industry, estimated at about $ 1.7 trillion in 2019, was among the hardest hit by the COVID-19 pandemic, which cancelled most vacations, closed borders and imposed strict travel conditions. In this paper we analyzed the impact of the COVID-19 pandemic on tourism, both in our country and worldwide. For our analysis we used data provided by the National Institute of Statistics, Eurostat, Euromonitor International, the World Tourism Organization, the IMF and by professional associations in the field of tourism in Romania and other countries. The results of the study show that the pandemic caused an estimated loss of $ 1.3 trillion worldwide and a 74% reduction in the number of international arrivals. Moreover, the impact of the pandemic will be felt for a long time to come, both at the level of tourism operators and tourists, and some travellers will definitely change their consumer behavior when it comes to tourism. Based on these analyzes, we identified several mutations regarding the future of tourism at national and international level.

Key words**:** *tourism, COVID-19 pandemic, tourism consumption*

INTRODUCTION

World tourism faced the worst year ever in 2020, with the World Tourism Organization (UNWTO) announcing a 74% reduction in international arrivals following the introduction of travel restrictions and declining demand due to the coronavirus pandemic (Covid-19) [14]. Destinations around the world last year saw a decrease of one billion in the number of international visitors, compared to a decline of only 4% during the global economic crisis of 2009 [8]. According to the latest UNWTO data, the collapse of international travel has led to an estimated loss of $ 1.3 trillion in export earnings, 11 times higher than in 2009. The crisis has endangered between 100 and 120 million people. direct jobs in tourism, mostly for SMEs [6].

2020 was an atypical, difficult and unusual year, it changed the way we live, work and many of the values we thought were important. Both human health and activity in all industries were mainly negatively affected by the coronavirus pandemic. The tourism industry was no exception, as it was one of those hit hard by the dreaded virus and restrictions.

The beginning of 2020 looked promising for all industries. The news of an unknown virus did not frighten anyone, especially since it came from another continent. The euphoria of the first days of the year was not over, when we came across terms such as lockdown, quarantine or state of emergency. Locked up in houses, between four walls, we started to reorganize our work or holidays, especially holidays. Where could we have gone if everything was closed?! Representatives of travel agencies said that 2020 has brought them a drop in sales of up to 70%.

Starting with March 16, 2020, when the State of Emergency was established in Romania, tourism went on vacation, but not one that would bring benefits. Since then, tourism consultants have predicted the collapse of the industry.

The entire HoReCa industry in Romania had in 2019 revenues estimated at 5 billion euros, and in 2020 will lose about 3 billion euros, of which 1 billion are only the losses of

hoteliers, calculated the representatives of the Alliance for Tourism (APT). They say the state aid promised by the state reaches 130 million euros, insufficient to compensate for losses more than 20 times higher.

In March 2020, COVID-19 hit also Moldova. The government from Chisinau acted and approved a series of traffic restrictions and entrepreneurial activity to stop the spread of the infection, but which resulted in a disastrous impact on the business environment. Transport, HoReCa, tourism, trade, services were the most affected branches, in which many businesses were closed and thousands of employees were laid off. However, the magnitude of the economic crisis did not begin to be seen until the autumn. According to the Ministry of Economy and Infrastructure, the pandemic crisis generated a contraction of 14% of the national economy in the second quarter of 2020 and 7.2% in the first half. [10].

MATERIALS AND METHODS

For our analysis we used data provided by the National Institute of Statistics, Eurostat, the World Tourism Organization (UNWTO), the IMF and by professional associations in the field of tourism in Romania and other countries [3].

The tourist circulation from 2020 was analyzed, compared to 2019.

For the second part of the study, data from questionnaires applied to tourists and travel agencies by the IMF, ANAT, Euromonitor International and the World Tourism Organization (UNWTO) were used.

RESULTS AND DISCUSSIONS

Destinations around the world last year saw a decrease of one billion in the number of international visitors, compared to a decline of only 4% during the global economic crisis of 2009 [2].

In 2019, travel and tourism were some of the most important sectors of the world economy, almost 10% of global GDP, with over 320 million jobs worldwide and a value of nine trillion dollars.

According to the latest UNWTO data, the collapse of international travel has led to an estimated loss of $ 1.3 trillion in export earnings, 11 times higher than in 2009. The crisis has endangered between 100 and 120 million people. direct jobs in tourism, mostly for SMEs.

The arrivals registered in the tourist reception structures in 2020 amounted to 6,335.4 thousand, decreasing by 52.3% compared to 2019. In this case, the arrivals of tourist foreigners represent only 7.2% (Table 1).

According to international arrivals, in Romania we have tourist mostly from Europe (78.4%) and of these 74.2% are coming the EU countries.

Table 1. Arrivals registered in the tourist reception structures in Romania 2019-2020

Tourist arrivals in România	2020	2019
Romanian tourists	5,879,251	10,597,000
Foreign tourists	456,149	2,671,000
TOTAL	6,335,400	13,268,000

Source: NIS, 2021 [7].

In the tourist reception structures, at the level of 2020, the overnight stays registered amounted to 14,444.7 thousand, these being decreased by more of a half (51.6%) compared to the overnight stays registered in 2019 (Table 2).

Table 2. Overnight stays registered in the tourist reception structures in Romania 2019-2020

Overnight stays in the tourist reception structures	2020	2019
Romanian tourists	13,448,015	24,612,000
Foreign tourists	996,685	5,258,000
TOTAL	14,444,700	29,870,000

Source: NIS, 2021 [7].

The highest share is represented by the overnight stays of Romanian tourists, this being 93.1% while the overnight stays of foreign tourists registered a share of 6.9%.

Concerning the overnight stays of foreign tourists, the largest share was registered by

tourists from Europe, representing 77.2%, 73% of the them coming from EU countries.

If we talk about the average length of stay in 2020, it was 2.3 days for Romanian tourists and 2.2 days for foreign tourists.

Regarding the index of net use of accommodation in 2020, it represented 22.9% of the total tourist accommodation structures, registering a decrease of 11.3% compared to 2019 (Table 3).

Higher indices of accommodation use in 2020 were registered at accommodation spaces on ships (29.3%), bungalows (28.9%), hotels (26.7%), campsites (24.3 %), tourist houses (22.1%), tourist villas (21.4%), tourist stops (19.4%) and agritourism pensions (16.7%).

The arrivals of foreign visitors in Romania, registered at the border points in 2020, were decreasing by 60.8% compared to 2019.

The most used means of transport for the arrivals of foreign visitors in Romania, were the road, representing 82.6%, respectively the air 14.5% of the total number of arrivals.

Regarding the departures of Romanian visitors abroad, in 2020, 9,510.1 thousand departures were registered at the border points, decreasing by 58.8% compared to 2019 (Table 3).

Table 3. Tourist indicators in Romania 2019-2020

Tourist indicators	2020	2019
Index of net use of accommodation	22.9%	34.2%
The departures of Romanian visitors abroad	9,510,100	23,065,000

Source: NIS, 2021 [7].

Also in this case, the means of road (71.0% of the total number of departures), and air transport (28.3%) were the most used for departures abroad.

Analyzing the global situation, we find for example, that the number of foreign visitors to Japan fell last year by 87.1%, being the most significant decline since 1964, when comparable data became available. Restrictions and measures taken to limit the spread of the coronavirus pandemic (COVID-19) have affected the tourism industry globally. The total number of foreign visitors, including tourists and businessmen, fell to 4.12 million in 2020, from 31.90 million in 2019. This is the lowest level since 1998. The Japanese government's initial target was 40 million of foreign tourists to visit Japan in 2020, but the effects of the pandemic, the postponement of the Tokyo Olympics and other sporting events have made it impossible to meet this target. In December, the number of foreign visitors to Japan fell by 97.7%, the 15th month of decline. And the number of Japanese who travelled abroad decreased in 2020 by 84.2% to 3.17 million, the lowest level since the publication of these data. In recent years, Japan's economy has become increasingly dependent on foreign tourists, launching more aggressive campaigns abroad to promote the tourism industry (World Tourism Organization, 2020) [14].

The opening of many borders in Europe, just before last summer's season, gave the international tourism industry only a brief respite in the middle of the pandemic.

In Europe, the tourism sector accounts for 10% of EU GDP (up to 25% in Croatia, 22% in Cyprus and 21% in Greece, if indirect impact is included) and generates, directly and indirectly, 23 million jobs.

For Germany, this meant that the collapse in the number of overnight stays during the initial lockdown in March (by more than 90% compared to the previous year) gave way to a decline of less than 50% in the summer months. Throughout 2020, the decline is over 60% in the number of accommodation of foreign visitors compared to 2019. The number of overnight stays in Germany decreased by about 51.2 million accommodations, and the amounts spent by visitors decreased by about 18,7 billion euros in 2020 compared to the previous year.

At EU level, travel restrictions imposed in the context of the COVID-19 pandemic have decimated the tourism sector, a major player in the EU economy. Revenues are expected to fall by 50% for hotels and restaurants, by 70% for operators and travel agencies and by 90% for cruise operators and airlines. Europe is half of the world's tourist destinations, and the situation is particularly difficult for tourism-dependent countries such as Spain, Italy, France and Greece [1], given that 22.6 million

people work in the EU tourism sector. In other terms, the EU tourism sector contributes 9.5% of EU GDP and represents 11.2% of EU jobs [13].

The Commission's Joint Research Center, which studies the spatio-temporal patterns of tourism in Europe, has analyzed the regional vulnerability of the tourism sector.

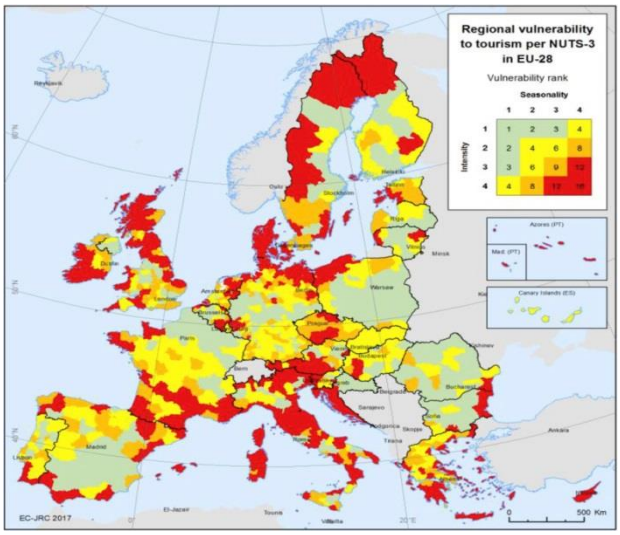

Fig. 1. Map of the regional vulnerability of the tourism sector

Source: EU Commission Joint Research Center.

It points out that the regions most at risk due to the seasonal nature of activity are spread across the EU; however, the intensity is variable, for example, some islands in Greece depend 90% on tourism [5].

Their vulnerability results from dependence on domestic or European tourism, their seasonal nature and their intensity.

The trade fair and congress sector was also affected, with events being canceled or postponed in Europe.

Situation in the Republic of Moldova

The tourist structures that offer accommodation services were frequented by fewer tourists during January-June of 2020. Thus, these services benefited 27.7 thousand tourists, by 75.3% less compared to the similar period of the previous year. This is after during the pandemic several tourism businesses had to stop their activity, and travel was restricted in several states.

Most tourists opted for hotels and motels, guest houses and tourist and agritourism guesthouses. During this period, no visitors were accommodated in a student rest camp.

More significant shares in the total number of foreign tourists accommodated in the collective tourist reception structures with accommodation functions belonged to those who came from Romania (29.8%), Ukraine (15.4%), the Russian Federation (9.8%), Italy and Turkey each (4.7%), USA (4.5%), Germany (4%).

At the same time, there were almost 113 thousand overnight stays of tourists, of which 73 thousand were those of Moldovan citizens (65% of total overnight stays) and 40 thousand overnight stays of non-residents (35%).

The average length of stay was 5.1 days, at guesthouses - 27.2 days, accommodation facilities - 2.7 days, hotels and motels (3.2 days), and at tourist and agritourism guesthouses, respectively 2.5 days.

In January-June 2020, travel agencies and tour operators provided tourist services to 31.4 thousand tourists and hikers. The number of foreigners who received services amounted to 6,575.

Among the main purposes underlying the visits were: 97.6% arrived for leisure, recreation and leisure purposes, 2.2% for business and professional purposes and only 0.2% for treatment purposes. The number of tourists and hikers who went abroad through these agencies totalled 16.6 thousand people.

Next, we will analyze the behaviour of post-pandemic tourism consumption.

In the top of the favoured destinations of Romanians in a pandemic year, Romania ranked first with 55% of the total number of bookings, with travellers adapting to the restrictions imposed by governments. The rest of the ranking contains on the second place Great Britain with 15% of the total number of reservations, on the third place Germany (8%), followed by Italy (6%), Spain and France with 4% and on the 7th place we have Belgium with 2%.

All the transformations caused by Covid 19 will force the industry to offer a different kind of tourism after the pandemic. Although it is impossible to predict with certainty what the future will bring, the following trends are

related to how people will prefer to travel around the world.

Local travel

International travel bans and the feeling of insecurity associated with flights and airports will make tourism options geared towards the domestic market. Also, the consequences of the crisis already have and will continue to have severe economic implications, people are more attentive to budgets or are unable to afford the trips they had in the pre-pandemic period [9].

However, they will still want to travel. While personal budgets will become tighter and tighter, the desire to go out and explore will only increase. As such, and because of this, many travel lovers will look to destinations closer to home, they will prefer trips that will allow them to stay with money in their wallet. It is expected that more people will make real tours in their countries of origin, supporting local economies by exploring their own cities [12].

Locations located in unknown areas thus have the opportunity to increase their exposure, and less frequented tourist destinations can benefit from demand, given the preference for less crowded places [11].

Nature tourism

Tourists will choose for nature destinations because this form of tourism will allow them to maintain social distance and access to discovery and contact with nature, which they could not benefit in recent months [4].

Wildlife tourism, on the blacklist

The controversial appearance of coronavirus in China has brought to the attention of the public, internationally, the way wild animals are treated. Therefore, there is a tendency for travelers to move away from experiences involving tourism with / near wildlife.

The Instagram snapshot of a tourist riding elephants will no longer be considered "cool". On the contrary, tourism of the future is expected to focus on supporting accredited initiatives for the conservation of the natural environment, flora and fauna to the same extent, in an ethical and sustainable way, such as observing penguin colonies from a safe distance.

Less mass tourism

The pandemic has highlighted the harmful effects of tourism and mass industry on the planet and the natural environments in which we live. Images of cities with less air and water pollution or the reappearance of wildlife in previously deserted natural spaces spoke for themselves. The collective message was and is that people need to take more care of the planet. This will undoubtedly influence post-corona virus travel decisions.

Aversion to mass tourism will force the industry to move towards sustainable, environmentally friendly travel deals with a minor impact on the local community. Travellers will opt for experiences that promote the health and well-being of people and the planet.

The virtual journey

As the world entered a pandemic, solutions for interconnection, travel, or participation in technology events emerged.

Live shows, video conferencing and virtual tours are universally accepted as a new trend. There are already impressive examples of this in the travel industry and it will continue to grow in this post-pandemic era.

Virtual initiatives could also have a positive impact on sustainability, given that the population is increasingly aware of the fragility of the ecosystem.

Micro-holidays

The concept of micro-vacation will probably also be common. Given the dangers associated with long-distance travel, the typical large annual journey will be replaced by the smaller ones, closer to home, throughout the year.

Experience tourism

During the prolonged period of isolation, people had time for introspection. Most have decided to slow down their pace or pursue long-forgotten passions. So, cycling holidays, sailing, hiking, fishing, many of the simple pleasures can come to the surface as holiday reasons, a different one. Locations with health programs, spas, authentic villages, nature are travel opportunities.

Road trips instead of air travel

Whether it is a trip by car, motorcycle or other means of land transport, discovering the country with full autonomy and flexibility can

be a growing option. Travelling with your own vehicles or with a rented car could also be more attractive because an air trip presents an increased risk of illness, with airports being an intersection for all travellers around the world. Land travel can also be seen as a cheaper alternative to air travel.

Preference for renting private property

Given that coronavirus outbreaks have been concentrated in large cities and on cruise ships, it is likely that the types of accommodation people are looking for will change. It is expected that potential guests will prefer to rent private villas, where there is the possibility to use their own facilities. Travellers could thus look at beach houses, mountain huts, apartments or holiday homes, trying to maintain social distance from others.

CONCLUSIONS

The travel and tourism industry has been one of the hardest hit by the corona virus pandemic. It will take a long time to return to something we all recognize as "normal", but there are plenty of opportunities for recovery, opportunities to be innovative and improve the travel experience for all who wish.

The corona virus pandemic took everyone by surprise in 2020, and holiday and travel plans have been shattered by restrictions imposed by authorities and installed fear. This was followed by a collapse in world tourism by over 60% in the first six months of the year. In 2019, travel and tourism were some of the most important sectors of the world economy, almost 10% of global GDP, with over 320 million jobs worldwide and a value of nine trillion dollars.

The end of the year brought a surprise on the tourist market, the tickets for the exotic holidays being sold extremely fast. The travel companies claimed that the sales exceeded expectations, the holidays to the Maldives, Zanzibar, Cancun - Mexico or the Dominican Republic being preferred by Romanian tourists, and the prices are lower than in previous years.

In the short and medium term, consumers will focus on domestic tourism or destinations close to home and reduce their travel budget. Brands and destinations that are attentive to the environment, to society and that adapt using technology will be the winners. The trips will be more and more customized, following to decrease the mass tourism and to increase the number of holidays in nature, in the tent or of those in the luxury segment.

The crisis caused by COVID-19 should be seen as an opportunity to rethink tourism for the future. Comprehensive plans for the recovery of tourism need to be developed quickly, taking into account the longer-term implications of the crisis on the sector (i.e. changes in travel behaviour). Structural transformation is needed to develop a more sustainable and resilient tourism economy in the future (for example, to avoid excessive tourism), in line with ecological and digital transformation.

Rethinking the business: All travel and travel companies will be able to use this break caused by corona virus to review their business concept and travel offerings. Particularly important for the continuation of the business will be the possession of a cash capital, and the digital businesses will be in trend and will have the opportunity to act first.

A new mentality: The pandemic period has raised questions about the sustainability of tourism sectors, such as cruising and aviation, especially as some European countries are moving towards an ecological recovery. Thus, the pandemic could be considered an opportunity for more sustainable business reconstruction, for the benefit of people, the planet, an opportunity to maximize a positive impact of tourism on the environment and the possibility of reducing its negative effects.

The major challenge of the situation is that accessing services in the travel and tourism industry is an extremely social experience, with travellers interacting with numerous operators and indirect service providers (agencies, hotels, restaurants, etc.). It will be difficult to implement some of the new normal movements, such as social distancing, at each touch point. Therefore, from the perspective of the research company Euromonitor International, this health crisis is expected to accelerate some existing trends,

such as digitization, automation, robotics and biometrics.

Digitization will accelerate online sales, reducing the need for outlets, such as travel agencies, to avoid exposing travellers to human-to-human contact. Automation will ensure that passengers can access self-service systems at key contact points, reducing interaction with staff. Biometrics will allow governments to track the health of each individual.

Finally, once the health crisis subsides, the economic impact will be the one that will determine how the rapid recovery can take place, as tourism demand depends on the disposable income of the population, especially among middle- and upper-income travellers.

Scenarios of international experts predict a return in 2021 for tourism, if the pandemic enters a downward slope after the appearance of vaccines. The population is expected to regain the confidence needed to travel and the restrictions imposed by the authorities to relax. However, it all depends on the active measures taken by governments to support the hospitality industry and airlines. The return of tourism to the quotas of 2019 is expected to be achieved only in the next three or four years, the realistic target being 2024.

The vaccine is thus the great hope for the hospitality industry, and from the second half of the year restrictions are expected to be lifted.

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TERRITORIAL DIFFERENCES IN ACCESSING RURAL DEVELOPMENT FUNDS TO SUPPORT THE MODERNIZATION OF AGRICULTURAL HOLDINGS IN ROMANIA BETWEEN 2000 AND 2020

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Abstract

One of the main tools for enhancing the competitiveness of the Romanian agricultural holdings is the measures to address their modernisation. However, up to date, little attention has been paid to the evolution and structure of these support measures in Romania. The article aims to present the configuration of the operation of funds designated for the modernization of the agricultural holdings in all the programming periods since Romania started to receive European funds: 2000-2006, 2007-2013 and 2014-2020. Through the evaluation of the available official data, we will infer the evolution of the funds absorbed by Romania, through NUTS 2 regions (development regions) and by NUTS 3 regions (counties). We have conducted this research using statistical data published on the Agency on Financing Rural Investment platform, Open Data platform from the same agency and Eurostat. During the last three programming periods (2000-2006, 2007-2013 and 2014-2020), the Common Agricultural Policy of the European Union has supported the modernization of agricultural holdings in Romania through three specific financing measures, supporting over 8,000 projects.

Key words**:** *programming period, Common Agricultural Policy, support measures, modernization of agricultural holdings*

INTRODUCTION

The support of agricultural holdings is a measure of the common agricultural policy (CAP), oriented to supporting agricultural production efficiency and enhancing agricultural farm competitiveness [2]. Still, there are other significant benefits related to greater cooperation [9].

EU agriculture development is clearly determined by technical progress [3]. Furthermore, the agricultural sector is influenced by the constant need for investment activities, mainly in agricultural holdings. Given the societal importance of agricultural investment activities and other economic sectors, the national programmes that support agricultural holdings investment are well established in the European Union [6]. Therefore, over the last three programming periods, SAPARD (Special Accession Program for Agriculture and Rural Development), 2000-2006, NRDP (National Rural Development Program) 2007-2013 and NRDP 2014-2020, the CAP enhanced EU farms' modernization through three financing mechanisms, respectively 3.1 Investments in agricultural holdings, measure 121 Modernization of agricultural holdings and sub-measure 4.1 Investments in agricultural holdings.

The paper aims to overview how European funds that support the modernization of agricultural holdings have been absorbed from a territorial point of view in Romania. Thus, it can be seen which development regions have greater success in attracting such funds, how many projects, what amounts they have attracted, and which development regions still have to recover in terms of attracting such support.

MATERIALS AND METHODS

This article is a comparative analysis between the three programming periods through which Romania could access European funds to support its rural development projects, respectively SAPARD 2000-2006, NRDP 2007-2013 and NRDP 2014-2020.

The data used for this study were extracted from Eurostat, from the Afir.info platform (regarding SAPARD projects) and Opendata.afir.info (regarding the projects within the other two programming periods) database. After that, the data was processed, and we made calculations and drew our own interpretations to achieve the desired results.
The growth rate of the financing of the regions was analyzed in relation to the growth rate of the total financing using the following formula:

Growth rate = (Present-Past)/Past x 100.

The reasons behind the support focused on specific regions could be determined by some indicators, namely economic size (SO), labour size (AWU) and agricultural size of holdings. Moreover, the gross value added (GVA) indicator was analyzed to have a first picture regarding the efficiency of the funds attracted by those regions. The gross value added indicator is characterized by Veveris (2014) as being "the main result indicator according to the EU evaluation methodology and is the basis for the calculation of impact indicators"[8].

RESULTS AND DISCUSSIONS

SAPARD 2000-2006

SAPARD program, intended for the acceding states, is the first scheme in which Romania could access European funds. The total number of projects funded through the SAPARD program in the acceding states amounts to almost 40,000 funded projects [7]. Almost 21,000 projects were supported through this investment measure [5]. Within this funding mechanism, Romania has submitted 4,451 projects. Approximately 43% are represented by the projects focused on the modernization of agricultural holdings through measure 3.1, these being in a number of 1925. The difference from 1924 projects to 1925 projects is caused by an error generated by inserting the data in the processing document. Due to the lack of data regarding the period of submission and completion, we cannot make a complete temporal interpretation of the submitted projects. Thus, we can only consider the amount related to this project in the total amount.
Table 1 presents the submission process, quantified in the number of projects and the financing value of these projects.
Romanian farmers started submitting these files from 2003 to 2006. In 2006 there were registered 1,208 files. Thus, the active period of file submission is 2003-2006, with an increasing trend, with a maximum in 2006, when the contracted amount's value was approximately 150 million euros.
The county with the most significant number of projects for the SAPARD 2000-2006 program is Constanța, with 151 projects worth approximately 13 million euros, representing 5.6% of the total amount.

Table 1. Total projects submitted measure 3.1.

Year of submission	Measure	Number of projects submitted	Proportion (% of projects)	Contracted value (euro)	Proportion (% of value)
2003	3.1	1	0.05	205,271.60	0.08
2004	3.1	223	11.5	21,542,627.87	9.4
2005	3.1	492	25.5	56,377,240.75	24.6
2006	3.1	1,208	62.7	150,781,775.42	65.6
2007	3.1	0	0	0	0
2008	3.1	0	0	0	0
2009	3.1	0	0	0	0
Total	**3.1**	**1,924**	**100**	**228,906,915.64**	**100**

Source: own calculations based on AFIR.info [1].

It is followed by Timiș County, with 119 projects and the highest projects' value at the county level, around 18 million euros, representing 7.9% of the total EU funds. Another county that has accessed many projects is Călărași, with no less than 99 projects with a value of approximately 12 million euros, representing 5.1% of the total

amount of inflow. Other counties where a large number of projects have been submitted are Arad (84), Iași (80), Galați (78), Brăila (76) and Tulcea (73) (Table 2).

Table 2. Total projects measure 3.1 by development regions

No.	Development regions	Number of projects	Contracted amount	Value per project
1	Reg. N-E	306	33,932,253.59	110,889.72
2	Reg. S-E	476	44,952,368.48	94,437.75
3	Reg. S	364	52,436,236.36	144,055.59
4	Reg. S-W	120	15,578,564.42	129,821.37
5	Reg. West	234	29,756,227.46	127,163.37
6	Reg. N-W	242	28,794,255.73	118,984.53
7	Reg. Center	162	20,245,120.25	124,969.88
8	Reg. B-IF	21	3,220,608.66	153,362.32
9	**Total**	**1,925**	**228,915,634.95**	**118,917.21**

Source: own calculations based on AFIR.info [1].

Regarding the total projects completed at the level of development regions (Table 3), it can be seen that the first two regions regarding the number of projects are the South-East Development Region (Brăila, Buzău, Constanța, Galați, Tulcea and Vrancea), and the development region South - Muntenia (Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova and Teleorman). Together, these two regions total 44% of the projects submitted under this first financing period analysed, attracting a total of 43% of the amounts contracted under this measure. These are also the two main regions where farms focused on their modernization.

Table 3. Total projects on measure 121 by development regions

No.	Development regions	Number of projects	Contracted amount	Value per project
1	Reg. N-E	331	80,716,422.60	243,856.26
2	Reg. S-E	824	173,328,189.88	210,349.75
3	Reg. S	570	133,708,303.99	234,575.97
4	Reg. S-W	247	47,871,475.96	193,811.64
5	Reg. West	333	90,103,652.14	270,581.54
6	Reg. N-W	349	78,668,093.11	225,410.01
7	Reg. Center	261	75,742,223.38	290,200.09
8	Reg. B-IF	15	65,651,633.20	4,376,775.55
9	**Total**	**2,930**	**745,789,994.26**	**254,535.83**

Source: own calculations based on AFIR open data [1].

Regarding the projects' value, it is observed that the highest value per project is found in the Bucharest - Ilfov Development Region, where on average, a project was financed with approximately 153 thousand euros.

The next from this point of view is the South-Muntenia Development Region, with a value per project of approximately 144 thousand euros.

A possible hypothesis for this could be a more extensive specialization in accessing EU funds with a higher value. Also, the presence of bigger farms could be another reason.

The national average of the projects is 118 thousand euros per project accessed under measure 3.1.

NRDP 2007-2013

During this period, the modernization of agricultural holdings was supported under the NRDP 2007-2013 by measure 121 - Modernization of agricultural holdings.

As indicated by the database "Open data AFIR"[1], for the programming period 2007-2013, through measure 121 of the NRDP, a number of 2,930 projects were accessed, with

a contracted value of approximately 745 million euros.

Quantifying the number of projects per county, Tulcea has the largest number of accessed projects, 307 in number, with a contracted value of approximately 59 million euros, representing 8% of the total sum accessed by Romania. On the second place of the most active counties in terms of the number of projects is Constanța, with a number of 200 projects, with a contracted value of approximately 38 million euros, representing 5.2% of the total amount.

The third county is Timiș, with 171 projects with a contracted value of 48 million euros, representing 6.5% of the total amount. Other counties with a high number of submitted projects are Ialomița (141), Dolj (130), Brăila (120) and Teleorman (113).

Table 5 highlights the first two regions regarding the number of projects. Those regions are the South-East Development Region (Brăila, Buzău, Constanța, Galați, Tulcea and Vrancea), with a total number of 824 projects and South - Muntenia Development Region (Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova and Teleorman), with 570 projects. In terms of the amounts attracted, the South-East Development Region absorbed the most considerable amount of money with approximately 173 million euros, followed by the South-Muntenia Development Region with around 133 million euros attracted. Those are the main regions in which farmers focused on their farm modernization.

It is highlighted that the highest value per project is found in the Bucharest - Ilfov Development Region, where on average, a project was financed with approximately 4.3 million euros.

The reason for this situation is that the headquarter of a non-banking financial institution is placed in Bucharest. This company accessed alone over 52 million euros as a credit guarantee fund. From the data provided by AFIR, this financing appears as a single accessed project [1].

Next from this point of view is the Region Development Center, with approximately 290 thousand euros value per project. The national average of the projects is 254 thousand euros per project accessed through measure 121.

NRDP 2014-2020

During 2014-2020, the modernization of agricultural holdings was supported by NRDP 2014-2020, through sub-measure 4.1

Investments in agricultural holdings. The total value of the sub-measure for the whole programming period was 1.2 billion euros. Table 4 presents the annual situation of the projects at the level of sub-measure 4.1.

Thus, the data provided by the AFIR Open Data platform allow visualizing the evolution of the first four years in which funds were accessed for this sub-measure. From here, it can be seen that approximately 80% of the funds available for this sub-measure were absorbed during the first four years.

Table 4. Total projects accessed on sub-measure 4.1

Year of submission	Measure	Number of projects submitted	Proportion (% of projects)	Contracted value (euro)	Proportion (% of value)
2015	4.1	598	14.51	116,077,355.78	12.00
2016	4.1	1,406	34.11	364,839,963.25	37.71
2017	4.1	1,549	37.58	206,948,189.45	21.39
2018	4.1	569	13.80	279,719,954.24	28.91
Total	**4.1**	**4,122**	**100**	**967,585,462.72**	**100**

Source: own calculations based on AFIR open data [1].

The county where the sub-measure 4.1 has the most significant number of projects is Tulcea, with about 381 projects with a value of approximately 64 million euros, representing 6.7% of the total amount.

It is followed by Constanța County, with 354 projects. In this county, the highest value of these projects at the county level is about 78 million euros, representing 8% of the total amount.

Another county that has attracted many projects is Dolj, with a number of 346 projects worth approximately 50 million euros, representing 5.3% of the total amount. Other counties where a large number of projects have been submitted are Olt (256), Călărași (228), Teleorman (205), Bihor (191) and Timiș (188).

Table 5. Total projects sub-measure 4.1 by development regions

Nr. Crt.	Development regions	Number of projects	Contracted amount	Value per project
1	Reg. N-E	294	61,289,271.01	243,856.26
2	Reg. S-E	1,197	227,018,001.78	210,349.75
3	Reg. S	844	154,518,819.88	234,575.97
4	Reg. S-W	681	137,260,528.04	193,811.64
5	Reg. West	364	107,059,035.29	270,581.54
6	Reg. N-W	393	169,128,376.22	225,410.01
7	Reg. Center	325	110,420,613.97	290,200.09
8	Reg. B-IF	24	890,816.53	4,376,775.55
9	**Total**	**4,122**	**967,585,462.72**	**254,535.83**

Source: own calculations based on AFIR open data [1].

Analysing the total projects at the level of development regions (Table 5), it is noted that most projects were carried out in the South-East Development Region (Brăila, Buzău, Constanța, Galați, Tulcea and Vrancea), with a total number of 1,197 completed projects. On the following positions as project numbers, are the South - Muntenia Development Region (Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova and Teleorman), with 844 projects and the South-West Oltenia Development Region (Dolj, Gorj, Mehedinți, Olt and Vâlcea), with a number of 681 projects.

Table 6. Growth rate per development regions and programming periods

Development regions	Contracted amount (P1) 2000-2006	Contracted amount (P2) 2007-2013	Contracted amount (P3) 2014-2020	Rate of increase in P2 compared with P1	Rate of increase in P3 compared with P2	Compared with total rate of increase	Compared with total rate of increase
Reg. N-E	33,932,253.6	80,716,422.6	61,289,271.0	137.88 %	-24.07%	↘	↘
Reg. S-E	44,952,368.5	173,328,189.9	227,018,001.8	285.58 %	30.98%	↗	↗
Reg. S	52,436,236.4	133,708,304.0	154,518,819.9	154.99 %	15.56%	↘	↘
Reg. S-W	15,578,564.4	47,871,476.0	137,260,528.0	207.29 %	186.73 %	↘	↗
Reg. West	29,756,227.5	90,103,652.1	107,059,035.3	202.81 %	18.82%	↘	↘
Reg. N-W	28,794,255.7	78,668,093.1	169,128,376.2	173.21 %	114.99 %	↘	↗
Reg.Center	20,245,120.3	75,742,223.4	110,420,614.0	274.13 %	45.78%	↗	↗
Reg. B-IF	3,220,608.7	65,651,633.2	890,816.5	1938.49%	-98.64%	↗	↘
Total	**228,915,635.0**	**745,789,994.3**	**967,585,462.7**	**225.79 %**	**29.74 %**		

Source: own calculations based on AFIR open data [1].

In terms of the highest inflows, most of the money in the period 2014-2020, for sub-measure 4.1, was attracted by the South-East Development Region with approximately 227 million euros attracted, followed by the North-West Development Region with 169 million euros attracted.

Analysing the growth rate of the regions, we can see that in P2 (2007-2013) compared to P1 (2000-2006), there are significant increase rates between 137% and 1938%.

The regions above the total increase rate are the South-East Region, the Center Region, and the Bucharest-Ilfov Region. Regarding the period P3 (2014-2020), compared to P2 (2007-2013), there are regions with values lower than the total increase rate and regions with values above, such as the South-East Region, South-West Oltenia, North-West and Center. Thus, it is noticeable how certain regions have had an upward evolution from one period to another in attracting funds.

Table 7. Contracted amount per UAA in Romania by NUTS 2 regions (Euro/ha)

Development regions	**Financial support/UAA (Euro/ha)**	**Financial support/UAA (Euro/ha)**	**Financial support/UAA (Euro/ha)**
	2000-2006	**2007-2013**	**2014-2020**
Reg. N-E	16.69	42.07	31.95
Reg. S-E	20.90	79.69	104.37
Reg. S	22.55	56.79	65.63
Reg. S-W	8.74	29.2	83.72
Reg. West	16.99	52.76	62.69
Reg. N-W	14.83	44.09	94.78
Reg. Center	11.61	43	62.68
Reg. B-IF	18.11	906.79	12.3
Total	**16.46**	**55.6**	**72.13**

Source: Eurostat, UUA (utilised agricultural area) [4].

In terms of the contracted amount per utilised agricultural area (for the modernisation of the agricultural holdings), in Table 7 it is noticed a constant increase of the amounts from the first period to the last, with a maximum of 104 EUR/ha in the South-East Region in 2014-2020 period (906.79 from B-IF Region it is an anomaly as it is explained above).

Figure 1 presents the share of the amounts in each region during all three supporting periods.

The period 2014-2020 was the most prolific regarding the amounts. The majority of regions have an upward trend, the value of attracted funds being bigger from period to period. This could be translated into a deeper specialization for Romanian farmers working with European projects and absorbing more money.

The analysis of business indicators such as the economic size, labour size or agricultural size of holdings gives more explanations for these territorial differences between development regions in Romania in attracting EU funds to modernise the agricultural holdings. From the economic perspective, it can be observed that the most significant value of standard output (represented in euro) is in South – Muntenia with over 2,1 billion euros.

Due to a large number of small holdings (less than 2 hectares), the smallest economic indicators per agricultural holdings are in South-West and North-East regions. Regarding the number of big farms (100 ha and over), the largest share is in two regions, respectively South – Muntenia and South-East, accounting for about 47% of the total number of large farms. Given the gross value

added from 2007, compared with 2017, there is an increase of this indicator for the agricultural holdings from the South-East and South-Muntenia regions, most probably due to the funds absorbed and the large number of projects implemented.

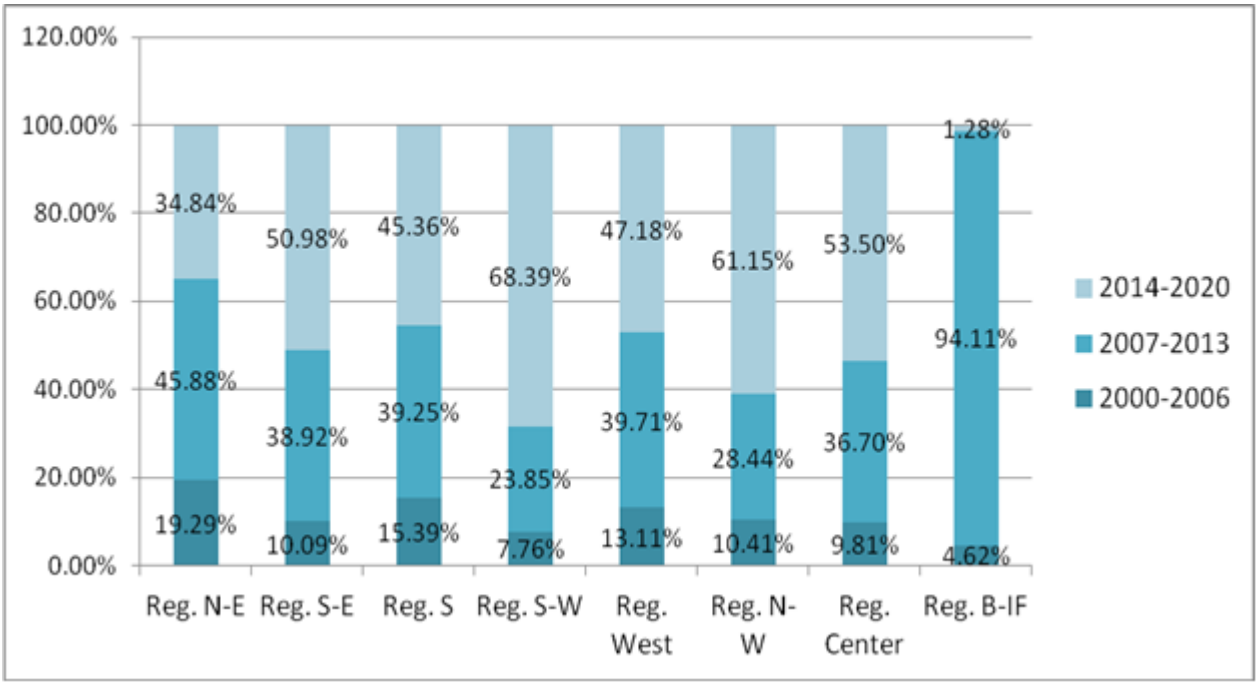

Fig. 1. Share of the amounts per period
Source: own calculations based on AFIR open data [1].

Table 8. Agricultural holdings by different indicators (economic size, labour size, phyzical size) in 2016

Development regions	Total holdings	Economic size		Labor size		Agricultural size of holdings			
						Less than 2 ha		100 ha and over	
		EUR of SO	EUR of SO/ holding	AWU	AWU/ holding	No	% of total	No	% of total
Reg. N-E	720,240	2,063,833,930	2,865	346,530	0.48	543,250	22.63	1,560	12.67
Reg. S-E	410,220	2,020,292,250	4,925	203,760	0.50	305,900	12.74	2,850	23.15
Reg. S	694,660	2,183,368,650	3,143	276,200	0.40	563,360	23.46	2,450	19.90
Reg. S-W	539,550	1,462,287,010	2,710	271,940	0.50	366,630	15.27	1,210	9.83
Reg. West	226,900	1,293,079,190	5,699	102,950	0.45	118,350	4.93	1,380	11.21
Reg. N-W	478,490	1,636,486,000	3,420	217,250	0.45	286,370	11.93	1,340	10.89
Reg. Center	330,950	1,367,075,010	4,131	156,270	0.47	199,300	8.30	1,430	11.62
Reg. B-IF	21,020	79,069,770	3,762	12,750	0.61	17,790	0.74	100	0.81
Total	**3,422,030**					**2,400,930**	**100**	**12,310**	**100**

Source: own calculations based on Eurostat data [4].
SO (standard output), AWU (annual work unit)

To have a clear perspective about the impact of these projects, deeper analysis has to be done with data at the farms level.

Table 9. Gross value added per regions

Development regions	GVA in agriculture 2007, (EUR million)	GVA in agriculture 2017, (EUR million)
Reg. N-E	1,259.1	1,286.1
Reg. S-E	930.9	1,466.8
Reg. S	1,100.7	1,501.4
Reg. S-W	665.1	990.5
Reg. West	870.5	844.6
Reg. N-W	1,164.1	908.1
Reg. Center	1,098.9	864.3
Reg. B-IF	80.1	237.5
Total	**7,169**	**8,099**

Source: own calculations based on Eurostat data [4].
GVA (gross value added)

CONCLUSIONS

Over the last three multiannual financial frameworks (2000-2006, 2007-2013 and 2014-2020), the EU common agricultural policy has supported the modernization of agricultural holdings in Romania through three specific financing measures. Those measures are represented by measure 3.1 Investments in agricultural holdings, measure 121 Modernization of agricultural holdings and sub-measure 4.1 Investments in agricultural holdings. Analysing the level of investments through these EU schemes to modernize agricultural holdings, it is noted that these measures were not concentrated predominantly in the same investment areas in terms of counties, but in the development regions of Romania specific to the level of NUTS 2. Thus, regarding the projects attracted at the level of regions in Romania, the data has revealed significant support concentration in two development regions, representing together about 50% of the total number of projects for the entire supported period 2000-2020. The South-East Development Region attracted 2497 projects for the period 2000-2020, followed by the South-Muntenia Development Region, with 1778 projects attracted during the same period. The same two regions managed to attract the most funds during this period, the South-East Development Region attracting the largest amount, respectively 422 million euros, followed by the South-Muntenia Development Region, with 340 million euros absorbed over the three multiannual financial frameworks. In terms of projects accessed and funds absorbed, the main reasons behind the domination of these two regions are explained by the size of the farm-areas (SE and South-Muntenia have major agricultural holdings in Romania), the economic dimension of the farms (being one of the largest) and the highest gross value added in the last years.

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MECHANISMS TO STIMULATE THE ACCELERATION OF INNOVATIVE DEVELOPMENT IN THE AGROINDUSTRIAL COMPLEX

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Abstract

Innovative development in the agricultural sector of the economy is a driver for increasing the efficiency of agricultural production. The purpose of the article is to develop mechanisms to stimulate the acceleration of innovative projects in the agro-industrial complex. The study clarified the theoretical and methodological aspects of the process of accelerating technological development. The restraining and accelerating factors of innovation processes in the agro-industrial complex are systematized. The analysis revealed disparities in the efficiency of investments in the agro-industrial complex and their contribution to the main macroeconomic indicators and export orientation. Mechanisms for stimulating technological acceleration have been developed: the introduction of an innovative lift for startups, the creation of technology platforms, and the improvement of regulatory and financial support. The practical significance of the presented mechanisms will stimulate the acceleration of innovative projects and increase the economic, social, technological and budgetary efficiency of agro-industrial complex management in industries and regions.

Key words**:** *technological acceleration, innovative projects, agro-industrial complex, efficiency, incentive mechanisms, forecasting*

INTRODUCTION

Increasing the competitiveness of the agro-industrial complex in the context of the transition to an export-oriented agrarian economy can be achieved through the development of an innovative agrosystem that provides the processes of generation, diffusion and acceleration of innovations and science-intensive products into production processes. The formation of balanced innovation and investment agricultural systems is a driver of sustainable socio-economic growth of the national economy. The problems of insufficient coordination of research institutes with sectors of the economy hinder the scientific and technological development of Russia [14,42,46]. The insufficient degree of congruence of interests of the stakeholders of the innovation process of science, the state, agribusiness, and society, the imbalance in the distribution of resources, knowledge, information, competencies, and technologies at all stages of the innovation process hinders the formation of balanced innovative agricultural systems.

The intensity and quality of congruence of stakeholders in innovation processes between large and medium-sized companies, small firms, research and educational centers, information and consulting services, universities, government bodies, non-profit structures is becoming increasingly important in the design of innovative agroecosystems. The evolution of national innovation systems NIS contributes to the increase of the main macroeconomic indicators of the development of society [13]. The efficiency of innovation processes is associated with both the circulation of intellectual capital in the production process and the quality of coordination between stakeholders in the process of emerging new ideas, generating and disseminating knowledge, and

implementing scientific and technological opportunities [3, 4, 10, 52].

In recent years, in foreign economic thought, one of the popular concepts that integrate science, education, and innovation into a single whole to develop and substantiate national innovation policy is the "knowledge triangle", which, by the way, is also reflected in the documents of the Bologna Process, the mechanism of functioning of which is shown in the works, for example, by M. Unger and V. Polt [48]. The authors demonstrated that the "knowledge triangle" unites other concepts that partially complement each other, such as the "third mission", where the need to modernize higher education as an initial element of human capital reproduction comes to the fore, "triple helix" (triple helix), where institutions such as the University, Business, Power strive for cooperation and, if necessary, partially take over each other's functions, which ultimately forms an innovative component of their interaction, an "entrepreneurial" university, which presupposes the entrepreneurial behavior of a higher educational institution, which in symbiosis with business should lead to the economic development of the region, as well as the "smart specialization" of the regions, developed by the expert group "Knowledge for Growth" of the Directorate for Technology and Innovation of the European Commission, interactions taking into account the existing unique competencies of each region within the framework of a single innovation cluster.

The model of "open innovation" is also aimed at developing cooperative ties between enterprises, universities, and state scientific organizations, which involves the search for the latest approaches to managing the transfer of knowledge and technology from universities and state scientific organizations to industry, where an important role is played by the commercialization of scientific research. M. Cervantes and D. Meissner [6] note the special value of the unique structure of innovation systems in the process of creating and commercializing new products, services and technological processes. Basically, we are talking about optimizing the structure and activities of technology transfer centers, including the formation of appropriate alliances.

Due to the openness of modern economic systems, the model of knowledge flow in clusters is gaining popularity recently, where knowledge becomes the main component of the production process and the main factor of competitive advantage, a feature of which is its resistance to copying and the possibility of self-generation [22].

The formation of new knowledge and its free flow within the cluster is one of the fundamental factors that are necessary for the transition of a cluster to an innovative development model. For the effective organization of innovation management in agriculture, it is important to develop directions for its balanced development, taking into account strategic approaches at the federal and regional levels [40, 50]. This can be achieved using the concept of national and regional agro-innovation systems (AIS). From a scientific point of view, the AIS concept is in a state of renewal and development, in the literature, there are discrepancies in the interpretation of the term, approaches to the analysis of the phenomenon [18, 27, 41, 35]. Relations between AIS subjects undergo a process of reorganization in the process of its formation, reaching a certain necessary balance (Leeuwis C., 2004), (Röling N., 2009), (Klerkx, L. et all, 2010) [23, 24, 37]. As a result of this process, several actors can be squeezed out of the system of emerging relations [5, 47, 49]. The principles of analysis and action of AIS integrate more traditional activities (support for research, dissemination, and education, creating links between research, extension services, and farmers) with other complementary activities that include the provision of skills, incentives, and resources for developing partnerships and business. , improving knowledge flows; creating conditions that allow actors to innovate.

According to Chris Steyaert, different startup models need to be considered to form effective relationships between company participants [43]. The experience of developing knowledge-intensive startups in Ankara (Turkey) has shown that stakeholder

relations begin to take shape already in the process of creating a company. The development of mutually beneficial relationships between the stakeholders of the startup helps to successfully achieve the company's development goals [21, 39].

A low degree of integration interaction hinders the effective functioning of innovative agricultural systems and predetermines the need to justify special support measures within the framework of the state's innovation policy.

In modern conditions, such a form of the business institute as science-based startups has developed, the creation of which makes special requirements for the organization of the innovation process, based on a combination of research, engineering, and business skills [7]. Along with the development of a new product, an entrepreneur must create a sustainable enterprise and promote its transformation into a major technological accelerator.

The study aims to develop the fundamental foundations, methodology, and assessment and forecasting tools for the formation of innovative and investment agricultural systems and mechanisms to stimulate the acceleration of innovative development of the agro-industrial complex.

MATERIALS AND METHODS

The methodological basis of the study was the state legislative acts, decrees and decisions of the government, scientific works of domestic and foreign scientists - economists and agricultural specialists on the problem under study. In the course of the research, monographic, abstract-logical, analytical, economic-statistical, expert research methods were used. As an information base for the study, we used regulatory and legislative acts, information from Rosstat, the Higher School of Economics, the Ministry of Agriculture of the Russian Federation, the Deloitte Research Center, as well as regulatory documents and materials from scientific literature and periodicals.

The methodology for the formation of balanced innovative agroecosystems is based on the synthesis of theories that determine the content, essence, specifics of the interaction of structural elements, and the dynamics of the development of ongoing processes. The theories that determine the content and essence of creating sustainable agrosystems include the theory of institutional development, the theory of NIS, and the concept of open innovation. The structure and structure, the specificity of the interaction of the elements of the innovative agrosystem is determined based on the theory of the triple helix and the actor-network theory. The study of the dynamics of the development of the course of innovation processes is determined by the specifics of the absorption capacity of knowledge absorption, marketing mechanisms to stimulate the demand for innovation, the functional characteristics of the actors of the innovation process - institutions of science, the state, agribusiness, taking into account the needs of society in the context of digital transformation [12]. The paper substantiates the synergy of interaction between the state, universities, academic institutions, agribusiness, taking into account the needs for innovation in the context of industries and regions.

The methodology for the formation of innovative agrosystems takes into account the transformation of the value-functional structure of the stakeholders of the innovation process into balanced innovative agrosystems and the presentation of the innovative agrosystem as a new stage in the evolutionary transformation of the agro-industrial complex, the application of the NIS theory and consideration of the author's innovative agrosystem as part of the NIS, taking into account the specifics of institutional interaction, according to North's theory, as a set of principles, norms, and rules for a balanced interaction of knowledge, information, competencies, technologies to form sustainable innovative agricultural systems [9, 11, 51]. The author's innovative agroecosystem in the context of the dynamics of the development of the processes taking place in it is presented as a flexible, open, multifunctional dynamic network structure of a full cycle, aimed at researching the need,

creating, introducing, distributing, commercializing and applying various types of innovations by the socio-economic needs of industries and regions.

There are different approaches and methods for assessing the level of innovative activity that are used abroad. There are several methods among them: European Innovation Scoreboard, Technology Achievement Index, Innovation Capacity Index, World Innovation Index Boston Consulting Group (GII BCG), World Innovative Index INSEAD (GII INSEAD), Global Innovation Factor Global Innovation Quotient). The works of various foreign and domestic researchers are devoted to the development of methodological approaches to assessing the level of innovative development and the effectiveness of innovation and investment agricultural systems both in the economy as a whole and in agriculture [30-34]. Studied the issues of analyzing and diagnosing the effectiveness of the course of innovative development processes, taking into account the synergistic interaction of the stakeholders of this process - the state, science, agribusiness, society, and implementation formations on an information basis.

RESULTS AND DISCUSSIONS

The paper analyzes and evaluates innovation processes in the agro-industrial complex of Russia in the context of the main stakeholders of the innovative agricultural system, studies the dynamics of innovation and investment activity, export potential.

In the ranking of countries by the level of innovative development. The Russian Federation occupies 47th place [16, 2], and the leading positions belong to Switzerland, Sweden, the USA, Denmark, Germany, the Netherlands, China, etc. In Fig.1. the level of government spending on research and development is presented, in% of GDP in 2017. Leading values for this indicator are also typical for Denmark, Portugal, and Germany, which justifies the high level of their innovative activity [17].

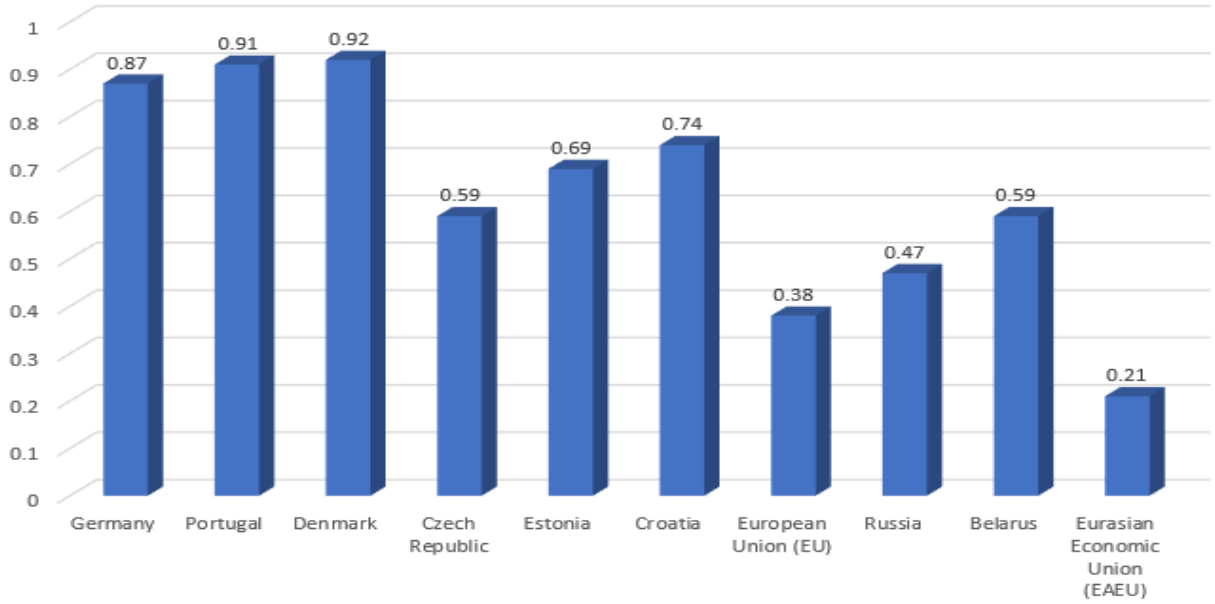

Fig. 1. Government spending on research and development, % of GDP in 2017
Source: Own calculations based on the Global Innovation Index [16].

Russia, undoubtedly, has a high agricultural potential, but it is still realizing it with an insufficient degree of efficiency, which fluctuates at the level of 15-17%. In foreign countries, this indicator is at the level of 55-60%. The share of agriculture in Russia's GDP is extremely low, which indicates an insufficiently effective use of the existing potential, despite the presence of significant climatic, scientific and intellectual resources.

Table 1 shows the indicators of the goals of the fundamental instrument of state support «State Program for the Development of Agriculture for 2013-2020».

Table 1. Indicators of the goals of the State Program for the Development of Agriculture and Regulation of Agricultural Products Markets in Russia in 2013-2018

Indicator	Year					
	2013	2014	2015	2016	2017	2018
Share of agriculture in GDP,%	3.5	3.8	4.2	4.4	4.2	3.5
Index of agricultural production in farms of all categories (in comparable prices) by 2015	-	-	100	104.8	107.8	107.2
Crop production index in farms of all categories (in comparable prices) by 2015, %	-		100	107.8	111.42	108.72
Livestock production index in farms of all categories (in comparable prices) by 2015, %	-	-	100	101.6	104.2	105.6
Physical volume index investment in main agricultural capital by 2015,%	-	-	100	112.2	116.5	121.5
Performance Index labor to the previous year, %	106.2	103.3	104.29	102.69	105.3	101
Produced gross value added created in agriculture, billion rubles	2,193.4	2,656.3	3,214.8	3,312.2	3,270.3	3,268.8
Number of high-performance jobs, thousand jobs	298.4	325.2	284.6	305	365.8	314.6

Source: Data National report [25].

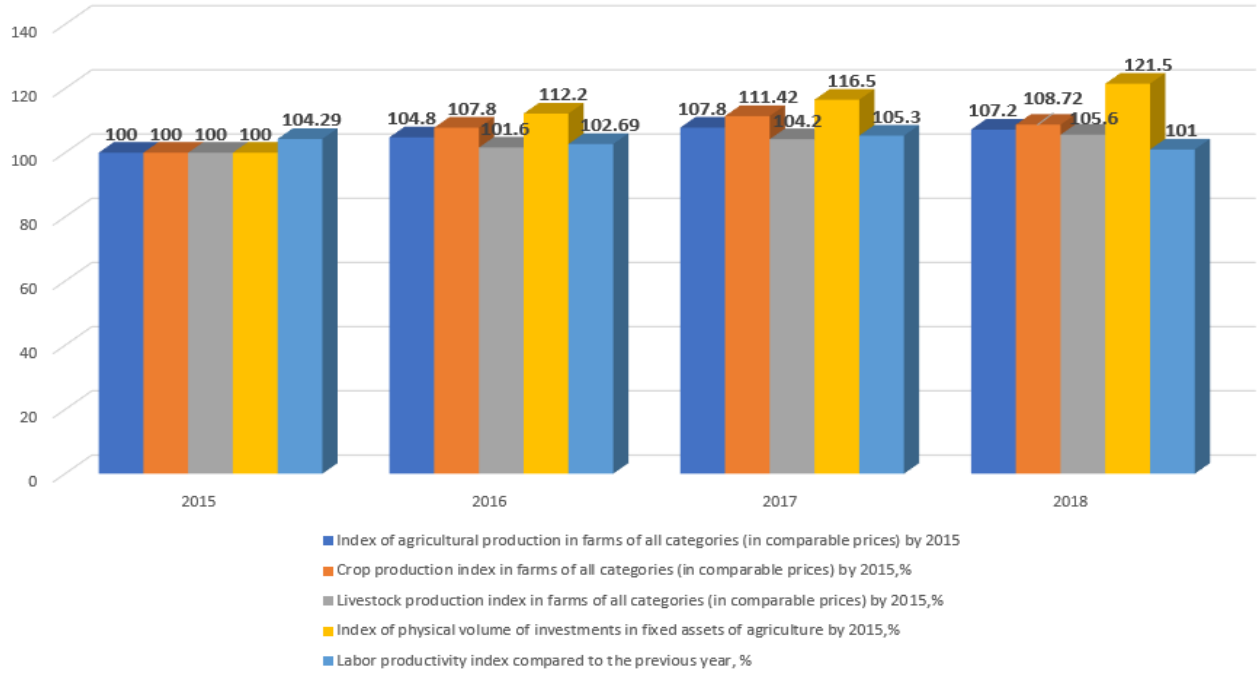

Fig. 2. Dynamics of achievement of indicators of the goals of the State program for the development of agriculture and regulation of agricultural markets in Russia in 2013-2018
Source: Own calculations based on the data National report [25].

The agricultural production index in 2018 amounted to 107.2% compared to 2015, which exceeds the target of the State Program by 0.5 percentage points. The index of production of livestock products in 2018 compared to 2015 increased by 0.2 percentage points. The opposite picture is observed in the crop production industry, it is characterized by a decrease in this indicator by 2 percentage points about 2015, associated with record volumes of crop production in 2017. The labor productivity index decreased by 3% in 2017, which is associated with fluctuations in the macroeconomic situation and difficult natural and climatic conditions on the territory of Russia (Fig. 2).

Table 2. Indicators characterizing innovation, investment, export activity and the process of modernization and rationalization by type of activity: agriculture, hunting and the provision of related services in these areas in Russia in 2012-2018

Indicator	2012	2013	2014	2015	2016	2017	2018
The amount of state support funds within the framework of the State Program for the Development of Agriculture and Regulation of the Markets of Agricultural Products, Raw Materials and Food, RUB million	-	260,960	262,122	254,982	295,928	257,529	254,141
Investments in fixed assets aimed at the development of agriculture, RUB billion	-	516	510	505	511	434	-
Fixed capital investments aimed at environmental protection and rational use of natural resources - land, RUB billion	19.7	13.8	14.5	15.7	12.2	10.2	10,0
The share of investments aimed at reconstruction and modernization in the total volume of investments in fixed assets (agriculture, hunting and the provision of related services in these areas),%	11.9	8.7	8.4	8.6	8.9	10.3	9.2
Share of investments in machinery, equipment, vehicles in the total volume of investments in fixed assets aimed at reconstruction and modernization,%	25.0	15.9	13.5	13.6	15.7	12.9	20.3
The share of exports of innovative goods, works, services in the total sales of goods, works, service	2.6	2.9	2.6	2.1	1.9	1.7	1.6
The share of innovative goods, works, services in the total volume of sales, goods, works, services in the domestic market	6.7	7.7	7.3	7.7	8.4	6.6	5.8
The share of innovative goods, works, services in the total volume of exports of goods, works, services	12.1	13.7	11.5	8.9	8.4	7.1	6.6

Source: Rosstat data and National report [15, 25].

Figure 3 shows the growth of investments in machinery and equipment, vehicles in 2018 compared to 2017, however, there is a decrease in this indicator compared to 2012. The level of investments in reconstruction and modernization is also characterized by a downward trend, which significantly affects the rate of increase in innovative activity. Despite the increase in the share of innovative goods in the total volume of shipped products in agriculture, it remains at a low level, in crop production, 4.2% of organizations are innovatively active, in animal husbandry - 3.9% compared to 2 times exceeding the average values in the economy.

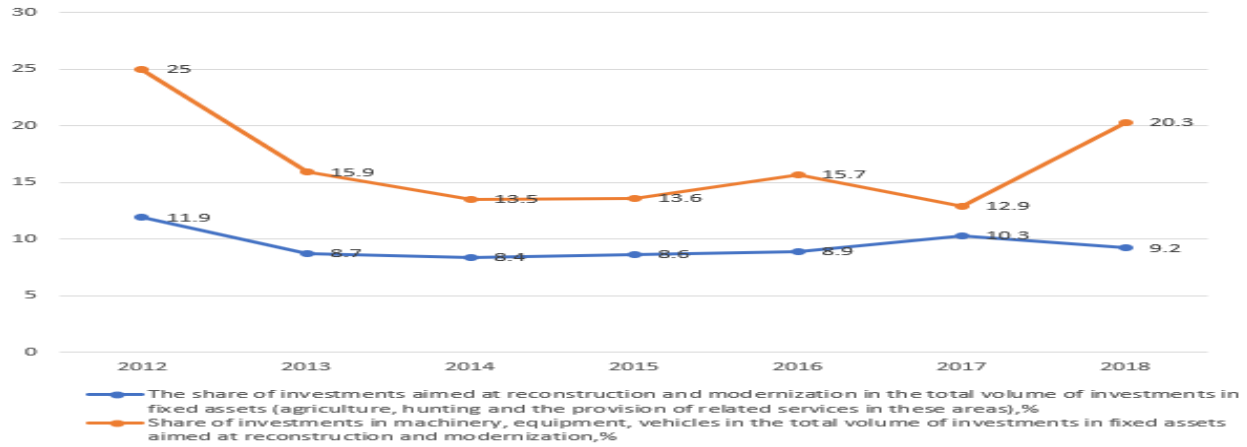

Fig. 3 Dynamics of indicators of innovation and investment activity of the agro-industrial complex,%
Source: Own calculations based on the data National report [25].

According to the Deloitte Research Center, the value of the weighted rating of the diffusion of innovations and science-intensive products in the agro-industrial complex at the end of 2018 is only 0.13 [1]. A higher degree of influence of the results of innovations on ensuring compliance with modern technical regulations, rules, and standards in 2019 was traced by the types of activities: "Growing of annual crops" (10) and "Breeding of poultry" (9); in agriculture as a whole – 33 [44].

An extremely low level of innovation activity is characteristic of such priority areas as precision farming technologies, used by about 5-10% of producers. On the other hand, in the EC this value reaches about 80%, in the USA - 60%, IT technologies about 0.05%.

According to V.F. Fedorenko, out of the total number of completed, accepted, paid for by the Ministry of Agriculture of Russia and recommended for the introduction of applied innovations and scientific and technical developments, only 2–3% are being introduced [15].

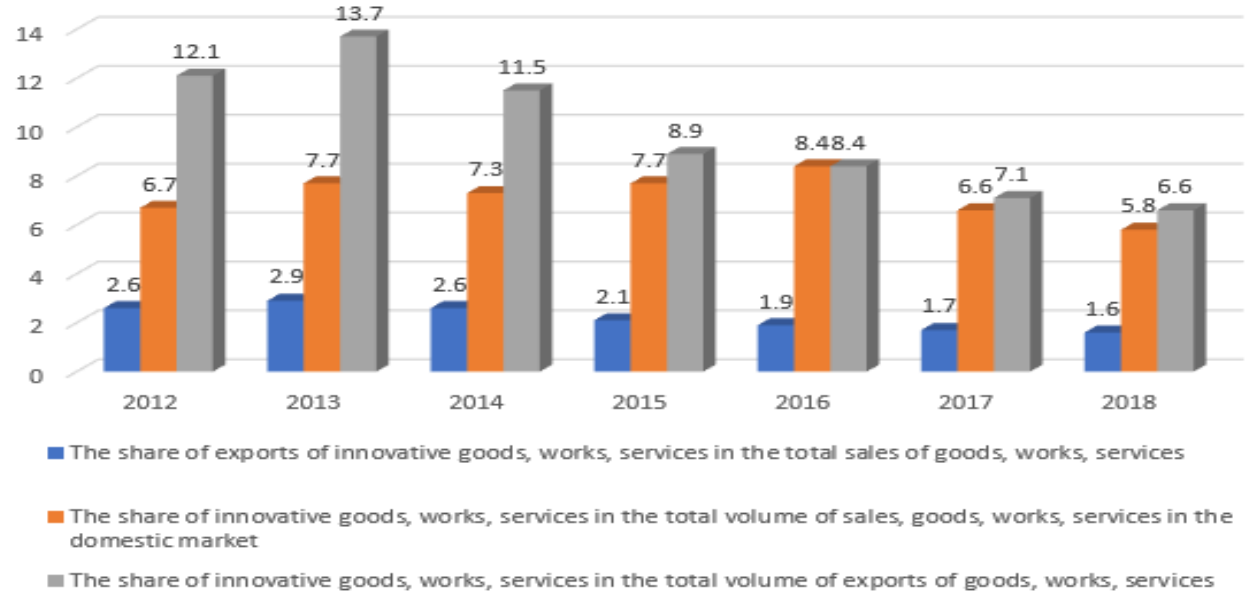

Fig. 4. Indicators of export activity of the agro-industrial complex in 2012-2018
Source: Own calculations based on the data [19].

About 40-50% of innovations and advanced scientific and technological achievements and developments remain unclaimed in the industry annually [8]. The current agrarian policy does not provide for the social development of agriculture and sustainable growth using innovative factors [26].

In modern conditions of the coronavirus pandemic and sanctions policy, it is especially important to increase the export potential and the formation of an export-oriented agricultural economy. The dynamics of export activity indicators are shown in Fig.4.

Figures 5 and 6 shows the indicators of financial support for the implementation of the priority project "Export of agricultural products" within the framework of the State Program for the Development of Agriculture and Regulation of Agricultural Products Markets [19].

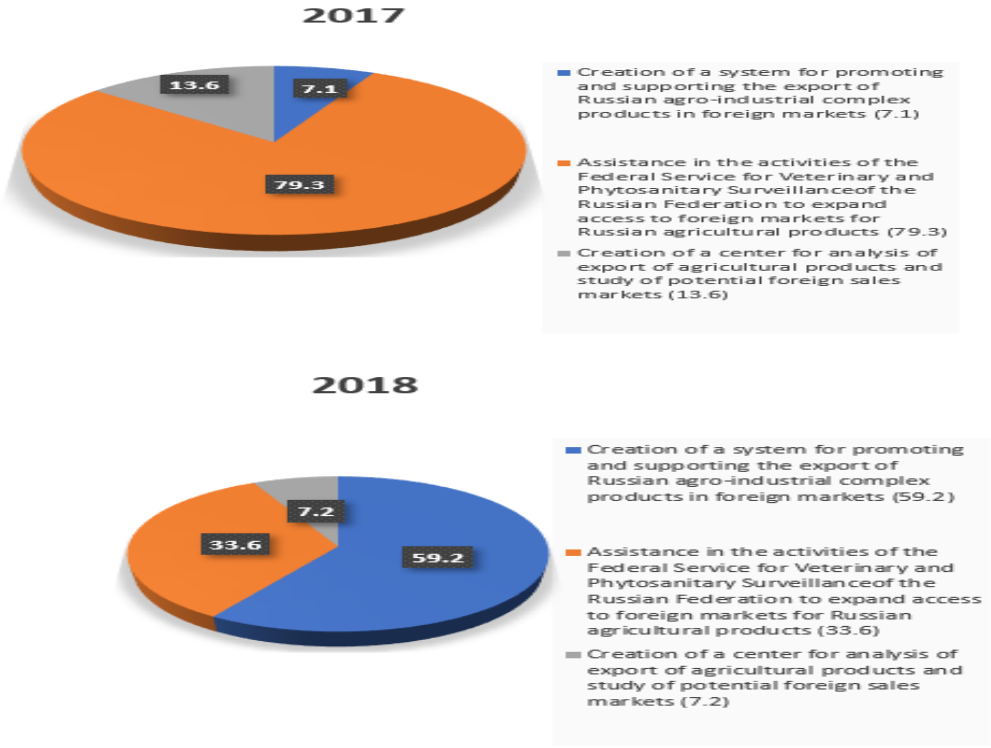

Fig.5. The structure of federal budget expenditures for the implementation of the priority project «Export of agricultural products" in 2017-2018», %
Source: Own calculations based on the data [25].

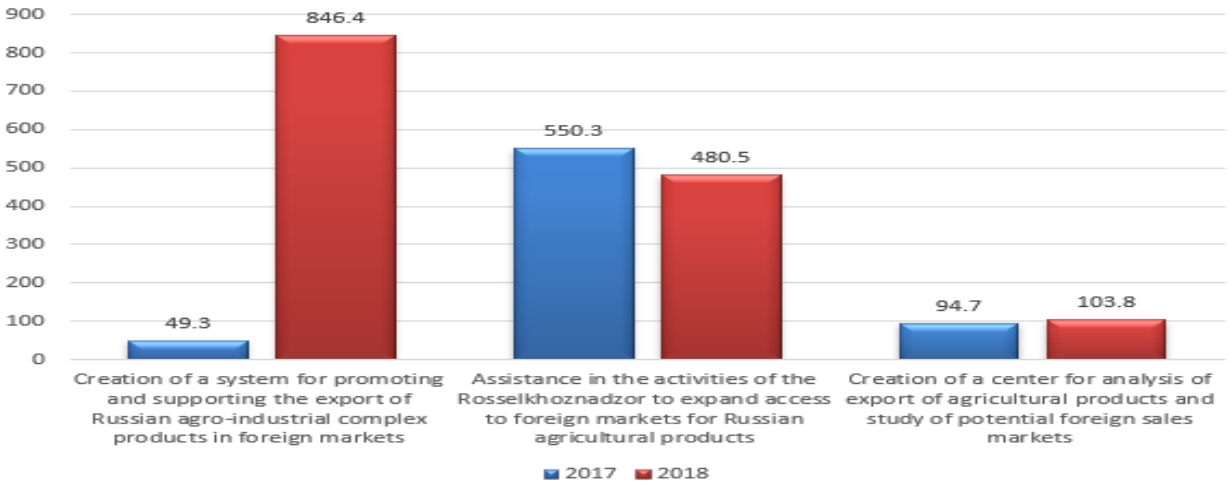

Fig. 6. Structure of federal budget expenditures for the implementation of the priority project "Export of agricultural products" in 2017-2018, million rubles
Source: Own calculations based on the data [25].

The development of an export-oriented agricultural sector of the economy based on the formation of balanced innovative agricultural systems presupposes the coordination of the efforts of stakeholders in the innovative processes of production and consumption of agricultural products; increasing sales markets, improving the quality of manufactured products, and reducing costs, building up the professional competencies of the main stakeholders, creating the necessary conditions for the self-development of innovative agricultural systems [25]. The study formulates methodological principles for the formation of innovative agricultural systems to develop organizational, economic, and financial mechanisms for the acceleration of innovative development (Fig. 7).

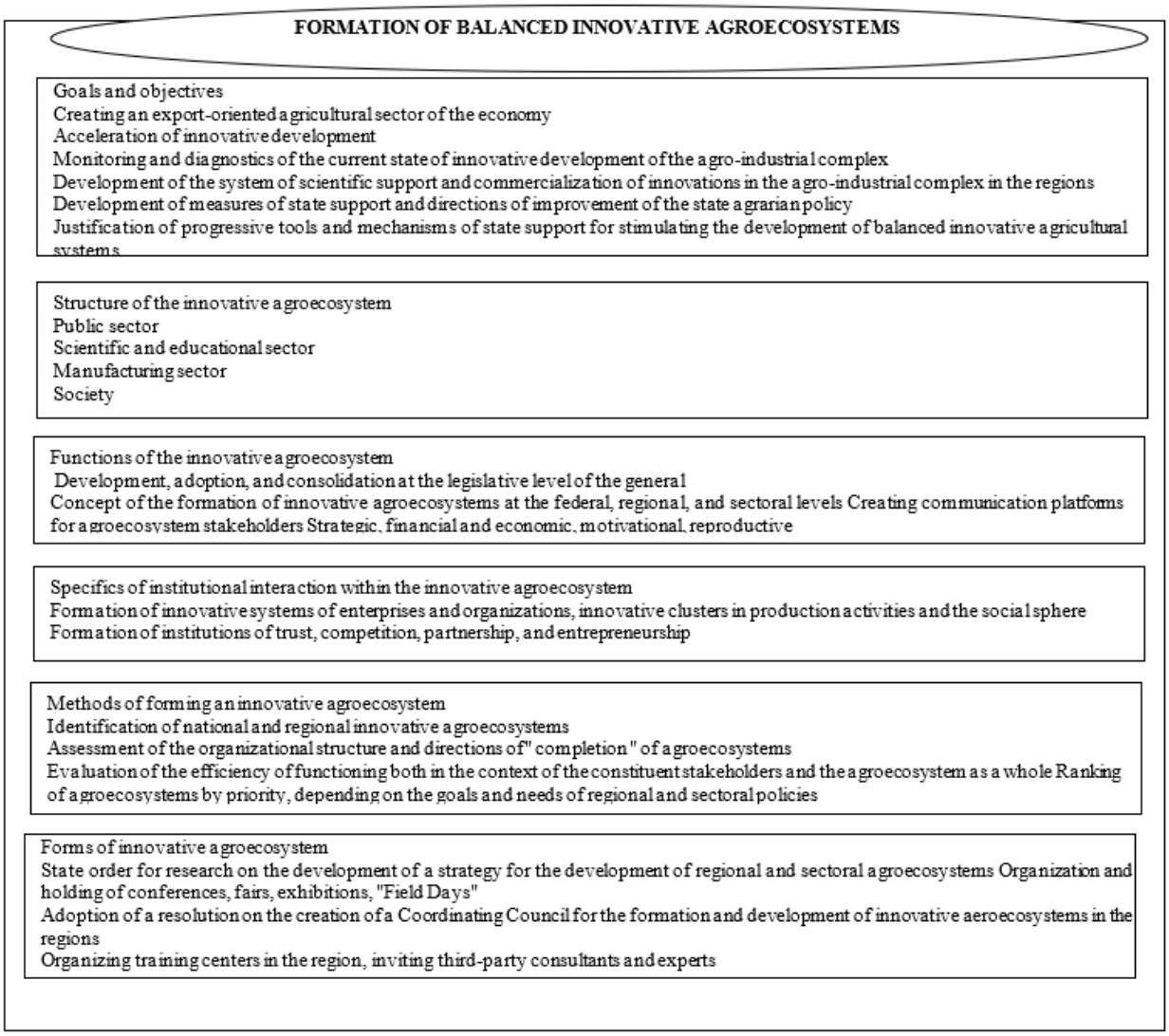

Fig. 7. Methodology for the formation of balanced agroecosystems in order to accelerate innovation and technological development.
Source: Own calculations.

(1)The principle of priority development of the regional infrastructure of the agro-industrial complex indicates the need for priority investment and supply of resources to those sub-sectors and enterprises that form the infrastructure of the agricultural system in the region;

(2)The principle of forming a balanced agricultural policy based on the flow of knowledge, competencies, technologies of the main stakeholders;

(3)The principle of direct and equal partnership within the agrosystem presupposes the creation of conditions for the

implementation of institutional functions, tasks, and mechanisms for accelerating the acceleration of innovative development of the agro-industrial complex.

(4)The principle of export-oriented orientation presupposes a policy aimed at integration into the world market;

(5)The principle of the synthesis of public and private sources of financing and stimulation of the formation of balanced agricultural systems involves the simultaneous use of mechanisms for creating agricultural systems and the formation of state coordinating bodies, making public investments and allocating resources to support and develop agricultural systems.

To develop effective organizational, economic, and financial mechanisms to stimulate the acceleration of innovative and technological development, it is necessary to study in more detail the essence and specifics of the formation of innovative agroecosystems. The figure 8 shows methodological approaches to the formation of balanced agroecosystems to accelerate innovative and technological development.

State support for the development of the agro-industrial complex in Russia is currently carried out within the framework of five key programs and projects: "The State Program for the Development of Agriculture for 2013-2020." [42]; State program "Comprehensive development of rural areas" [36] "Federal scientific and technical program for the development of agriculture for 2017-2025." [14]; National project (program) "International cooperation and export" [29]; National project "Small and Medium Business and Support for Individual Entrepreneurial Initiatives" [45].

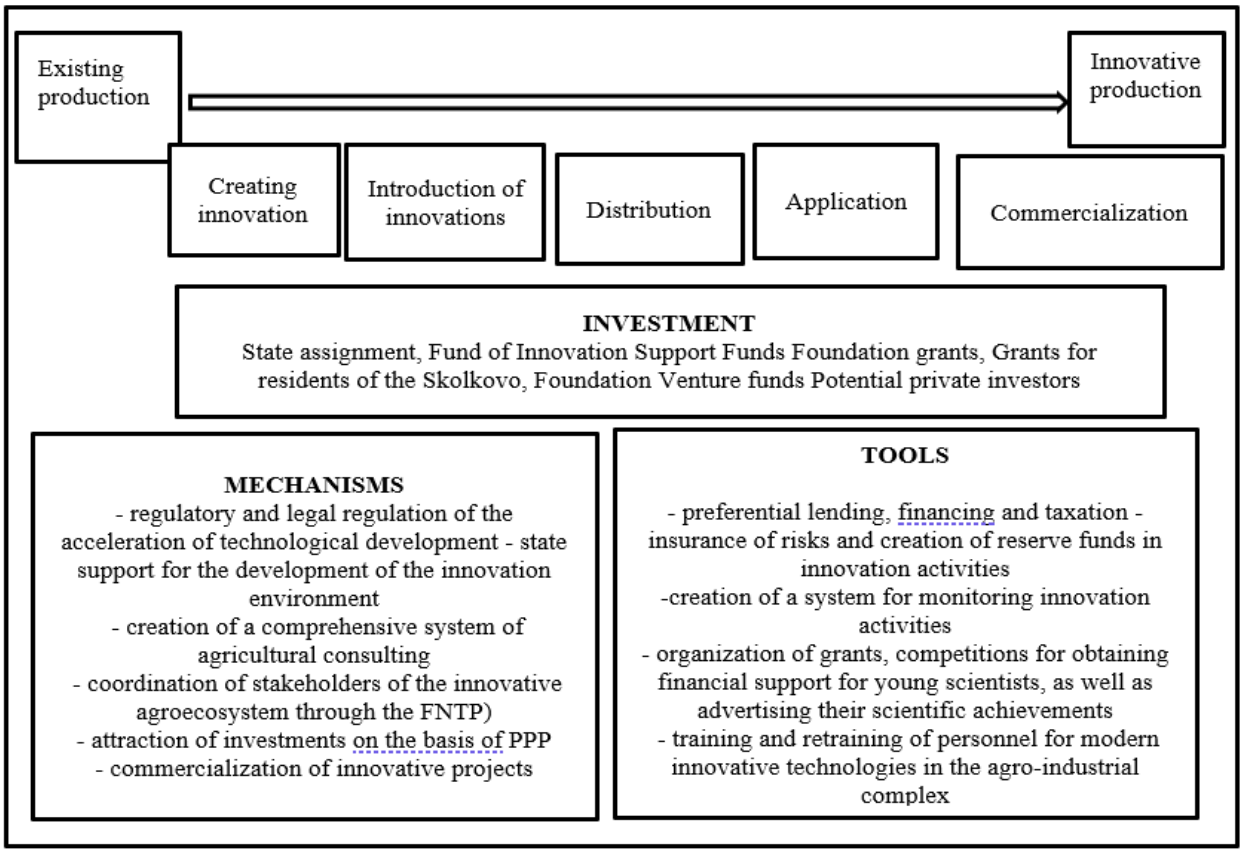

Fig. 8. Mechanisms and tools for stimulating and supporting the acceleration of technological development of the agro-industrial complex
Source: Own calculations.

Each state program and project has corresponding budgetary funding, which may be revised in connection with the COVID-19 pandemic [28, 38]. State support for the acceleration of innovative and technological development is carried out in direct, indirect, and mediated forms. The direct form of support is the "State Program for the Development of Agriculture for 2013-2020", "The Federal Scientific and Technical Program for the Development of Agriculture for 2017-2025. When implementing support in this form, producers, and consumers of scientific products are forced to be guided in their economic activities by the norms and rules established at the legislative level. With indirect support from the state, prerequisites are created for independent decision-making by both manufacturers and consumers of scientific products. An example is the creation of selection and breeding centers within the framework of the national project "Science". An indirect form of support is not directly related to both producers and consumers of scientific products but has an indirect impact on their development. An example is the Integrated Rural Development Program.

Support at the early stages of the innovation process is carried out through general instruments: grants from the RFBR (Russian Foundation for Basic Research) and Russian Science Foundation (Russian Science Foundation), a state assignment of the Russian Academy of Sciences. For developers of innovative solutions (starting from the pilot stage): grants for residents of the Skolkovo Foundation, as well as for venture capital opportunities through the Skolkovo Venture Fund - Agrotechnical I, created in 2018. Investments in start-ups in the agro-industrial complex are also carried out by private venture funds [20]. In this case, the attention of the state should be focused on the formation of a favorable investment climate, modernization of science and agricultural education. Some proposals to improve the efficiency of state support in the scientific and technological sphere of the agricultural sector of the economy. The article proposes the creation of the Fund of Funds for the Support of Agro-Innovation as a key element of the investment mechanism for financing and distributing funds on the principles of co-financing from the state and large agribusiness. Moreover, co-investors, along with the powers of the Fund, can participate in the investment committee and make the most active decisions.

CONCLUSIONS

The article develops theoretical and methodological foundations for the formation of balanced innovation and investment agricultural systems and practical mechanisms for accelerating the technological development of the agro-industrial complex. The methodology for the formation of balanced innovative agroecosystems is based on the synthesis of theories that determine the content, essence, specifics of the interaction of structural elements and the dynamics of the development of ongoing processes. The study of the dynamics of the development of the course of innovation processes is determined by the specifics of the absorption capacity of knowledge absorption, marketing mechanisms to stimulate the demand for innovation, the functional characteristics of the actors of the innovation process - institutions of science, the state, agribusiness, taking into account the needs of society in the context of digital transformation. The paper substantiates the synergy of interaction between the state, universities, academic institutions, agribusiness, taking into account the needs for innovation in the context of industries and regions. The author's innovative agroecosystem in the context of the dynamics of the development of the processes taking place in it is presented as a flexible, open, multifunctional dynamic network structure of a full cycle, aimed at researching the need, creating, introducing, distributing, commercializing and applying various types of innovations in accordance with the socio-economic needs of industries and regions. The paper analyzes and evaluates indicators characterizing innovation and investment, export activity and the process of modernization and rationalization in the Russian agro-industrial complex in 2012-

2018, reveals disparities in the level of investment and efficiency of agricultural production. The article develops the principles of the formation of innovative agricultural systems and methodological approaches to their formation and development in order to develop organizational, economic and financial mechanisms for the acceleration of innovative processes. Organizational, economic and financial mechanisms and instruments of state support for the acceleration of innovative and technological development have been developed. For the further development of the agro-industrial complex, it is necessary to form a system of financial institutions for uninterrupted continuous financing of agribusiness at all phases of the innovation cycle. These investment institutions include government assignments, grants from funds, grants for residents of the Skolkovo Foundation, venture funds, funds to support small innovative businesses, public-private partnerships, and impact investment.

Stimulating the acceleration of the technological development of the agro-industrial complex requires the implementation of an active state innovation policy, which should be aimed at creating conditions for the effective development of innovative activities and the further formation of development institutions (technology parks, venture funds, business incubators, etc.), consolidating the Concept at the legislative level. the formation of regional and sectoral innovative agroecosystems in order to increase the export potential of the domestic agro-industrial complex and the formation of a model of an export-oriented agricultural economy.

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COVID-19: INSTITUTIONAL PREREQUISITES FOR NEW FORMS OF RENT-SEEKING IN THE TOURISM INDUSTRY

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Abstract

This article examines the institutional problems and new forms of rent - seeking in the tourism sector of Bulgaria in terms of changes in the impact of Covid -19 after the declared state of emergency in the country on March 13, 2020. The study applies: (1) analysis of search conditions on rent; (2) the role of Covid -19 and the creation of new forms of rent-seeking; (3) negative economic effects are presented by measuring rents. The impact of Covid-19 measures and legislative initiatives help to create rent-seeking.

Key words: *Covid 19, institutional impact, rent-seeking, tourism*

INTRODUCTION

The phenomenon of rent-seeking has been of interest to many authors over the past fifty years. The problem has long since acquired an economic, political, environmental and social character. Its continuing relevance is due to the fact that it can be used to assess the negative impact of the economic system, on the one hand, and on the other hand the generation of losses in it. In this regard, the study of rent-seeking must be interdisciplinary.

Tourism is one of the most important sectors of the Bulgarian economy. It occupies 12% of the country's GDP, and 11% are employed in it. Natural capital, unique sites and a favorable climate are a source of income for approximately three hundred thousand Bulgarians. Therefore, the distribution of goods and resources related to this sector is essential. Some of the participants earn unreasonably by using non-market methods and with minimal effort receive a steady income.

Under Covid-19 circumstances, the state has created rules for the tourism sector, triggering the rent-seeking paradox.

The purpose of the paper

The aim of the development is to establish the new forms of rent-seeking in the conditions of Covid-19 in the tourist branch of Bulgaria. Due to the current state of emergency in the country, the number of cases in which companies in the sector have benefited at the expense of partners and customers, although they have not fulfilled contracts, have not provided services or used freely the money of their customers and more, has gone up.

The stages of the study are:

- Analysis of the prerequisites for rent-seeking in tourism, including the benefits, barriers, results for economic agents;
- The role of Covid-19 in the search for rent-seeking and its new forms;
-Recommendations for improving the environment in order to reduce the rent-seeking in the country's tourism.

MATERIALS AND METHODS

In accordance with the purpose of the study to establish the rules, leading to various forms of rent-seeking - "system error" - is used normative legal analysis. To study the aborted journeys to measure their value and what is the impact used comparative institutional analysis. Graphically and retrospectively are presented the costs related to planning the current activity without expecting income. A graphical comparison of the total losses of tour operators and travel agencies by country. Information from the National Statistical Institute of the Republic of Bulgaria (NSI)

and information from 150 cases presented by 25 companies engaged in tour operator activity were used.

RESULTS AND DISCUSSIONS

Rent-seeking and Service sector

Rent-seeking refers to all unproductive, alienating activities that bring a positive return to the individual, but not to the society as a whole. The allocation of resources for rent-seeking has a cumulative effect on the economic activity in several ways. First, to the extent that rent-seeking is sought from activities such as corruption and tax evasion, lower incentives and opportunities for production and investment, overall economic performance is declining. Second, rent-seeking can compete with productive sectors for scarce economic resources, leading to uneven distribution of labor, capital and talent in the economy.

The rent-seeking has been known for a long time. Levy (1988) [8] describes that an important prerequisite for participation in tax activities in Rome was the availability of sufficient capital, which allowed wealthy Roman citizens to provide funds to rulers and collect taxes. Wade (1984) [13] examines the relationship between administration and farmers in India related to the provision of access to water. Taking the place in the state body was the only opportunity for their relatives to receive from the resource. Water was free, but the farmers had actually paid in advance for the job. In practice, some of the employees in higher positions earned a steady income through these appointments. Baumol (1988) [3] points out that the choice of civil service is related to the possibility of receiving unregulated income. Eventually, officials began to earn more than the wages associated with their daily activities by circumventing the rules. These side incomes in many cases become permanent.

Contemporary authors view the problem in many ways. They come to the conclusion that government activities, ownership, way of resource allocation is not the only condition for the existence for rent-seeking. Rent-seeking is also present in private relations, in the markets even in the conditions of competition, as mentioned by Tullock (1967) [10].

However, Krueger (1974) [6] is the one who defines the term. According to her, the rent-seeking can be linked to economic payments controlled by the political state system. In this regard, non-market payments even always lead to conditions for rent-seeking. Taxes and subsidies could distort the market and make it less efficient. That is, the rent-seeking is typical for both public and private activities.

Stiglitz (2010) [11] considers specific forms of rent-seeking behavior. For him, the rent-seeking is created by those rules that lead to social inequalities in the economic system. The author says that unfounded rules in favor of someone controlling the economic organization are the cause of negative externalities. He defines that incentives to concentrate wealth are at the core of annuity demand.

Niskanen (1975) [9] believes that bureaucracy creates the conditions for some market participants to gain an advantage. He promotes the notion that bureaucrats are trying to maximize their budgets. Thus they achieve utility. He lists some variables that he defines as "useful", namely increasing his salary, reputation, power. But critics dispute this thesis, saying it is only a personal benefit and has nothing to do with the public interest. On the contrary, other private entities are affected. Even privatized government activities can lead to incentives to rent-seeking.

- Information asymmetry
- Intensive and diverse institutional changes
- Problems of coordination structure
- Problems of distribution of property rights

Institutional prerequisites for rent-seeking in tourism in Bulgaria

Akerlof (1970) [1] identifies some serious problems affecting markets, characterized by asymmetric information. According to a contemporary theory, uncertainty is largely due to information asymmetry - the uneven and unequal distribution of information in conditions of limited rationality and opportunism leads to the rent-seeking. In the

tourism of Bulgaria we observe a great number of such examples.

The reduction of some indirect taxes has led certain players in the tourism sector to benefit from the distribution of rights. This distribution of profits is not transferred as value to consumers at the expense of price. It becomes an annuity for the service seller.

The country's legislation introduces new, numerous rules in tourism, which have been repeatedly changed and are still being amended during the state of emergency. They made it easier for some players to adjust and for others to get confused. In practice, the administration's measures allowed the larger players in the tourism industry to benefit at the expense of the smaller ones.

Activities were suspended after the imposition of the state of emergency. This disrupted coordination. Some market participants took advantage of the situation, albeit for a short time. They withheld not small sums at their own expense. Others have suspended operations indefinitely. This has led not only to an outflow of tourists, but also to significant economic losses.

Forms of rent-seeking in tourism in connection with Covid-19

Description of the forms

The alternative order of taxation. On the one hand, hoteliers are taxed for accommodation with a 9% VAT rate, according to The Amendment to the Law on Value Added Tax (VAT) - entered into force on 1 July as amended and ext. DV. issue 55 of 19 June 2020 [2].

On the other hand, tour operators (TO) and travel agents (TA), when performing the same service, are taxed at 20%.

It is known that a Tour operator (TO) is a specialized organization that creates tourist products and organizes the provision of tourist services.

Also, a travel agent (TA) is an organization that sells the services and packages of other companies (Tour Operators). TA acts as an intermediary between the client and the Organizer of the trip itself.

In the cases when a company, the addressee of the service, chooses to use it directly by the hotelier, he refunds the tax payment in full. According to the text of Art. 86 of the VAT Act - in the case of tax delivery for tour operators and travel agents - the latter has a "zero rate".

This puts the first group of actors in a better position than the second. Profit from the advantage is capitalized as a new form of rent-seeking.

Practice for advantage through unenforceable clauses. In the contracts concluded between a tour operator and a consumer during the crisis with Covid-19, emerged a new practice - a tour operator imposes an agreement in which a clause for "withdrawal from the contract without the consumer to pay a penalty" can be activated only in extremely short time - 24 hours. These deadlines are unenforceable for consumers. A contractual relationship where "unreasonable" time limits are introduced under EU law is a breach of the principle of effectiveness. However, the same is a prerequisite for rent-seeking.

Money withheld in case of cancellation.

In case of refusal of consumers to pay extra for a service - organized tourist trip - under the emergency legislation related to Covid-19, the Bulgarian authorities allowed tour operators to withhold payment for canceled trips for a period of 12 months. Although in the event of an unrealized trip, the TO is obliged to offer an alternative (to change the date of the reservation or to choose another destination) or to return the money in many cases, the TO refuses the alternatives, justifying its possibility to cancel the contract and to withhold the amount paid in advance as a form of "contract termination costs". Retained money is a new form of rent-seeking. The same goes for airlines. The latter can also withhold money from unused plane tickets. Carriers believe they can withhold these amounts in full.

Error when searching in the reservation system

International Air Transport Association (IATA) accredited agents have the right to sell airline tickets to most airlines. Accreditation requires strict compliance with the rules imposed by the international organization on the number and qualification of staff, volume of activity, security of payments, work with

the Billing and Settlement Plan system and others.

It is know that BSP is a system designed to facilitate and simplify sales, reporting and control procedures of IATA accredited travel agents. It improves financial control and cash flow for airlines.

The global system, covering 177 countries and territories, serves approximately 350 airlines. Gross sales volume: $ 249 billion. (IATA, 2013) [5].

In this system, the BSP is organized by algorithms that suggest the right way to search for airline tickets.

IATA has a monopoly on access to information. According to it, in case of a "search error" there is a violation of the airline's rules, which is expressed in the incorrect use of information in the electronic format of the system, which harms the carrier. Tour operators cannot circumvent these rules and have to pay the amounts requested by the airline for breach of contract. The information is disseminated asymmetrically and, in addition to IATA, carriers and licensed agencies have information that the ordinary tour operator does not have access to. That is, because of IATA's market power, there is a lack of transparency, which becomes a form of rent-seeking. At the time of the survey, we had no information on whether the airlines were actually part of an informal coalition with IATA and whether they were taking advantage of these amounts.

Self-inflicted bankruptcies

This is another entirely new form rent-seeking in tourism. Many tour operators have difficulty supporting themselves, as they have incurred costs in the last few months that are inherently difficult to reimburse.

Their counterparties virtually suspend all payments - which leads to consider these amounts as recoverable. In the medium term, their average variable costs cannot be covered, which makes them consider their bankruptcy foreshadowed (Fig.1).

Regarding their future activity in the short term in August, 36.4% of the managers plan to continue with their current activity, 35.2% of them expect to continue their activities, with reduced volume, 23.0% foresee to suspended activity temporarily, and 4.2 % predict to discontinue it.

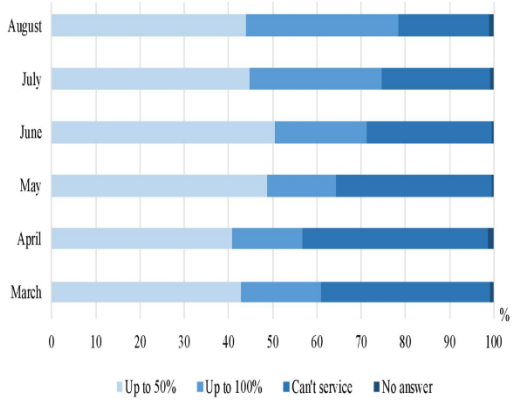

Fig. 1. Opportunity to serve the cost of the activity with your own funds in short term (one month) by month
Source: A graph showing the NSI survey, Activity and condition of accommodation in the conditions of an epidemic situation from March to August 2020, pp.2-3 [12].

Despite this, they continue to accept money for new bookings knowing that they will not reverse the service, it they will not return the money because they will probably be insolvent under Chapter Four of the Commercial Act of Bulgaria [4].

In this situation, we believe that through the amounts they provide an unjustified benefit - rent-seeking.

Measurement of rent-seeking in tourism in connection with Covid-19

Following the declared epidemic, many countries have closed their borders to travel and tourism.

Others introduced general quarantine. Many airlines have cancelled flights. Group visits to landmarks were also collected. Tourism found itself in a difficult situation and ceased operations.

But the money of the tourists remained in the travel companies, although they could not make their trips. The Bulgarian government has passed a law to withhold these payments for 1 year. It is about Law on Measures and Actions during the State of Emergency, announced by a decision of the National Assembly of March 13, 2020 and on overcoming the consequences (Title supplemented, SG No. 44/2020, effective 14.05.2020 d.) [7].

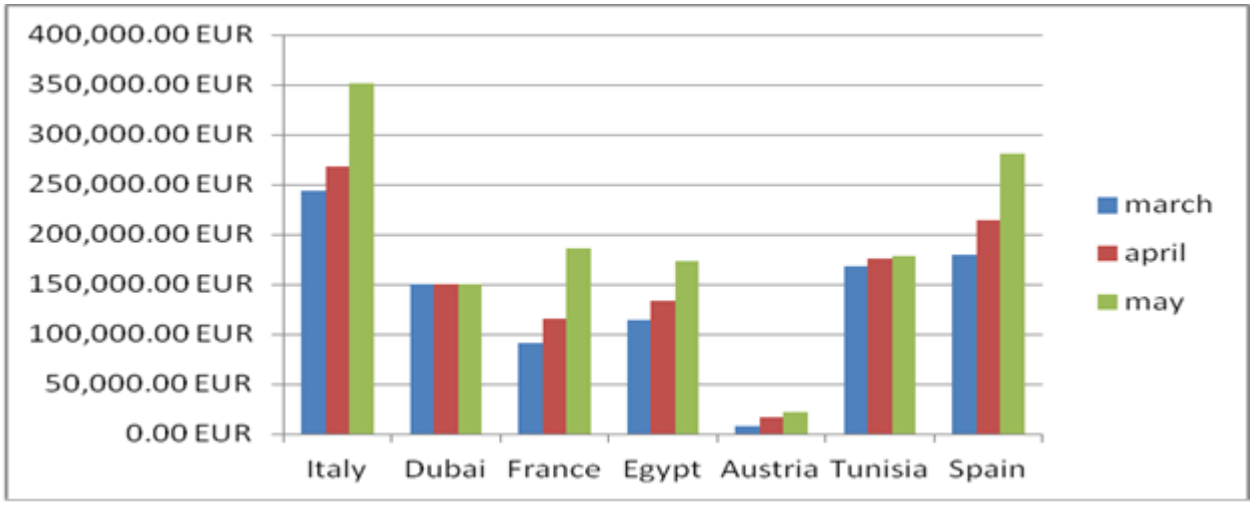

Fig. 2. The money withheld by travel companies for failed organized tourist trips in different countries
Source: own concept based on several travel agencies.

CONCLUSIONS

The conditions easily identify Covid-19 forms of rent-seeking. Information asymmetry creates opportunities for certain entities in the sector to present their behavior as legitimate, although this is not the case. Accordingly, they mislead consumers and thus manage to secure sustainable rents during the crisis. These rent-seeking distort the incentives of economic agents to invest.

The special legislation regarding the pandemic cannot contradict the special legislation related to the protection of absolute rights. That is, rights can be limited only temporarily. They cannot be taken away.

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EFFICACY AND AFTER-EFFECT OF HERBICIDE PREPARATIONS IN THE MAIZE-WHEAT CROP-ROTATION UNIT

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Abstract

The purpose of the study was to trace the after-effect of soil and leaf herbicides applied in maize on the next crop in rotation – wheat. In a 4-year period were carried out field experiments. The efficacy and selectivity of herbicides in maize were traced. Visual observations of plants of wheat were conducted during various phenological phases of the crop: germination, first leaf displayed (BBCH-11), two leaves displayed (BBCH-12), tillering (BBCH-20), lactic maturity (BBCH-77). Manifestations of phytotoxicity on the wheat plants were not established. After-effect of the herbicides was traced and the formation of major quantitative traits: plant height, length of classes, number of classes, number of grains in the class and weight of grain in the class. By variance analysis of pooled data were analyzed signs and evidenced the differences compared to the untreated control. The differences between the variatns with treatment and the control are essential. This confirms the visual assessments about the lack of negative after-effect of Laudis OD, Lumax 538 SC, Elumis, Gardoprim plus Gold 500 SC, Wing P, Stellar, Casper 55 VG and Merlin flex, applied in maize, on the next crop in rotation.

Key words**:** *development, efficacy, elements of crop yield, maize, herbicides, wheat*

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important food and feed crops in the world. Over the last few years, there has been a steady tendency to an increase of the planted areas in Bulgaria, from 328,000 ha to 473,200 ha (*Report 2010-2020, Ministry of Agriculture and Food in the Republic of Bulgaria).* According to Popescu A. *et al*. the main agricultural crops cultivated in Romania are cereals. Agricultural production is mainly represented by cereals which achieved 30.41 million tons, of which maize grains 17.43 million tons (57.31%) [16]. Maize is highly susceptible to weeding. Weed species and its population density adversely affect the biomass accumulation of maize (fresh and dry); the plant height, leaf area, grain length, their mass, the number of grains per ear, and overall on maize yield reduction [3, 9, 13]. According to studies by various authors, at heavy weeding, the maize yields can be reduced by 77 to 91%. Research is also available on the indirect damage of the weeds on maize [5], as well as on manifestations of resistance of economically important weeds in maize production to certain active substances [2]. Research at home and abroad show that in order to reduce the harmful effects of weeds on maize, it is necessary to apply a complex of protective and agro-technical measures, in combination with chemical control agents [7, 11, 12, 18, 21]. A number of authors have reported data on the biological effect of soil and leaf herbicides on weeding in maize, as well as on their impact on grain yields, [3, 8, 20,]. In recent years, a number of studies have been conducted in Bulgaria on the efficacy of a significant number of herbicides for weed control in maize. For example [8] report that, under a three-year experiment, the studied soil and leaf herbicides have a very good effect on the available weeds by the 40th day after treatment. The dynamics in the development and production of the crop depend to a large extent on the soil and the climatic conditions, as well as on the agro-technology [4]. Herbicides are a major means of reducing the losses caused by weeds, and are an integral part of modern crop technologies. However, their intensive application leads to

environmental pollution, including accumulation in soil and subsoil, [1, 14, 15]. Currently, over 260 herbicidally active compounds are known, on the basis of which hundreds of commercially available products are formulated. Recent generation herbicides are significantly more effective, used in low concentrations and are relatively rapidly degraded by soil microorganisms.

Researchers around the world are developing, enhancing and optimizing methods for the detection of herbicide residues in soil, however, studies related to identifying the after-effects of herbicides on the growth and yield of subsequent crops in crop rotation are still insufficient [19]. This type of research is therefore particularly relevant, and the data obtained provide more complete information on herbicide preparations in order to achieve a higher environmental and economic result in the use and optimization of the production of safe foods.

MATERIALS AND METHODS

Field experience with hybrid corn Kolomba (450 FAO) is based on the experimental base of the Agricultural University - Plovdiv, Bulgaria, in the period 2011 - 2014. The block method was used, with the size of the experimental plot 21 m^2, in four replications.

Table 1. Variants of the experiment

Soil herbicides		
Lumax 538 SK	375 g/l *S-metolachlor* +125 g/l *Terbuthylazine* +37,5 g/l *Mesotrione*	4 l/ ha
Gardoprim Plus Gold 500 SK	312,5 g/l *S-metolachlor* +187,5 g/l *Terbuthylazine*	4,5 l/ha
Wing P	212,5 g/l *Dimethanamid-p* +250 g/l *Pendimethalin*	4 l/ha
Merlin flex	240 g/l *Isoxaflutole*	420 ml/ha
Leaf herbicides		
Laudis OD	44 g/l *Tembotrione*	2 l/ha
Elumis	30 g/l *Nicosulfuron* +75 g/l *Mesotrione*	2 l/ha
Stelar	50 g/l *Topramezone* + 160 g/l *Dicamba*	1 l/ha
Caspar 55WG	50 g/kg *Prosulfuron* +500 g/kg *Dicamba*	300 g/ha
Controls		
Untreated cultivar		
Untreated cultivar with cultivation		

Source: Own experiment.

As variants for chemical weed control, the herbicides presented in Table 1 were tested: Variants Untreated cultivar and Untreated cuiltvar with cultivation were used for control. The soil in the examined region is classified as alluvium. Based on the international classification of FAO, it is defined as Mollic Fluvisols. It is characterized by average sandy-clay mechanical composition, not high humus content of 1.01-1.32%, a weak alkaline reaction of the soil (pH 7.6 to 7.9), carbonate content of up to 1.65% and lack of salts (0.06-0.07%) [17].

Maize is grown by established technology for tillage, fertilization, sowing, rolling. The herbicides are applied with a hand sprayer at a solution consumption of 30-40 l/da. To study the effectiveness of herbicides, two reports were made in each plot of the experiment - on the 28th and 40th day after treatment with soil herbicides; and on the 20th and 40th day after leaf herbicides.

2011 and 2012 are characterized by different agrometeorological conditions during the maize vegetation. In 2011 the spring is moderately warm and dry. The precipitation in January is only 24.6 l/m^2, while in the following 2012 the precipitation is 120.2 l/m^2. The summer of 2011 is very hot, but the rainfall is close to normal.

The pre-sowing preparation of the areas for sowing in 2012 was made in the conditions of extreme drought. In March and April of the same year the precipitation was only 27.1 m^2, which hindered the growth of certain groups of weeds, typical for this period. Heavy later rains (in May - 160.8 l/ m^2), however, created conditions for secondary weeding and reporting good effectiveness of soil herbicides.

RESULTS AND DISCUSSIONS

During the vegetation periods of maize in 2011 - 2013 there are agrometeorological conditions for strong weeding of the experimental plots mainly with late spring species. Mainly ten species of weeds were identified, with predominant annual dicotyledon species: red-root amaranth (*Amaranthus retroflexus* L.), blackberry nightshade (*Solanum nigrum* L.), goosefoots (*Chenopodium album* L.), common purslane

(*Portulaca oleraceae* L.), common cocklebur (*Xanthium strumarium* L.) and caltrop/ goat's - head (*Tribulus terrestris* L.). Annual cereals are represented by green bush (*Setaria viridis* L.) and green foxtail (*Setaria glauca* L.). Of the perennial species, the main representatives during the experimental period were the Johnsongrass (*Sorghum halepense* L.), and bindweed (*Convolvulus arvensis* L.). The results obtained regarding the efficacy of the tested herbicides for the three trial years are demonstrated in Tables 2 - 5. In 2011 and 2012, the soil herbicides fully controlled the available weeds - from 92.6% for Merlin flex (2012) to 99.2% for Lumax 538 SK (2011). The leaf herbicides showed similar efficacy for this period. For Laudis, Elumis, and Stellar, weed control was above 95% during both reporting periods. Casper showed lower results by 4-5%, due to its spectrum of action, as this preparation is not effective enough against wheat weeds.

Table 2. Efficacy of soil herbicides on maize on the 28th day after treatment, 2011-2013

Variants	**2011**		**2012**		**2013**		**Average for the period**	
	Weeds n./m^2	Efficacy,%	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %
UTC	564.0	-	284.0	-	172.0	-	340.0	-
UTC with cultivation	45.8	91.9	13.5	95.2	47.0	85.5	28.1	91.7
Lumax 538 SK – 4l/ha	4.7	99.2	9.3	96.7	36.0	81.4	15.3	95.5
Gardoprim Plus Gold 500 SK– 4l/ha	6.3	98.9	6.5	97.7	44.0	79.6	15.9	95.3
Wing P – 4l/ha	11.8	97.9	16.5	94.2	36.0	82.0	19.8	94.2
Merlin flex - 420 ml/ha	17.6	96.9	21.0	92.6	62.0	79.1	24.9	92.7

Source: Own survey.

Table 3. Efficacy of soil herbicides in maize on the 45th day after treatment, 2011-2013

Variants	**2011**		**2012**		**2013**		**Average for the period**	
	Weeds n./m^2	Efficacy,%	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %
UTC	602.0	-	597.0	-	220.0	-	473.0	-
UTC with cultivation	57.0	90.4	37.0	93.8	55.0	73.8	49.9	89.4
Lumax 538 SK– 4l/ha	9.5	98.4	19.3	96.8	65.0	69.0	31.3	93.4
Gardoprim Plus Gold 500 SK– 4 l/ha	11.4	98.1	18.6	96.9	60.0	71.4	30.0	93.7
Wing P – 4 l/ha	19.4	96.7	21.4	96.4	58.0	72.4	32.9	93.0
Merlin flex – 420 ml/ha	22.1	96.3	28.8	95.2	61.0	70.9	37.3	92.1

Source: Own survey.

Table 4. Efficacy of leaf herbicides on maize on the 20th day after treatment, 2011-2013

Variants	**2011**		**2012**		**2013**		**Average for the period**	
	Weeds n./m^2	Efficacy,%	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %
UTC	706.0	-	724.0	-	316.0	-	582.0	-
UTC with cultivation	6.0	99.1	9.0	98.8	90.0	71.5	35.0	94.0
Laudis OD – 2 l/ha	12.0	98.3	7.0	99.0	24.0	92.4	14.3	97.5
Elumis – 2l/dka	28.0	96.0	24.0	96.7	18.0	94,3	23,3	96.0
Stelar - 1 l/ha	8.0	98.9	7.0	99.0	34.0	89.2	16.3	97.2
Caspar 55WG - 300 g/ha	43.0	93.9	37.0	94.9	42.0	86.7	40.7	93.0

Source: Own survey.

In 2013, which was characterized by less favorable climatic conditions during the growing of maize, a lower efficiency of the applied herbicides was observed.

For the soil ones, it was ranging from 69% to 82% for both periods of monitoring, due to the severe drought after the second ten days of April and the whole of May, when the rainfall was only 3.4 mm/m^2, i. e. during the active period of action of the herbicides. For the leaf herbicides, the efficacy was higher and ranges from 77.8% to 96.8%.

For the soil ones, it was ranging from 69% to 82% for both periods of monitoring, due to the severe drought after the second ten days of April and the whole of May, when the rainfall was only 3.4 mm/m^2, i. e. during the active period of action of the herbicides. For the leaf herbicides, the efficacy was higher and ranges from 77.8% to 96.8%.

On average, during the test period, the efficacy of the soil herbicides is high - from 92.7% to 95.5% and is maintained until the 45th day after treatment. Leaf herbicide control is also high and ranges from 90.7% (Casper - 30 g/da) to 97.5% (Laudis OD – 200 ml/da). In the zero control, weed density reaches 564 n./m^2.

For the research period, more favorable conditions for the development of wheat were recorded in the growing 2013/2014 season, compared to 2012/2013 one.

The visual observations of the crop for manifestations of phytotoxicity due to the soil and leaf herbicide products applied in the previous crop were carried out through five phenophases of wheat: germination, first leaf displayed (BBCH-11), two displayed leaves (BBCH-12), twinning (BBCH-20), milky maturity (BBCH-77).

Table 5. Efficacy of leaf herbicides in maize on the 40th day after treatment, 2011-2013

Variants	**2011**		**2012**		**2013**		**Average for the period**	
	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %	Weeds n./m^2	Efficacy, %
UTC	767.0	-	797.0	-	424.0	-	662.7	-
UTC with cultivation	13.0	98.3	19.0	97.6	170.0	59.9	67.3	89.8
Laudis OD – 2 l/ha	19.0	97.5	12.0	98.5	52.0	87.7	27.7	95.8
Elumis – 2l/dka	34.0	95.6	34.0	95.7	48.0	88,7	38,7	94,2
Stelar - 1 l/ha	18.0	97.6	17.0	97.9	64.0	84.9	33.0	95.0
Caspar 55WG - 300 g/ha	48.0	93.7	42.0	94.7	94.0	77.8	61.3	90.7

Source: Own survey.

The data show that there were no visual negative effects on the wheat plants, Diamond variety (EWRS ball is 1). The effect of the applied herbicides on the height of the wheat plants, Diamond variety, and the formation of basic quantitative traits in the crop were also monitored (Table 6 and Table 7).

Table 6. Evidence of the differences by traits between the treatment variations and the untreated control, 2013-2014 (average) Height of wheat plants (cm)

Variants	$\bar{x}$	**D**	**Evidence**
5	81.34	1.19	ns
2	81.23	1.08	ns
3	81.11	1.12	ns
6	81.10	0.95	ns
8	80.65	0.50	ns
9	80.36	0.21	ns
UTC	**80.15**		
4	80.10	-0.05	ns
1	79.98	-0.12	ns
7	79.86	-0.24	ns
	$gD_{5\%}$ = 1.98	$gD_{1\%}$ = 2.85	$gD_{0.1\%}$ = 3.87

Source: Own survey.

Table 7. Elements of yield

Variant №	$\bar{x}$	D	Evidence	Variant №	$\bar{x}$	D	Evidence
Length of ear (cm)				Number of classes			
2	7.01	0.235	ns	9	46.95	0.97	ns
7	6.985	0.21	ns	8	46.58	0.6	ns
UTC	**6.775**			6	46.27	0.29	ns
5	6.735	-0.04	ns	5	46.07	0.09	ns
1	6.73	-0.045	ns	**UTC**	**45.98**		
8	6.71	-0.065	ns	1	45.79	-0.19	ns
6	6.675	-0.1	ns	4	44.90	-1.08	ns
4	6.575	-0.2	ns	2	44.56	-1.42	ns
3	6.49	-0.285	ns	3	44.16	-1.82	ns
9	6.485	-0.29	ns	7	44.11	-1.87	ns
LSD	5%	1%	0.1%	LSD	5%	1%	0.1%
	0.38	0.59	0.83		2.40	3.58	4.86
Number of grains per classes				Mass of the grain in the class (g)			
2	26.18	1.15	ns	9	1.04	0.095	ns
9	26.16	1.13	ns	2	1.005	0.06	ns
UTC	**25.03**			5	0.98	0.035	ns
5	24.87	-0.16	ns	**UTC**	**0.945**		
8	24.46	-0.57	ns	1	0.935	-0.01	ns
6	24.36	-0.67	ns	6	0.89	-0.05	ns
4	24.22	-0.81	ns	8	0.885	-0.06	ns
1	24.18	-0.85	ns	4	0.875	-0.07	ns
3	24.01	-1.02	ns	3	0.865	-0.08	ns
7	24.00	-1.03	ns	7	0.84	-0.10	ns
LSD	5%	1%	0.1%	LSD	5%	1%	0.1%
	2.16	3.75	5.32		0.11	0.21	0.35

Source: Own survey.

The characteristics were analyzed through variance analysis of the averaged data over the study period: height, length of ears, number of ear, number of grains in the ear, and mass of the grain in the ear [6, 10].

The reliability of the differences was evaluated against the untreated control. The values of the wheat plants height of the variants tested ranged from 79.86 to 81.34 cm (at untreated control - 80.15 cm); the length of the class was from 6.48 to 7.01 cm (at untreated control - 6.77); the number of classes from 44.11 to 46.95 (at untreated control - 45.95). The number of grains in one class was 24.0-26.18 (at untreated control - 25.03, and the mass of grains in one class was from 0.84 to 1.04 (at untreated control – 0.945).

It is noteworthy that for all traits, the differences between the treated variations and the control are insignificant, ie. they form values at the level of the untreated variant.

This confirms the visual assessment of the absence of adverse effects on the next crop – wheat, from the herbicides Laudis OD, Lumax 538 SC, Elumis, Gardoprim plus Gold 500 SC, Wing P, Stellar, Casper 55 VG and Merlin flex, applied to leaf and soil on maize.

CONCLUSIONS

Under experimental conditions, the soil herbicidal preparations exhibit very good to excellent efficacy against sensitive weeds, destroying from 92.6% to 99.2% of them.

The leaf herbicides Laudis OD, Elumis, Stellar, with the exception of Casper, destroy more than 95% of the annual weeds in the trial zone.

The visual observations, performed in five phenophases of wheat development, show that the herbicides Laudis OD, Lumax 538 SK, Elumis, Gardoprim plus Gold 500 SK, Wing P, Stellar, Casper 55 VG and Merlin flex, applied in soil and on leaves of the previous crop (maize), have no adverse effect on wheat as the next crop in the rotation.

The differences between the treated variants and the control, regarding the basic quantitative traits - the height of the wheat

plants, the length of the class, the number of classes, the number of grains in one class and the weight of the grain in one class, are insignificant, ie. they form values at the level of the untreated control.

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MATHEMATICAL MODELS DESCRIBING THE DYNAMICS IN AVERAGE PRICES AND PURCHASED QUANTITIES OF FRESH FRUITS

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Abstract

Data on product categories and hierarchical relationships among them are presented in a built relational database. Fresh fruits category, including 14 product types (cherries and morellos, apples, peaches and apricots, grapes, etc.) is the subject of consideration in this work. The article presents mathematical models describing the dynamics in average prices and purchased quantities of fresh fruits, average per household in Bulgaria. The examined period covers generally 17 years from 2001 to 2017. Linear and quadratic equations have been constructed and analyzed. The results show a growth in purchased quantities, average per household for almost all studied fresh fruits. A similar situation occurs with the other examined indicator. An increase in the average prices of the 14 fruit types has also been observed for the surveyed period, while for some of them (grapes, plums, pears, cherries and morellos, strawberries and raspberries), compared with the rest, this process has been more intensive.

Key words**:** *average prices, fresh fruits, linear and quadratic models, purchased quantities*

INTRODUCTION

Relational database management systems have become ubiquitous components of modern application software [10]. Each relational database management system uses two languages: data definition language for defining a relational database schema and data manipulation language for storing and retrieving data [14]. A relational schema specifies various properties of tables and columns within tables, the most important of which is the type of data contained in each column [15]. The relational database strongly supports security, consistency and avoids the redundancy of records [12].

Mathematical models are a useful tool in describing the dynamics of agricultural production regarding various products from the vegetal or animal sector and their prices at delivery, and also for studying the purchasing power of the households for various food products [2, 3].

Information concerning food and non-food products has been extracted from the web site of Bulgarian National Statistical Institute [11]. The indicated product categories and hierarchical relationships among them have been presented in a created relational database [1].

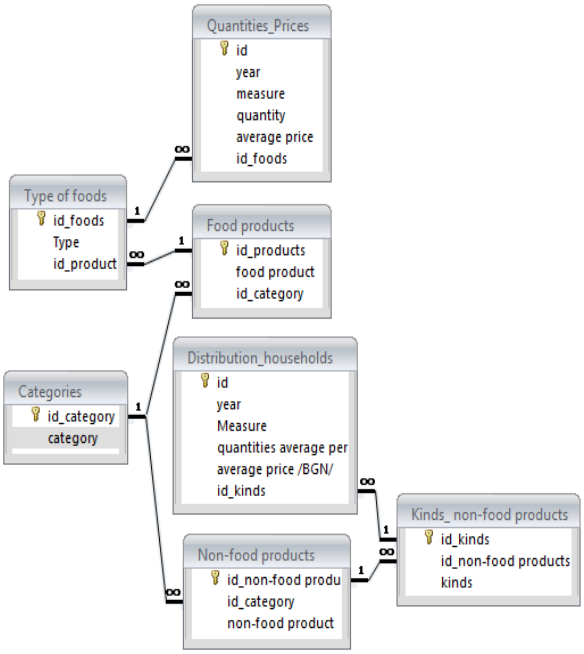

Fig. 1. Scheme of the database
Source: Own conception.

In this respect, Figure 1 presents the schema of seven tables which describe the relations between various product categories and

average quantities, average prices and also average quantities per 100 households.
The tables shown in Figure 1 are:
- Categories (id_category, category);
- Food products (id_product, food product, id_category);
- Non-food products (id_non-food products, id_category, non-food product);
- Type of foods (id_foods, id_product, type);
- Quantities_Prices (id, year, average price, measure, quantity, id_foods);
- Kinds_non-food products (id_non-food products, id_kinds, kinds);
- Distribution_households (id, year, measure, average price, quantities average per 100 households, id_ kinds).
Different datasets obtained from the listed database tables can be processed. For this purpose, certain mathematical-statistical methods for analysis [13], [6] and assessment can be applied. Some of them are regression and correlation analysis. Regression analysis forms the core for a family of techniques including path analysis, structural equation modelling, hierarchical linear modelling, and others [7]. While correlation analysis helps in identifying associations or relationships between two variables, the regression technique or regression analysis is used to "model" this relationship so as to be able to predict what will happen in a real-world setting [5]. This work considers part of the exposited issues about data concerning certain food products.
The aim of the article is to present mathematical models describing the dynamics in average prices and purchased quantities of fresh fruits for the period from 2001 to 2017 in Bulgaria.

MATERIALS AND METHODS

The created database stores information about the two main product categories for 17 years time interval. They include 20 food and 11 non-food products, respectively. The number of food product types is 79 and the number of non-food product types is 31.
The fresh fruits category has been studied in this work. It contains the following 14 product types:
- Cherries and morellos;
- Apples;
- Peaches and apricots;
- Pears;
- Plums;
- Strawberries and raspberries;
- Grapes;
- Olives;
- Watermelons and melons;
- Pumpkins.
The main surveyed economic indicators for the listed products include:
- Average prices;
- Purchased quantities, average per household;
- Period (examined years).

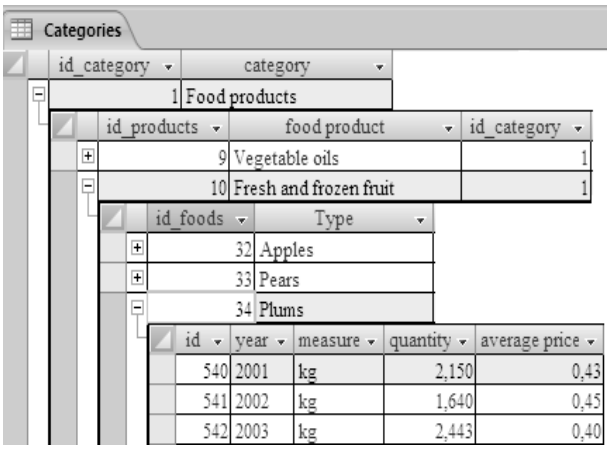

Fig. 2. Visualization of the information from the database tables
Source: Data from the National Statistical Institute, Bulgaria [11].

Information related to fresh fruits category has been presented in four database tables - Categories, Food products, Type of foods, Quantities_Prices (Fig. 2). The use of certain parameters (criteria) makes it possible to find the respective records from the tables. Subsequently, these data have been stored and processed. In this connection, it is necessary to calculate:
- The differences - $P_{i+1\,j}$ and $Q_{i+1\,j}$

$$P_{i+1\,j} = p_{i+1\,j} - p_{i\,j} \quad (1)$$

$$Q_{i+1\,j} = q_{i+1\,j} - q_{i\,j} \quad (2)$$

where: $p_{i+1\,j}$ and $p_{i\,j}$ - average prices of j^{-th} product for current and preceding year, $1 <= i <= 16$, $1 <= j <= 10$;

$q_{i+1\,j}$ and $q_{i\,j}$ - purchased quantities of j^{-th} product, average per household for given and preceding year.

If any of the examined differences ($P_{i+1\,j}$ or $Q_{i+1\,j}$) is greater than zero, then the relevant indicator (average price or purchased quantity) grows in the given year. Otherwise, that is, if $P_{i+1\,j} < 0$ or $Q_{i+1\,j} < 0$, then the value of the indicator decreases;

- The percentage change of the referred variables (purchased quantities, average per household and average prices) for each year compared with the preceding one:

$$g_{i+1\,j}\% = \frac{q_{i+1\,j}}{q_{i\,j}} \cdot 100 - 100 \qquad (3)$$

$$v_{i+1\,j}\% = \frac{p_{i+1\,j}}{p_{i\,j}} \cdot 100 - 100 \qquad (4)$$

The considered indicators have been studied in the years between 2001 and 2017. Linear and quadratic models have been constructed and analyzed. Software packages such as MS Excel [8] and R Commander [4], [9] have been used for the data processing.

RESULTS AND DISCUSSIONS

Information about each of these 14 fruits types has been searched from the database tables. For this purpose the parameter queries have been created and used. The necessary information has been extracted depending on the entered parameters (certain indicator, types of fruit, time period). As a result, the obtained information from the database about these objects has been stored in an xlsx file and has been analyzed.

The calculated values of the variable Q_{i+1j} are negative for 4 consecutive years about two of the examined products (grapes and pumpkins) as follows: for the first of them from 2002 until 2005, and for the second one in the period 2004-2007. Therefore, the purchased quantities of the referred products, average per household in the indicated time intervals continuously reduced. As can be expected, the lowest indicator values for the considered two fruit types were registered in 2005 and 2007 respectively. One interesting fact should be noted. The surveyed difference Q_{i+1j} is positive in the years between 2006-2009 for the grapes, whereas for the other product - pumpkins this period includes 2011-2014. A similar situation was observed for the purchased quantities, average per household about the following fruits: watermelons and melons, apples and plums. In this case, the number of the consecutive years is three. The indicator grew for the first two products in 2006-2008, while for the other two products in 2005-2007, 2012-2014 and 2007-2009, 2011-2013, respectively.

The reverse process, i.e a reduction of the purchased quantities of watermelons and melons was observed during 2003-2004. The case is similar for this examined indicator about the apples in 2015-2017, as well as about the plums in 2004-2006. The calculated values of the variable Q_{i+1j} ($4<=i<=9$, $j=5$) for olives are greater than 0, therefore a continuous growth of the purchased quantities of the indicated fruit was established over the interval 2004-2009. Periods are alternated during the other years in which this indicator for each of the listed products reduce and then increase or vice versa.

The values of the variable g_{i+1j} (percentage change of purchased quantities) are significantly higher for apples in the 2nd, for pears in the 5th, for cherries and morellos in the 13th and for plums in the 16th year from the studied interval (Fig. 3). While the lowest values for the same indicator were observed for peaches and apricots in the 2nd, for pears in the 6th and for strawberries and raspberries in the 7th year from the considered period. As a whole, the limits within which the variable g_{i+1j} varies are the smallest for the olives in comparison with those for the other investigated fruits.

The dynamics of change in purchased quantities of the examined 14 fruit types has been tracked and analyzed in the interval 2001-2017. Linear and quadratic models have been used for this purpose. The construction of the referred models requires finding the parameters of the listed regression equations.

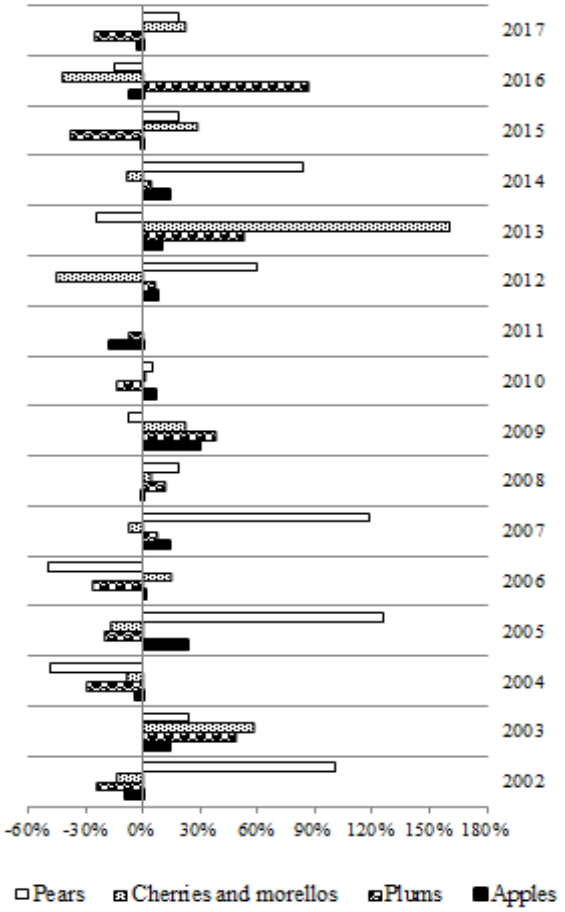

Fig. 3. Percentage change of the purchased quantities, average per household
Source: Own calculations on the basis of data from National Statistical Institute [11].

They are presented in Table 1, as well as the calculated determination coefficients (R^2). It should be noted that the linear and quadratic equations concerning surveyed data on watermelons and melons are not adequate. The results of the analysis showed that the variations in the data about the other fruit types are best described by second-degree polynomials. The presented models are adequate at 5% level of significance. In addition, the obtained linear equations for purchased quantities of plums, strawberries and raspberries for the examined interval are also not adequate.

A decreasing tendency in the purchased quantities of grapes, cherries and morellos, average per household was established at the beginning of the period. A gradual increase of the variable was observed for 2007-2019, with the exception of some individual years in which a certain decline was registered.

A llittle different was the situation with the examined indicator for apples. The increase in the purchased quantities of this fruit, average per household is significantly higher in comparison with the other fresh fruits, although a slight decline is observed for the last 3 years of the time interval.

Table 1. Results of the analysis

Fresh fruits	Linear equations	R^2	Quadratic equations	R^2
Watermelons and melons	y = 0.351x+22.85	0.140	$y = 0.002x^2+0.310x+22.98$	0.140
Apples	y = 0.930x+10.76	0.861	$y = -0.033x^2+1.534x+8.848$	0.884
Grapes	y = 0.269x+5.016	0.549	$y = -0.005x^2+0.364x+4.716$	0.553
Peaches and apricots	y = 0.302x+4.254	0.738	$y = -0.001x^2+0.331x+4.160$	0.738
Olives	y = 0.156x+3.078	0.882	$y = -0.005x^2+0.248x+2.787$	0.900
Plums	y = 0.027x+1.517	0.073	$y = 0.014x^2–0.227x+2.323$	0.443
Cherries and morellos	y = 0.074x+1.081	0.452	$y = 0.002x^2+0.029x+1.223$	0.461
Strawberries and raspberries	y = 0.018x+1.145	0.068	$y = 0.009x^2–0.143x+1.659$	0.375
Pumpkins	y = 0.080x+1.001	0.582	$y = 0.008x^2–0.074x+1.493$	0.708
Pears	y = 0.068x–0.020	0.822	$y = 0.004x^2–0.016x+0.248$	0.896

Source: Own calculations on the basis of data from National Statistical Institute [11].

The values of the indicator for peaches and apricots, olives, pumpkins and pears increased steadily over most of the period. Only the purchased quantities of strawberries and raspberries, average per household remained unchanged during 2009-2012, but in 2016-2017 this variable decreased slightly.

The obtained determination coefficient (R^2) for the surveyed data about olives is higher in comparison with the others. Its value is 0.90. This means that the time explains 90% of the variations in the purchased quantities of this fruit, average per household. The lowest value of this examined variable was calculated for strawberries and raspberries. In the case, it is 0.375 (Table 1). Therefore, the time explains 37.5% of the variations in the purchased quantities of the indicated fruits.

Data for the second studied indicator have been also analyzed. Generally, an increase in the average prices of the 14 fruit types has been observed for the 17 years period, while for some of them (grapes, plums, pears, cherries and morellos, strawberries and raspberries), compared with the rest, this process has been more intensive.

The values of the differences P_{i+1j} are negative for certain years, but the decline of the investigated indicator is small. The increase of the average prices of watermelons and melons, plums, pumpkins, cherries and morellos is over 2.5 times, while for the other fruit types in the range between 1.54 and 2.48 times. It should be noted that the growth of the average prices of apples is the least.

The calculated values of variable v_{i+1j} (over 50%) are much higher respectively for peaches in the 2nd, for pumpkins, strawberries and raspberries in the 7th year from the considered time period. High values of this variable (over 35%) were also observed for watermelons and melons in 2003, for grapes in 2005 and for cherries and morellos in 2016 (Fig. 4).

The dynamic changes in the average prices of the studied fruit types for the 17 years interval are presented analytically with the equations shown on Table 2. The described models (linear and polynomials of the second degree) are adequate at 5% significance level. The obtained values of the determination coefficients about the surveyed data for each fruit were compared. The results showed that the variations in average prices of fresh fruits are best described with the second degree polynomials.

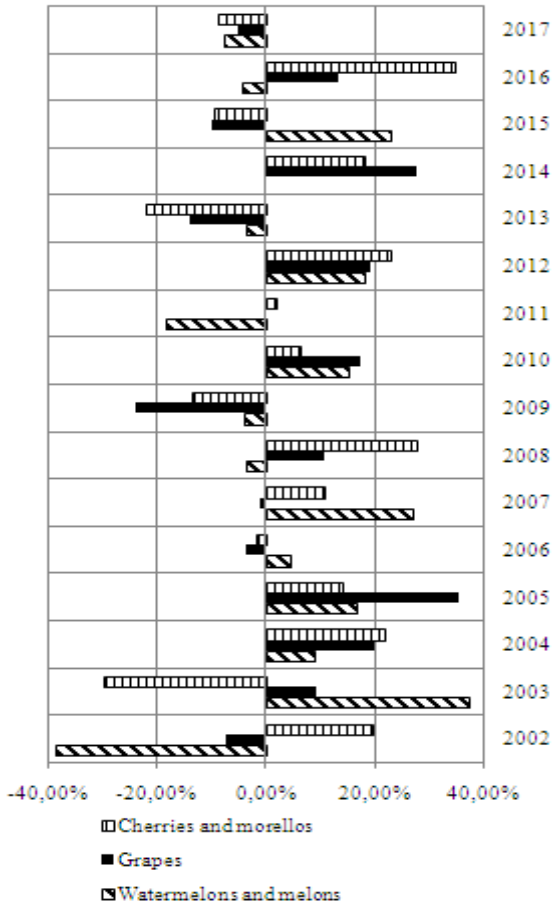

Fig. 4. Percentage change of the average prices of some studied products

Source: Own calculations on the basis of data from National Statistical Institute [11].

Table 2. Visualization of the constructed regression models

Fruit types	Linear equations	R^2	Quadratic equations	R^2
Watermelons and melons	y=0.021x+0.309	0.779	$y = -0.001x^2+0.038x + 0.256$	0.807
Apples	y=0.018x+1.101	0.433	$y = -0.002x^2+0.057x + 0.977$	0.548
Grapes	y = 0.043x+0.689	0.766	$y = -0.001x^2+0.069x + 0.609$	0.781
Peaches and apricots	y = 0.033x+1.025	0.600	$y = -0.001x^2+0.057x + 0.949$	0.618
Olives	y = 0.170x+3.361	0.938	$y = -0.004x^2+0.258x + 3.083$	0.952
Plums	y = 0.033x+0.450	0.592	$y = -0.004x^2+0.108x + 0.211$	0.770
Cherries and morellos	y = 0.097x+1.308	0.802	$y = 0.001x^2+0.083x + 1.354$	0.803
Strawberries and raspberries	y = 0.158x+1.25	0.882	$y = -0.002x^2+0.205x + 1.099$	0.887
Pumpkins	y = 0.019x+0.373	0.516	$y = -0.001x^2+0.054x + 0.264$	0.608
Pears	y = 0.074x+1.170	0.829	$y = -0.001x^2+0.105x + 1.073$	0.838

Source: Own calculations on the basis of data from National Statistical Institute [11].

The calculated determination coefficient has the highest value for olives. It is 0.952. This means that the time explains 95.20% of the variations in the average price of this fruit. The lowest value of the surveyed variable (R^2) is obtained for apples. In this case, the

coefficient of determination is 0.548. Therefore, the time explains 54.80% of the variations in the average price of the apples.

CONCLUSIONS

The information concerning various food and non-food products has been organised and stored in a built relational database. Fresh fruits category containing 14 product types has been studied in the current article. Applying a certain set of criteria, the searched information about the referred objects has been extracted from the database. The obtained data have been saved in a separate xlsx file and have been processed. Linear and quadratic models are used to describe the dynamics in average prices and purchased quantities of fresh fruits, average per household. The considered period includes the years from 2001 to 2017.

The obtained results from this study show that the linear equations concerning the data on purchased quantities of watermelons and melons, plums, strawberries and raspberries, average per household are not adequate. Similar is the situation with the quadratic equation for the data about watermelons and melons. The other described models (linear and polynomials of the second degree) are adequate at 5% significance level.

The values of the purchased quantities of watermelons and melons, average per household in some of the considered years changed significantly. A growth of this studied indicator for the other fresh fruits was established for the indicated period.

The increase in average prices of seven fresh fruits types (grapes, plums, pears, cherries and morellos, strawberries and raspberries) was more intensive in comparison with the rest ones.

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PERFORMANCE OF ROMANIAN BARLEY VARIETIES FOR GRAIN YIELD AND SOME QUALITY TRAITS UNDER RAINFED CONDITIONS

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Abstract

The present study aimed to identify barley varieties with high grain yield and quality for rain-fed conditions. The trials were conducted in the experimental field of the ARDS Șimnic during two growing seasons (2018/2019 and 2019/2020). The analysis of the results from the two years of study showed that the Simbol variety (5,842 kg/ha) performed the best for grain yield, while the Ametist variety (4,662 kg/ha) had the lowest grain yield. The highest average value of test weight was found in the Univers variety (61.5 kg/hl) and the lowest in the Ametist variety (55.5 kg/hl). The average protein content values ranged between 9.9% (Simbol) and 11.5% (Dana). The years (precipitation and air temperature) were the predominant source of variation in yields and test weight, representing 87.3% and 78.8%, respectively of the total sum of squares, thus indicating the relative importance of the climatic conditions in achieving of high yields and quality. Therefore, the Simbol variety is recommended for increasing barley yield and improving farmers' incomes in the central part of the Oltenia region and in areas with similar agro-ecologies.

***Key words*:** *barley, protein content, test weight, yield*

INTRODUCTION

Cultivated barley (*Hordeum vulgare* L.) belongs to the genus *Hordeum*, the *Poaceae (Gramineae)* family is of major importance as an annual cereal that is mainly used as animal fodder, as a raw material for malting in beer and whiskey production and for human consumption. It is a self-pollinating diploid crop (2n = 2x = 14).

Barley contains essential minerals and vitamins, especially beta glucans therefore it is indicated as a good source of food for people suffering from type II diabetes or prediabetes and for a healthy lifestyle [1].

In Romania, the total area covered by this crop is about 422 thousand hectares with a total production of 1,870 million tons and an average yield per hectare of 4,432 kg. In the world, barley ranked fourth in production of cereal crop after maize, rice and wheat [9].

In Europe, two-row barley varieties are predominantly used for malting, but lately, six-row barley varieties are used for malt production in some regions of the United States [18].

The agronomic value of a variety depends not only on its genetic potential, but also on its ability to reach the genetic potential under different environmental conditions [8].

In the Oltenia region, lack of rainfall and associated droughts are the main causes of low crop productivity [2, 3, 4, 5, 17].

According to [13], the genotypic characters of a cultivar and agro-climatic conditions during the growing season are the two key factors influencing grain yield and quality, therefore the choice of suitable cultivar is the first step to success in the growing systems of barley.

The yield performance and yield stability are the important features in choosing cultivars for different areas.

Because barley has a significant role in food security, we believe that is important to evaluate and recommend the best performing varieties for the Oltenia region.

MATERIALS AND METHODS

During the 2018/2019 and 2019/2020 growing seasons, 6 six-row barley varieties created at NARDI Fundulea (Dana, Cardinal FD, Univers, Ametist, Smarald and Simbol) cultivated at the Agricultural Research and Development Station (ARDS) Șimnic, were evaluated.

The trials were conducted in a randomized block design (in three repetitions), with a plot size of 9 m^2. The usual agricultural practices for the conventional cropping system were applied. The complex fertilizers were administered before sowing with 200 kg/ha NPK 20.20.0. Ammonium nitrate (NH_4NO_3) was also administered in February (200 kg/ha) and in April (150 kg/ha).

The sowing took place on 8 and 18 October in 2018 and 2019, respectively.

The test weight (kg/hl) was analyzed by specific apparatus and the protein content (%) by spectrometric method using NIR analyzer INFRAMATIC 9200.

Analysis of variance (ANOVA) was used to comparison varieties and to determine the effects of genotype, year, and genotype x year interaction for the studied parameters.

The Duncan's multiple comparison test (at $p \leq 0.05\%$) was used to demonstrate the differences between the studied varieties.

The climatic conditions of the two experimental years showed a great variability for precipitation and air temperature.

The amount of precipitation in both years of study was lower than the multiannual average and with a very uneven distribution per months (Figures 1 and 2).

In most months of the 2018/2019 growing season (October, December, February, March, April, May, July) there was a deficit of precipitation which negatively affected the barley crop.

The largest precipitation deficiencies (-44.5 mm and -34.9 mm, respectively) compared to the multiannual average, have been registered during the sowing period (October) and the flowering period (May).

In the 2019/2020 growing season, the distribution and amount of precipitation were considerably more favourable, which led to increased yields in that year.

The average air temperature in 2018/2019 was higher by 1.5°C and in 2019/2020 was higher by 2.15°C, which confirms the heating trend for this area.

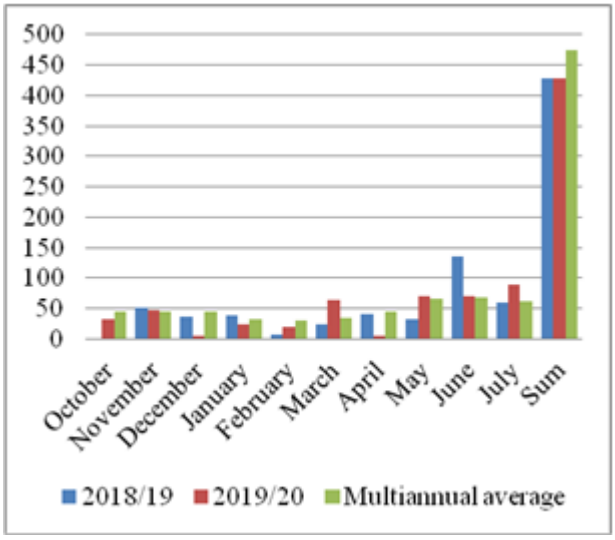


Fig. 1. Total monthly precipitation (mm) at ARDS Șimnic
Source: own processing based on data from Meteorological Station Șimnic, Craiova.

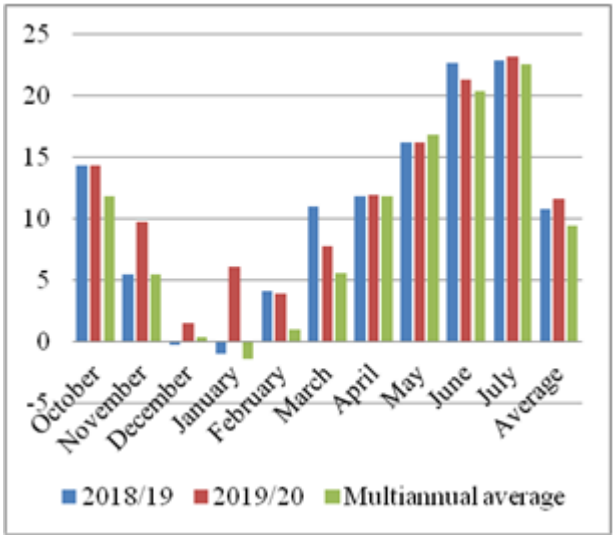


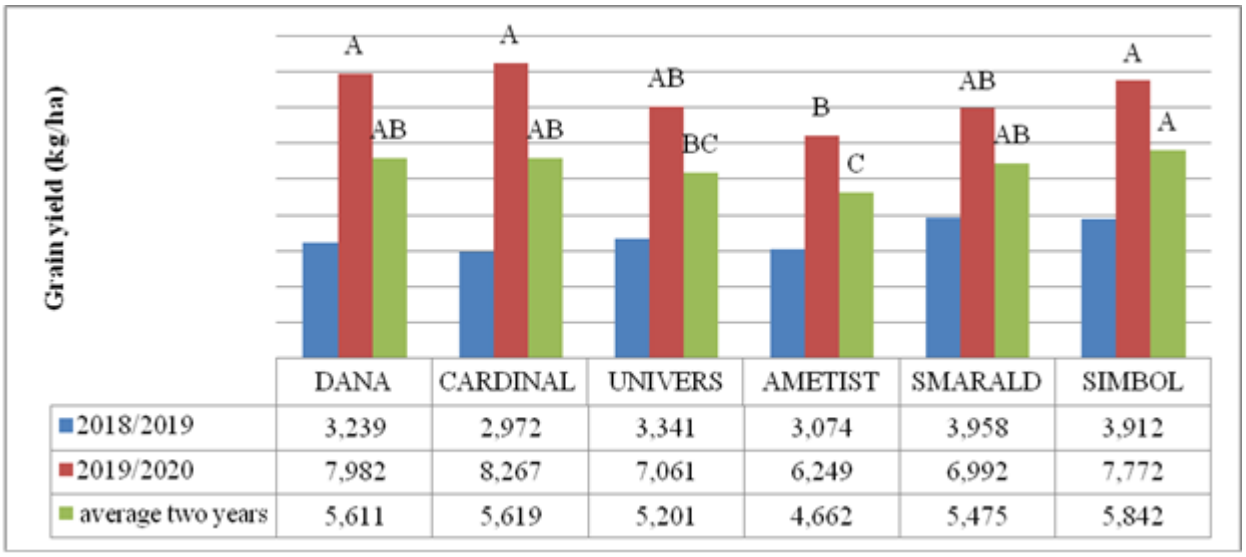
Fig. 2. Mean monthly air temperature (°C) at ARDS Șimnic
Source: own processing based on data from Meteorological Station Șimnic, Craiova.

RESULTS AND DISCUSSIONS

Grain yield

The analysis of the variance for grain yield in 2018/2019 did not show significant differences ($p \leq 0.05$) between the barley

varieties. The level of grain yield of the studied varieties ranged from 2,972 kg/ha for the Cardinal variety to 3,958 kg/ha for the Smarald variety (Figure 3). This year, the yields were lower than in 2019/2020, probably due to the deficit of precipitation during the periods of flowering, pollination and grain-filling (May and July), periods considered critical for barley yield [15, 16]. According to [6], due to heat stress during the grain-filling stage, pollen infertility and seed abortion occur, which ultimately lead to reduced in grain yield.



	DANA	CARDINAL	UNIVERS	AMETIST	SMARALD	SIMBOL
2018/2019	3,239	2,972	3,341	3,074	3,958	3,912
2019/2020	7,982	8,267	7,061	6,249	6,992	7,772
average two years	5,611	5,619	5,201	4,662	5,475	5,842

Fig, 3. The grain yield values of barley varieties cultivated under rain-fed climate conditions at ARDS Simnic
Source: Own calculation.

For the year 2019/2020, which was more favourable for barley cultivation, the analysis of variance for grain yield showed significant differences between the barley varieties ($p \leq 0.05$).

The Cardinal (8,267 kg/ha), Dana (7,982 kg/ha) and Simbol (7,772 kg/ha) varieties were significantly superior compared only to the Ametist variety (6,249 kg/ha).

In average for two-years, the barley variety Simbol gave maximum value for grain yield (5,842 kg/ha) followed by Cardinal (5,619 kg/ha), Dana (5,611 kg/ha) and Smarald (5,475 kg/ha) varieties which were statistically at par with each other. The Simbol variety was significantly superior compared only to the Ametist (4,662 kg/ha) and Univers (5,201 kg/ha) varieties.

Similar results have been reported in other studies. [19], following research conducted during 2013-2015 at ARDS Marculesti, reported that the best yields were obtained by Symbol (6,641 kg/ha), Smarald (6,627 kg/ha) and Ametist (6,497 kg/ha) varieties and the lowest yield by Dana variety (5,709 kg/ha). Following the research conducted in 2016 and 2017 at ARDS Turda, [10] also reported a very good behaviour of the varieties Smarald (5,093 kg/ha), Simbol (4,819 kg/ha) and Cardinal (4,813 kg/ha).

Test weight

The value of test weight in the 2018/2019 growing season ranged from 50.6 kg/hl (Ametist) to 57.5 kg/hl (Univers), the differences between the varieties being statistically non-significant.

During the 2019/2020 growing season values of the varieties was higher than in the first year because of more favourable conditions. The Univers variety (65.4 kg/hl) had the highest test weight, while Ametist variety (60.7 kg/hl) had the lowest ($p \leq 0.05$).

The average of test weight over the two-years was also higher ($p \leq 0.05$) at Univers variety (61.5 kg/hl) followed by Cardinal variety (59.2 kg/hl), while Ametist variety had the lowest value (55.5 kg/hl).

Our results were similar with those reported by [11], but were less values than those of some research [8, 12, 18].

According to the Grading Manual from 2017 [7], barley grain should have a test weight from 63 kg/hl (Class I) to 67 kg/hl (Class III) for malting production and from 60 kg/hl (Class I) to 62 kg/hl (Class II) for animal feed.

Protein content

According to [11], protein content is one of the most important selection criteria for the quality of malt. It should be in the range of 9.5-11.5% [18].

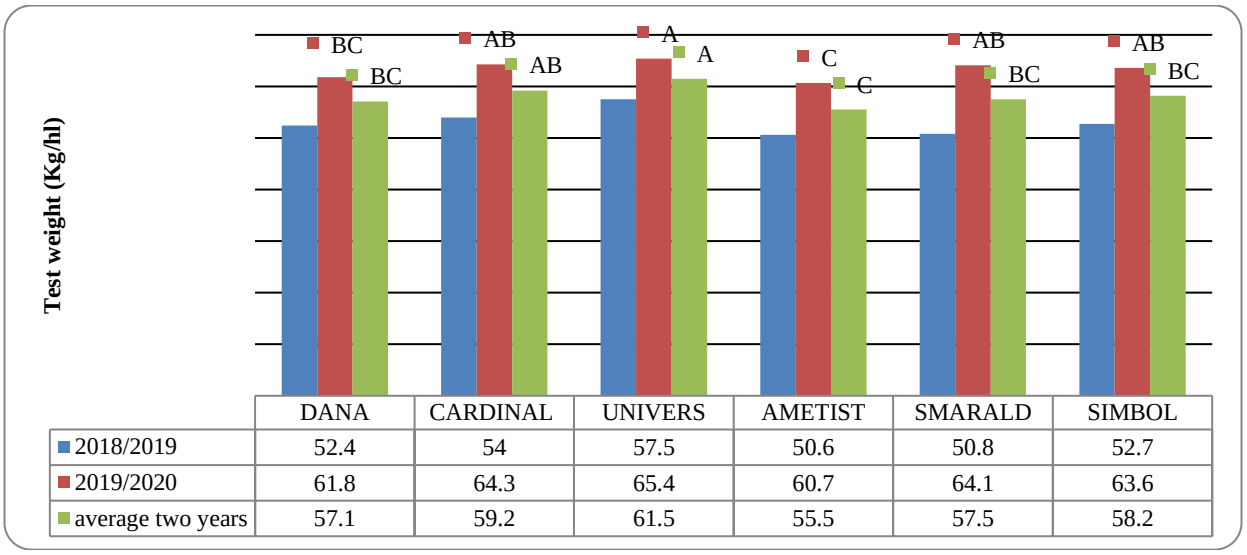
The protein content of grain barley during the 2018/2019 ranged from 10.2% (Smarald) to 11.3% (Ametist), but the differences between the varieties being statistically non-significant.

During the 2019/2020 growing season the Dana variety (12.7%) had the highest protein content followed by Ametist variety (11.1%), while Simbol variety had the lowest value (9.2%).

The average protein content over two-years varied between 9.9% (Simbol) and 11.5% (Dana), the differences between the varieties being statistically non-significant.

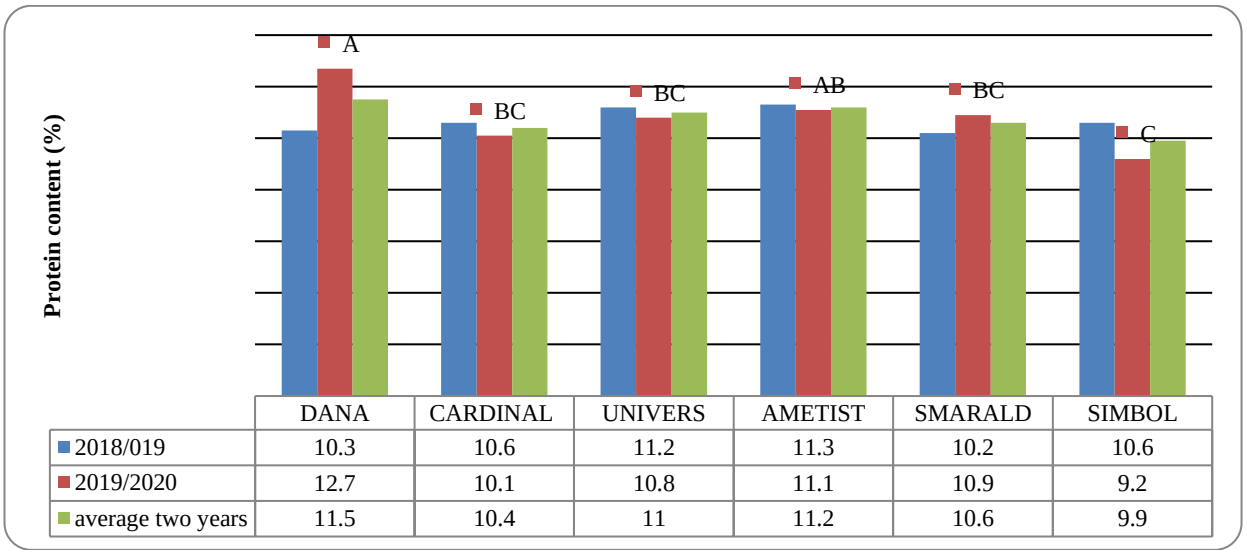
Similar to our results for protein content, researchers such as [18] also obtained at NARDI Fundulea during 2012-2015.

On the other hand, these values were less than those of some research [12, 13].



	DANA	CARDINAL	UNIVERS	AMETIST	SMARALD	SIMBOL
2018/2019	52.4	54	57.5	50.6	50.8	52.7
2019/2020	61.8	64.3	65.4	60.7	64.1	63.6
average two years	57.1	59.2	61.5	55.5	57.5	58.2

Fig. 4. The test weight values of barley varieties cultivated under rain-fed climate conditions at ARDS Simnic
Source: Own calculation.



	DANA	CARDINAL	UNIVERS	AMETIST	SMARALD	SIMBOL
2018/019	10.3	10.6	11.2	11.3	10.2	10.6
2019/2020	12.7	10.1	10.8	11.1	10.9	9.2
average two years	11.5	10.4	11	11.2	10.6	9.9

Fig. 5. The protein content values of barley varieties cultivated under rain-fed climate conditions at ARDS Simnic
Source: Own calculation.

In terms of the impact of genotype, year and genotype x year interaction on yield, test weight and protein content, it is presented in Table 1.

The results for grain yield showed significant effects in the case of genotype (G) ($p \leq 0.05$), the year (Y) ($p \leq 0.01$), as well as in the case of the G x Y interaction ($p \leq 0.05$).

The sum of square for genotype effect explained 3.2% of the total variation, the differences between years explained 87.3% of the grain yield total variation, while the effects of G x Y interaction explained 3.6% of total variation. The great effect of Y (year) on grain yield was due to the contrasting growing conditions (distribution and amount of precipitation, air temperature) in which the experiments were set up.

Our results are in agreement with [14], who stated that year (Y) explained the highest percent of yield variation (81%) in Rimski Šančevi experimental field near Novi Sad, while the influence of G and G × E interaction is usually smaller effect.

Test weight of the barley varieties was significantly ($p \leq 0.01$) influenced by genotype and year, but not significantly by genotype x year interaction.

The sum of square for genotypes effect explained 9.7% of the total variation; the year explained 78.8% of the test weight variation, and the effects of G x Y interaction explained 2% of total variation.

[8] reported only highly significant effects of the genotype of test weight.

The protein content was significantly ($p \leq 0.01$) influenced by genotype and G x Y interaction ($p \leq 0.05$), but not significantly by year (Table 4). Similar results have been reported by [13].

In contrast, [12] reported a significant effect of year on protein content due to drought during grain-filling stage which increased protein content.

Table 1. ANOVA of tested parameters and F test for two-years

Source	Sum squares	DF	Mean squares	F test	Total variation explained (%)
Grain yield					
Genotype (G)	5,269,099	5	1,053,820	2.68*	3.2
Year (Y)	141,939,425	1	1,419,239,425	362.18**	87.3
Genotype x Year (G x Y)	5,906,994	5	1,181,399	3.01*	3.6
Error	9,405,470	24	391,895		
Total	162,520,988	35			
Protein content					
Genotype (G)	11.02	5	2.20	2.65*	25.0
Year (Y)	0.07	1	0.07	0.08	0.16
Genotype x Year (G x Y)	12.99	5	2.60	3.12*	29.5
Error	19.97	24	0.83		
Total	44.05	35			
Test weight					
Genotype (G)	117.09	5	23.42	4.86**	9.7
Year (Y)	953.78	1	953.78	197.90**	78.8
Genotype x Year (G x Y)	23.86	5	4.77	0.99	2.0
Error	115.67	24	4.81		
Total	1,210.40	35			

* Significant at the 5% probability level; ** Significant at the 1% probability level
Source: Own calculation.

CONCLUSIONS

The results for two years of study indicated that yield performance and test weight of studied barley varieties were highly influenced by year effect.

The Simbol variety (5,842 kg/ha) followed by Cardinal FD (5,619 kg/ha), Dana (5,611 kg/ha) and Smarald (5,475 kg/ha) varieties

showed the best performances among varieties tested, while the Ametist variety (4,662 kg/ha) had a low grain yield and adaptability. So, variety Simbol was recommended for the central part of the Oltenia region and areas with similar agro-ecologies for sustainable barley production and for improving farmers' incomes.
The Univers variety was noted by the high value of test weight (61.5 kg/hl) and by good protein content (11%), but had a low yield.

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MONITORING THE VEGETATION OF AGRICULTURAL CROPS USING DRONES AND REMOTE SENSING - COMPARATIVE PRESENTATION

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Abstract

Precision farming is agricultural land management, involving the introduction of efficient technologies and machinery to make farming more efficient and ensure production control. Thus, through the measurements in the field and the analysis of environmental factors (weather, quality and soil properties, seasonality, stage of plant development), farmers obtain the information needed to manage resources and culture efficiently. This study presented the results of the measurements in the field, using unmanned aerial vehicle (UAV) with specific topography, with the precision of multispectral camera technology. The Article includes a comparative presentation between multistructural images obtained by a type of unmanned aerial vehicle (UAV) with multi-rotor configuration and multistructural analysis performed by remote sensing by satellites on the same agricultural surface in the Baragan plain.

***Key words*:** *unmanned aerial vehicle (UAV), precision agriculture, normalized difference vegetation index (NDVI), green normalized difference vegetation index (GNDVI)*

INTRODUCTION

Over the last decade, the unmanned or uncrewed aerial vehicles - UAVs have proven to be applicable in many technological areas. The increasing number of the world's population and rapid industrial development tend to overexpose arable soils and fields. In order to meet production expectations, agriculture can even be a threat to the environment.

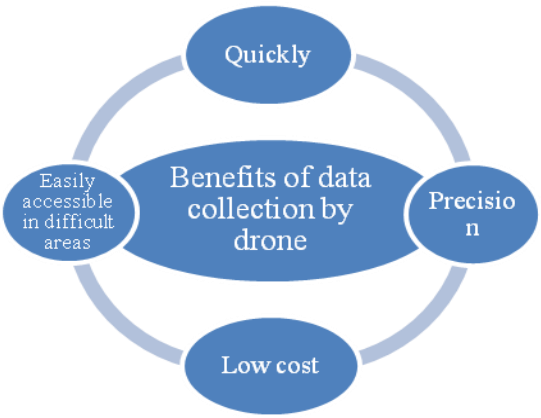

Fig.1.Scheme of drone use in agriculture
Source: Authors Contribution.

In this respect, the use of drones eloquently leads scientists to seek better solutions and reliable techniques to preserve the environment and, in addition, to increase the potential of agriculture in a sustainable way [1, 2, 8, 10, 13, 14].

The benefits of data collection from UAVs are presented in Fig. 1.

Intensive use of remote sensing is justified according to Fig. 2 as a first advantage, large area that can be covered in a shorter time than drones.

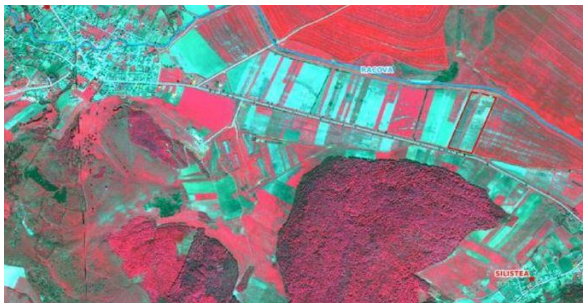

Fig. 2. Satellite image of agricultural parcels, Source:Agrointel.ro, 2017 [1].

Another major advantage is the accuracy of the information that this technology delivers on the location of agricultural parcels declared by farmers and on the types of crops existing on the land (each plant emits specific electromagnetic radiation in the visible and invisible spectrum in several spectral bands, this allows for rapid identification of existing crops on the area concerned [5].

Data on the use of drones

A UAV drone assembly is composed of an aeromodel, designed according to a particular design, with dedicated systems dedicated to remotensing (multi-spectral sensors from HD video photons to thermal and IR), launch/landing system and ground control station. (HD = high definition, IR = infrared).research data can be collected via multi-spectral sensors, by processing the information obtained by drones. The use of drones in research has the following advantages:

-detailed analyzes of concentrations of water and useful substances in soil and plants;

-evaluation of the level of infestation of crops with diseases and/or pests, with delimitation of infestation levels;

-assessment of the state of agricultural vegetation using specific vegetation indicators;

-detailed farm maps, for which important crop and soil parameters can be seen and monitored.

In this context, the main objective of the research was the evaluation of an agricultural plot located in the north of Braila county, Salcia Tudor, grown with maize, and the culture was established in spring 2020.

MATERIALS AND METHODS

For this purpose, a drona Parrot Bluegass with the Sequoia spectral chamber (Fig. 3) was used. Parrot Bluegass fields is a quadricopter made for multiple uses in agriculture, being an accessible and able tool justify the investment of farmers through the results obtained.

Parrot Bluegers fields incorporates two cameras:

-Front camera, full HD, through which you can monitor: Farm infrastructure, cropped terrain, orchard, vineyard or livestock herd;

-The Parrot Sequoia multispectral camera, which captures images that are processed using the Pix4DFields software [7], and immediate steps can be taken based on the results to save or improve crops.

Fig. 3. The Sequoia multispectral chamber
Source: Parrot Bluegrass Fields Drone [9].

Technical specifications of Parrot Bluegers drone

Dimensions: Lxlxh355.0 x 140.0 x 407.0 mm; maximum take-off weight below 500g;

Propeller number: 4; GPS Yes; maximum altitude 120 m; weight (with accumulator):1.81 kg;

Collision sensors: Sensor positioning (drone body): bottom, front, angle ofgrasping (front) 64° (horizontal), 62° (horizontal), 50° (vertical), 49° (vertical).

Fig. 4. Parrot Bluegrass Drone
Source: Agricultural Drones [9].

Remote control: Integrated display No; operating frequency: 2.4 GHz, 5.8 GHz; maximum operating distance 2 km remote; full HD video resolution; Integrated camera, Yes; resolution: 14MP;

Power and charge: Baterry, Li-polimer battery capacity 6,700 mAh/99 Wh;

Autonomy 25 minutes. The multi-spectral sensor on the Parrot Sequoia camera provides a complete and adaptable solution, analyzing plant vitality by capturing the amount of light it absorbs and reflects the collected data will help to map crops and analyze NDVI indications, GNDVI by obtaining maps that can be transferred to farmers' work machinery, contributing to an excellent optimization in agricultural work (fertilization, treatments with plant protection products and not least irrigation).

Data on the use of remote sensing

Using satellite images and/or air (provided by aircraft), the following shall be determined:

• the areas and locations of agricultural parcels;
• the types of agricultural area;
• the crops on those parcels and the stage of farming vegetation;
• how cross-compliance rules are complied with;
• the existence of ineligible elements (buildings, water, forests) on agricultural land for which payment applications are submitted.

Irregularities detected

The most common types of irregularities identified by remote sensing in accordance with Figure 5 are those related to the location and areas of agricultural land declared to be in use by farmers. Minor discrepancies between topographic maps and orthophotonels obtained by remote sensing are compensated, and for differences of no more than 3% between the area declared and that identified by remote sensing farmers are not penalized.

Fig. 5. Satellite used for remote sensing
Source: Geocledian.com [4].

Above this threshold penalties apply progressively, above 20% the payment is suspended for that year and above 50% is suspended it applies not only suspension, but also multiannual sanctions, for a duration of up to 3 years.

Regarding this aspect, the provisions of Final OTSC Guidelines of the EU Commission have been respected [3].

Other types of irregularities, equally common to the situation, are the absence or misclassification of crops covered by payment applications and the failure to comply with the requirements for obtaining a certain type of aid, such as for example, orchards, traditionally operated, where the main production is hay. But if the maximum number of 240 trees per hectare is exceeded, the main yield is not hay, but fruit. This is therefore another classification both in the categories of grants granted by the APIA [Agricultural paying and intervention Agency] and in respect of the levies and taxes to be paid by the farmer [6].

Calculation of the vegetation index

The vegetation Index is an indicator that is calculated as a result of operations with different spectral ranges of remote sensing data and is related to the vegetation parameters in a given image pixel. The effectiveness of the vegetation index is determined by the characteristics of the reflection. The calculation of most vegetation indices is based on two more stable sections of the spectral reflection of the plant curve.

NDVI- vegetation index normalized difference. Most commonly known in agriculture, characterizes the density of vegetation and allows farmers to assess germination, growth, the presence of weeds or diseases, and to predict field productivity. Index indicators are generated by green table satellite images that absorb electromagnetic waves in the visible red domain and reflect them in the near infrared domain. The red region of the spectrum (0.62 to 0.75 μm) represents the maximum absorption of solar radiation by chlorophyll and the near infrared area (0.75 to 1.3 μm) has the maximum energy reflection from the leaf cell structure. That is, high synthetic activity results in lower reflectivity values in the red spectrum region and high values in the near infrared region of the spectrum. The ratio of these indicators to each

other allows you to clearly separate vegetation from other natural objects. As a result, it is possible to obtain a full spectrum analysis and to identify areas requiring re-seeding, application of plant protection products or fertilizers. NDVI is recommended when looking for differences in surface biomass over time or in space. NDVI is most effective when portraying the density variation of the canopy during the early and medium development stages, but tends to lose sensitivity to high density levels [11].

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

GNDVI - vegetation index difference normalized green. It is similar to NDVI, except that instead of red, it measures green spectrum in the range from 0.54 to 0.57 microns. This is an indicator of the photosynthetic activity of the plant shell; it is most commonly used in assessing the moisture content and nitrogen concentration of plant leaves according to multispectral data that do not have an extreme red channel [11].
Compared to the NDVI index, it is more sensitive to chlorophyll concentration. It is used in the assessment of the depressed and aging vegetation.

$$GNDVI = \frac{(NIR - Green)}{(NIR + Green)}$$

The Earth Observation satellites (EOS) are intended to obtain information about the surface and atmosphere of the Earth from a distance of a few tens to 36,000 km in space. The derived information does not come from a single satellite, but from a whole series of satellites with different instruments and observation missions. The "civilian" observation satellites have been orbit since the early '70, and the resolution and the level at which the details of the earth's surface can be described is now in the orders of the centimers. Satellites that offer free images generally have a resolution of about 10 meters.

RESULTS AND DISCUSSIONS

Processing of information obtained through the drone

The software for the creation and analysis of multispectral images in the Parrot Bluegass drone is from Pix4Dfields.com, as shown:
(1)Example of using the GNDVI index for the study of photosynthesis activity as shown in Figures 6 and 7.

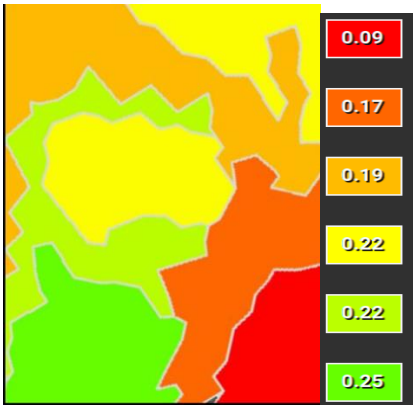

Fig. 6. Zoning map for differentiated application of agro-technical measures, obtained from analysis of GNDVI
Source: Pix4Dfields Software [7].

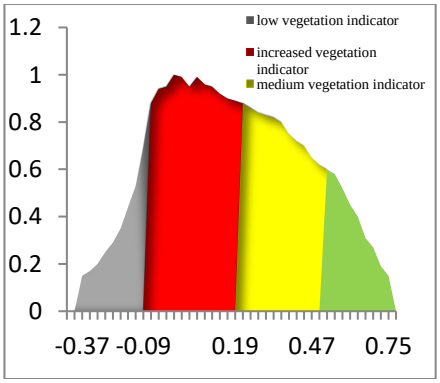

Fig. 7. GNDVI - Boundary legend
Source: Pix4Dfields Software [7].

(2)Example of using the NDVI indexto study the development of foliar mass as shown in Figures 8 and 9.

Satellite image processing was carried out but the assistance of the Solorrow application

After processing satellite images, the same plots, grown with maize in the area of Salcia Tudor, were obtained the zoning map according to Fig.10.

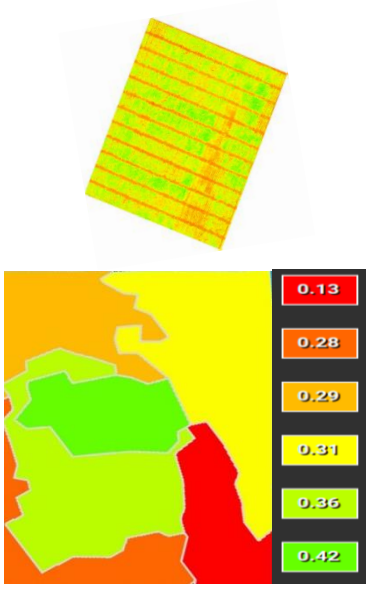

Fig. 8. Zoning map for differentiated application of agro-technical measures, obtained from analysis of the NDVI

Source index: Pix4fields program [7].

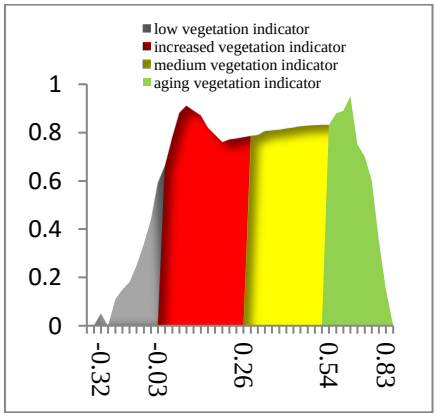

Fig. 9. NDVI - Boundary.legend

Source: Pix4fields program [11].

Benefits of Solorrow application

The result of the analysis strictly reflects soil heterogeneity, since by mediating values over a longer period of time, errors are eliminated either from the technology used, from the special annual environmental conditions, from crop rotations or from other specific causes,The application creates the plot potential map, and this is used to generate the prescription map. The analysis obtained may be used for variable-rate agricultural sowing or for the differentiated application of solid or liquid fertilizers.

Fig. 10. Map with productive potential depending on the distribution of biomass in the last 5 years; prescription map as well as export options

Source: Solorrow application [12].

CONCLUSIONS

Satellite images reflect the distribution of vegetative mass in the field, making it possible to identify areas with low vegetation and develop agro-technical measures to improve them. NDVI-per-year analysis will help determine productive and non-productive fields, and this information will help to achieve optimal crop rotation. For example, an NDVI index analysis will reveal fields where there has never been a high yield of

five years, and you can decide whether to invest in fertilizers or to sow perennial herbs for food.

The availability of such spatial and temporal data obtained using drones, linked to the use of field sensor networks, which provide real-time measurements, is a change in the way farmers implement the benefits of precision farming, as well as farm-level decision management. A great advantage is that low-cost solutions can be achieved by using drones for small areas for small farmers as well as satellite images for large areas for large farmers:

-Photogrics and architectural heritage relevance;

-Monitoring in agriculture and forestry, natural disasters;

-Biodiversity and monitoring of communication routes;

-Acquire recent and prior satellite images;

-Orthophotlan, multispectral, interferometric.

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ASPECTS CONCERNING CONTRIBUTION OF WATER SUPPLY AND SANITATION NETWORKS (WSS) INVESTMENTS TO SUSTAINABLE DEVELOPMENT GOALS (SDGs) IN ROMANIA

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Abstract

As shown in previous research, in Romania there is a significant gap of development of water supply and sanitation networks (WSS), with significant regional and urban-rural disparities. In the light of the 2030 Agenda and the 17 sustainable development goals (SDGs), a sustainable development can only be achieved through a holistic approach, in which the links between several SDGs are harnessed. Today, with the start of the SARS-COV-2 pandemic in 2020, public health and personal and family hygiene are the highest priorities, practically reaffirming the crucial importance and synergies of SDGs such as SDG1- No Poverty and SDG6-Clean Water and Sanitation. In this context, the paper analyses some current trends, benefits and contributions of European and Structural Investment (ESI)-funded WSS projects in Romania, through the Large Infrastructure Operational Program. The conclusions present some recommendations and perspectives on the continuation of sustainable development efforts for the water and wastewater infrastructure sector in Romania, especially those increasing access to public WSS services in poorly served rural areas.

Key words**:** *: sustainable development, objectives, rural, infrastructure, water supply and sanitation (WSS)*

INTRODUCTION

One of the most important issue in sustainable development is ensuring the availability of the natural resources for all the present and future needs of economic and social development.
The Agenda 2030 calls for a global and holistic approach to tackle most of the new, growing challenges linked to the factors that may jeopardize the prospects of sustainable development, such as the climate change, the water scarcity and the Sars-Cov-2 pandemics.
Romania has long since started to struggle for sustainable development, at least from a conceptual viewpoint, as developed in the early (published before year 2000) outstanding papers of Romanian Academy researchers.
Although some important steps and progress towards sustainable development have been done since Romania has become a member state of the European Union, there is still a lot of work to be done on the implementing side.
The EU cohesion policy represents the opportunity to develop many sectors of the Romanian economy representing essential pillars of the sustainable development, such as the infrastructure capital.
This research approaches developments on the SDGs (Sustainable Development Goals) in Romania, related in particular to the implementation of the L.I.O.P (Large Infrastructure Operational Program), Priority Axis AP3: Development of environmental infrastructure under efficient resource management conditions, for the strategic objective SO 3.2: Increasing the level of urban waste water collection and treatment, as well as the level of ensuring the supply of drinking water to the population [12].
The authors share some experience with the complicated issue of sustainable development of the water sector by implementing the Water Framework Directive (mainly of the water supply and sanitation (WSS) network in Romania. This topic of research has been approached in previous papers from some

different perspectives of economic and environmental analysis, enabling the development in time of a more and more synthetic assessment and a sustainable development statement.

The main issues that have been already highlighted or assessed in these papers are related to:

-The problems and requirements of promoting increased access to WSS [8];

-The correlation between water infrastructure and economic development [7];

-The importance of water security for a sustainable agriculture development [5];;

-The impact of the regionalization of the WSS operating companies on increasing the access in the rural areas of Romania [9].

The present paper resumes some of the WSS sustainable development issues in Romania, from a more multidimensional viewpoint of the SDGs in the Agenda 2030, taking also into consideration some new challenges and emergencies raised by the Sars-Cov-2 pandemics in 2020.

MATERIALS AND METHODS

Theoretical, qualitative and quantitative analysis is used to describe the progress or the situation of the research subject, namely of some Sustainable Development Goals (SDG1 and SDG 6) indicators in relation to the progress of WSS major infrastructure projects [3].

The methods and materials include: A literature review mainly based on previous research outcomes; Conceptual analysis; Analysis and synthesis of main strategic objectives of the Large Infrastructure Operational Program for sustainable development in the Romanian WSS sector; Tables, graphs and figures on the nature and direction of evolution, either extracted from relevant national/international reports or based on own data computations, in view of a comparative analysis for the trends of selected indicators.

The Eurostat monitoring indicators and the country report corresponding to the 2020 European Semester shall be used for reference and comparisons.

Progress is being analysed both in relation to the SDG targets and the evolution of the indicators in Romania vis-à-vis the EU, given that our country benefits from European Structural and Investment (ESI) funding precisely to reduce the gap with the EU average. This approach is supposed to emphasize the effectiveness of these programs and/or make new efforts aware.

RESULTS AND DISCUSSIONS

Requirements and challenges for sustainable development in the national context

In the case of Romania it was needed, about 30 years since, a more special awareness and the effective change of the development paradigm, in the sense of principles and requirements of sustainable development. Identification and adaptation of sustainable development concepts and requirements to the particular situation of Romania as a former socialist developing country for which it was necessary to identify the best way forward, was required for:

-Efficient and harmonious transition, from the centralized and planned socialist economy to market economy, based on the legacies of supply and demand;

-Sustainable economic growth, i.e. sustainable in terms of natural, economic, social and environmental resources, i.e. sustainable development.

The dimensions of the environmental irreversibility, for the case of Romania, were well highlighted and analysed, in early contributions of the Romanian Academy researchers.

The papers of [1, 11,14] may be cited, being interesting to note that some of these critical environmental aspects, which threaten the prospects for sustainable development, are still valid today: the torrentiality of the waters and the clogging force of the reservoirs, due to the disquiet of forests, of large river basins; the increased climatic instability of our biogeographical space, subject to periods of extreme intensity and duration; deterioration of the geography of uses by reducing the wetlands of the Romanian landscape (Danube

Delta, lakes, floodplains, etc.); accelerated expansion of soil erosion, reaching 6 million ha of agricultural land.

The conclusion is, once again, true and visionary: from a certain threshold of environmental sustainability, the problem of survival is the same for the whole planet, a fact that determines the need to globalize sustainable development actions.

Finally, one area that required funding and development to support the entire process of sustainable development of Romania is the environmental infrastructure, namely the water supply and sewerage (WSS) infrastructure that still presents a urban-rural or/and European-national development gap. [8, 6].

With the current national sustainable development strategy (SNDD) 2030, Romania is setting itself the national framework for supporting Agenda 30 and implementing the set of 17 SDGs. The strategy supports Romania's development on the three main pillars of sustainable development, namely the economic pillar, the social pillar and, of course, the environmental pillar.

Thus, the following principles and directions of action can be summarized (Romania's SNDD 2030, 2018) [16]:

- For the economic pillar it is considered necessary to guarantee long-term economic growth that benefits the citizens of Romania. Such an approach will create a culture of entrepreneurship in which citizens can integrate and accomplish material and aspirational goals;
- Reforms and economic growth are also closely linked to the social pillar of Romania's sustainable development. Efforts and investments are needed here to reach a cohesive society that benefits from some much-needed progress: improving the education and health system, reducing inequalities between men and women, or urban and rural areas.
-The environmental pillar has become more robust as awareness of environmental importance has increased significantly in recent years, both in terms of the natural and the anthropogenic environment.

Sustainable development of WSS services in Romania through ESI-funded programs

As further detailed and developed, investments in environmental infrastructure and especially in WSS infrastructure or irrigation systems continue to pose particular challenges in the context of the 2030 Agenda for Sustainable Development.

The quantitative and qualitative state of the waters has a major impact on the associated ecosystems; thus, only the rational use and responsible management of water resources can ensure the sustainable development of a country or region.

Therefore, especially since Romania has adopted the environmental EU acquis, investment needs in the field of environmental and water infrastructure are a great challenge for our country, from an economic, financial and administrative point of view, especially in the context of the global health, environmental and economic crisis. Thus, for the period 2010-2027, the total costs for the implementation of the Water Framework Directive (2000/60/EC) or European Water Quality Directives and the program of measures at national level amount to around EUR 20 billion.

To conceptually support these investments, identifying and verifying the correlation between environmental infrastructure and sustainable economic development at local, regional or national level is still a methodological conceptual challenge for economic research [7].

The urge to achieve Sustainable Development Goal (SDG) 6-Clean water and sanitation – by ensuring availability and sustainable management of water and sanitation for all, was more than ever needed in the current pandemic [4].

There is clear and sufficient evidence pointing to the correlation between a lack of access to clean sanitation or hygiene and the risks of acquiring SARS-CoV-2. Sanitation is important since “standard wastewater treatment processes are effective for enveloped viruses, including SARS-CoV-2. Each stage of wastewater treatment combining physical, biological and chemical processes results in a further reduction of the

potential risk of exposure and accelerates pathogen reduction" [19].

As there will be pointed further in this research, based on the latest reports [18, 3] in many parts of the world but also in Romania there are still high-percentages of households without access to a bathroom at home.

Table 1. Global targets (6.1. and 6.2) status of progress on SDG 6- Water and sanitation for all

Global target	**Global indicator Status**	**Summary and priority areas for acceleration**
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all (100%)	6.1.1 Proportion of population using safely managed drinking water services Baseline:70% (2015) Latest: 71% (2017)	Achieving the SDG global target 6.1 by 2030 will require a four-fold increase in the current rate of progress. 7 out of 8 SDG regions are currently off track. 785 million people still lack even basic drinking water services. Among these, 8 out of 10 live in rural areas and nearly half live in Least Developed Countries.
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all (100%) and end open defecation (0%), paying special attention to the needs of women and girls and those in vulnerable situations.	6.2.1a Proportion of population using safely managed sanitation services Baseline:44% (2015) Latest: 45% (2017)	Achieving the SDG global target 6.2 by 2030 will require a four-fold increase in the current rate of progress. No SDG region is currently on track. 2 billion people still lack even basic sanitation services. Among these 7 out of 10 live in rural areas and 3 out of 10 in Least Developed Countries.
	6.2.1b Proportion of population with a handwashing facility with soap and water available at home Baseline:60% (2017) Latest: 60% (2017)	There are currently insufficient data to estimate global trends in access to basic handwashing facilities. Over half of the population in rural areas and nearly three quarters of the population of Least Developed Countries lack handwashing facilities with soap and water. In Sub-Saharan Africa 2 out of 5 people have no handwashing facility at all.

Source: Summary Progress Update 2021-SDG 6 - Water and Sanitation for all [4].

Data are raising concerns, since good hygiene practices play a central role in helping contain the spread of COVID-19.

Considered as a goal concerning the lifeblood of society and the planet, progress towards the eight SDG 6 targets is expected to have catalytic effects across the entire 2030 Agenda.

Estimates on the progress and challenges in the SDG6 (in Table 1) come from the latest UN Water Report (Summary Progress Update 2021: SDG 6 — water and sanitation for all) and the general conclusion is that: „The world is not on track to achieve SDG 6" [4].

In Romania, the state of development of the WSS sector is among the poorest in Europe, a fact already reported in previous publications: especially "in rural areas at regional levels, inadequate water treatment, poor sewerage network and low access to centralized water and wastewater systems are the main weaknesses of this environmental sector" [8].

Another issue of concern is that the worst quality of groundwater in Romania is in the rural areas, where the sewerage network is underdeveloped or totally missing and the waste water gets directly into underground. The presence of nitrates in high concentration in the underground waters affected human health in some areas.

Regarding the agri-food sector, the too slow progress of the overall national agri-food system, the still large discrepancies and non-convergence between our country's agriculture and that of the other EU countries, the existence of large severe rural poverty areas, as well as the precarity of Romania's population's food security have been signalled and analysed in [5].

From most country-specific documents and assessments for Romania (quoted in the following sections), but also from other previous studies it can be concluded that, in the environmental infrastructure sector, there is still a substantial gap between Romania and other Member States, as well as between Romania and European averages.

Therefore, support for this sector (Environment) through specific investment programs and reforms financed by the European ESI Funds is still particularly necessary in Romania, in order to progressively alleviate the significant gaps in the existing sector but also to address in advance possible new environmental problems and challenges, such as those arising as a result of the serious public health crisis triggered by the pandemic with Covid-19 (2020), with a particularly strong negative impact in the area of sustainable development.

Critical aspects in the implementation of LIOP Priority Axis 3

This section proposes an evaluation of the interim results and performance recorded in the implementation of Priority Axis 3 of the Large Infrastructure Operational Program (LIOP), for specific objective SO 3.2. in view to a further correlation with progress or stagnation on some SDGs (especially relevant to the environment) in Romania [12].

In general, the package of measures contained in the LIOP is a continuation of efforts made under the Sectoral Operational Program Environment (SOP Environment) 2007-2013.

The measures cover the most significant and demanding areas of environmental infrastructure.

An overwhelming proportion of the funds will be directed to the areas where Romania must comply with the environmental acquis (and the obligations established under the Accession Treaty). This in itself is a factor of sustainable development as compliance with the acquis requires sustainable growth; a pillar of the Europe 2020 strategy.

In line with the Guide to Thematic Objectives, LIOP draws attention to the Regional Water Master Plan and their compliance with the Hydrographic Basin Management Plans. A complementary program for rural areas is financed through the European Fund for Agriculture and Rural Development (EAFRD), with coordination taking place at operational level. Certain projects initiated under POS Environment 2007-2013 have not been completed in time. Some will be completed on the basis of national funds and others are proposed for 'staging' on the basis of funds currently allocated.

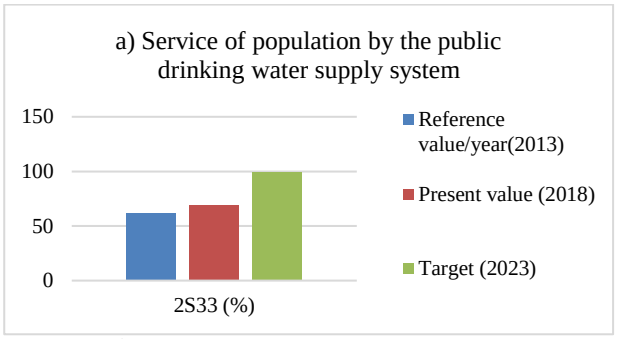
With regard to the specific objective of OS3.2 - Increasing the level of urban waste water collection and treatment, as well as the degree of ensuring the drinking water supply of the population, it can be said that the level of implementation and achievement of the targets at the end of the program is modest, especially taking into account that the results of financial implementation are generated almost entirely by phased projects (approximately 78% of the sector payments of 230.94 million. euro represent payments from phased projects).

The pace of implementation of phased projects is still slow, with significant delays from the original timetable. Their implementation had reached just 301.73 million euros of the total eligible value of phased projects of 963.27 million euro. Euro (2019).

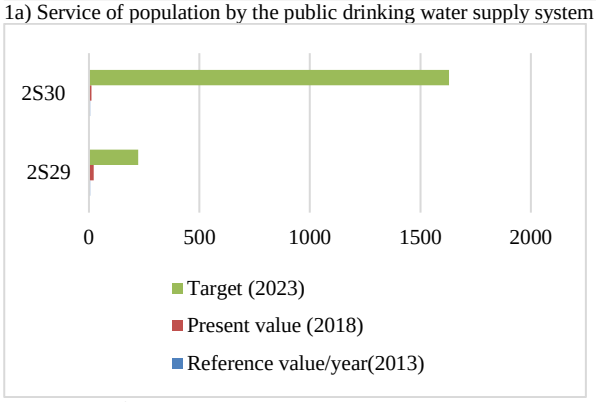
This reveals complex problems in the implementation of major projects based on a large number of various works contracts requiring simultaneous management. In addition, major delays in the preparation of new investment projects are recorded at axis 3 level. However, the contracting level of 82.26% completed by the projects in preparation attests an acceptable level that provides a sufficient basis for the implementation of the axis in approved terms.

Outcome indicators are presented as follows (2019):

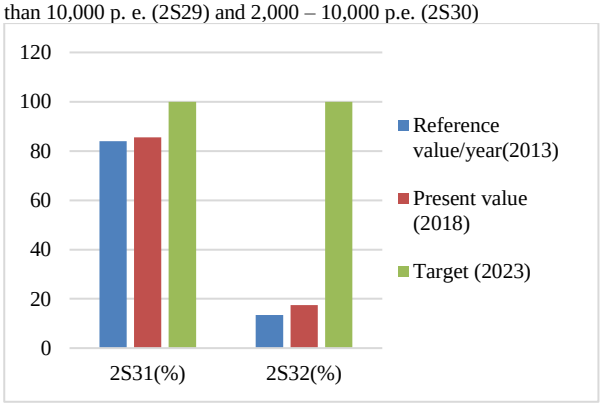
- 2S29 Number of compliant wastewater treatment plants WWTPs serving agglomerations of more than 10,000 p.e. (population equivalent): the reached value is 22 up from 15 in 2017; a number of 117 WWTPs meet 2/3 compliance criteria laid down in Article 5 of Directive 91/271/EEC;
- 2S30 Number of compliant WWTPs serving agglomerations of 2,000 to 10,000 p.e.: the reached value is 12 up from 7 in 2017; 524 WWTP meet only the criteria for the structure of the treatment plant laid down in Directive 91/271/EEC, Article 5;
- 2S31 The connection of biodegradable organic loading (in equivalent inhabitants) to systems for the collection of wastewater in agglomerations with more than 10,000 p. e.: the value is 85.6% down from 86.56% in 2017;
- 2S32 Level of connection of biodegradable organic loading (in equivalent inhabitants) to collection systems in agglomerations with 2,000-10,000 p.e.: the value reached is 17.5% up from 17.08% in 2017;
- 2S33 The degree of service of population by the public drinking water supply system: statistical data available in 2019 (NSI) indicate a value of 69.4% (up from 67.5% in 2017.



1a) Service of population by the public drinking water supply system



1b)Number of compliant WWTPs serving agglomerations with more than 10,000 p. e. (2S29) and 2,000 – 10,000 p.e. (2S30)



1c) The level of connection of biodegradable organic loading (in equivalent inhabitants) to collection systems (in agglomerations with more than 10,000 p.e. (2S31) and 2,000 – 10,000 p.e. (2S32) - %)

Fig. 1. LIOP Goal 3.2 Specific outcome indicators, Priority Axis 3

Source: Adaptation and own processing by LIOP (April 2020 version) and implementation reports [12].

The level of service of the population by the public drinking water supply system (2S33) increased by 13% in 2018, but an increase of another 43.3% is needed to reach the target value in 2023, so it would require a tripling of the growth rate of this indicator (Fig 1a).

Figure 1 (a, b, c) analyses these result indicators and highlight the following issues related to the impact of the WSS investments made.

The level of connection of biodegradable organic loading (in equivalent inhabitants) to collection systems in agglomerations with more than 10,000 p.e. (2S31) and 2,000 – 10,000 p.e. (2S32) recorded slow increases, but with large differences in impact, as follows (Fig. 1c):

-2S31 increased by less than 2% in 2018, and an increase of another 13% needed to reach the 100% target, but this is possible by 2023 (urban sewage);

-For 2S32, which actually refers to sewerage sanitation in rural areas or small towns, the increase is the same, extremely modest, of only 4% while it would take another 82% to achieve the target, this being impossible until 2023.

In terms of the number of compliant WWTP (wastewater treatment plants) serving agglomerations of more than 10,000 (population equivalent) p.e. (2S29) and 2,000 to 10,000 p.e. (2S30) the situation is very inadequate, although there is some intermediate progress of the work that has not been recorded in the results because the WWTP is not operating at the projected all capacity, although they are completed (Fig.1 b).

The impression is that in this area of WSS infrastructure investment funded by LIOP, the pace of preparing and implementation of major projects is very slow, given that the process has started relatively early, many projects being actually phased out of the average POS. However, these major WSS projects will form the basis for the portfolio of the forthcoming financial program, taking into account the significant investment needs to comply with the European Wastewater Directives.

As analysed in the next chapter, this perpetual lag in Romania in terms of environmental infrastructure and especially water and wastewater seriously hinders Romania's progress towards the Sustainable Development Goals SDG1, SDG6 and all connected SDGs.

Progress on the SDGs

SDG 6 is to ensure availability and sustainable management of water and sanitation for all by 2030 is critical to sustainable development. Safe drinking water and sanitation are human rights.

Besides, frequent and correct hand hygiene is one of the most important measures to prevent infection with SARS-CoV-2. (UN Water, 2021) [18].

Access to these services, including water and soap for handwashing, is fundamental to human health and well-being [8].

Taking in consideration the complex links and synergies of the SDGs [10] the contribution of the water supply and sanitation services is considered essential for:

-adequate nutrition (SDG2-No hunger);

-healthcare and prevention of diseases (SDG3-Good health);

-normal functioning of schools (SDG4-Education);

-business or institutions (SDGs-8, 9, 16).

Besides, larger access to WSS enables the better participation in society of women, girls and marginalized groups, thus it is a factor of progress towards SDG 5-Gender equality, as prefigured in a dedicated paper [6].

Unfortunately, efforts in Romania, the EU and around the world to implement the Sustainable Development Goals have been severely affected or impacted in 2020 by the health, economic and environmental crisis caused by the SARS-COV 2 pandemic.

The effects and the measures taken to mitigate the impact of the pandemic have been resented globally especially by:

- the health systems unable to cope with the disease;
- (up to 90 per cent) students unable to attend school;
- businesses shutting down affecting global value chains. Unfortunately the SARS-COV 2 pandemic may lead the return of up to 71 million people into extreme poverty undernourishment in 2020 [17].

However, as a result of economic growth and development policies or reforms achieved in recent years, the indicators suggest that Romania is making progress towards the United Nations Sustainable Development Goals (SDGs).

Table 2. Indicators measuring Romania's progress towards the SDGs: SDG1-No poverty

SDG-Sub-theme Indicator		***Unit***	***Romania***		***EU-28***	
			Starting value	Latest value	Starting value	Latest value
SDG1-No poverty						
Basic needs	Population living in dwelling with a leaking roof, floors or foundation or rot in window frames or floor	% of population	16.2	10.1	15.6	13.9
	Self-reported unmet need for medical care	% of population over 16	10.9	4.9	3.7	2.0
	Population having neither a bath, nor a shower, nor indoor flushing toilet in their household	% of population	33.7	25.6	2.2	1,7
	Population unable to keep home adequately warm	% of population	14.7	9.6	10.7	7.3
	Overcrowding rate	% of population	50.6	46.3	17.0	15.5

Source: Own selection- extract from country report Romania, 2020 European Semester (SWD (2020) 522 final) [2].

Romania has managed to advance 4 positions in the international ranking on the SDGs implementation (from 42 to 38), a fact stated in the 2020 Global report on the 2030 Agenda [15].

Some of these SDGs (mainly related to the implementation of the priority axis 3 of the L.I.O.P) have been analysed by us to verify their progress, factors and prospects.

In this respect, for SDG 1, "No Poverty", there are analysed the indicators expressing poverty through the degree of access to infrastructure and public services, in order to achieve the basic needs of the Romanian population (Table 2).

Although there is progress from 2013 to 2018 to observed, there are two indicators where Romania's situation is much worse than the EU's (average) situation:

(a)The population with no bathroom, shower, and indoor toilet with running water in the household; the rate has fallen further in Romania (from 33.7% in 2013 to 25.6% in 2018) but is still extremely high (20 times higher) compared to only 1.7% in the EU.

(b)The rate of overcrowding of homes is 46.3%, which is three times higher than the average in the EU (15.5%).

These aspects of lack of access to water supply and sanitation (WSS) services and the impossibility of social distancing are currently gaining new valences and risks from the poor hygiene and living conditions, in the SARS-COV-2 global health crisis.

The conclusion is that for the time being, in Romania, poverty remains high and access to essential public services is limited. The risk of poverty mainly affects rural areas and vulnerable groups.

Table 3. Indicators measuring Romania's progress towards the SDGs: SDG6-Clean water and sanitation

SDG-Sub-theme	*Indicator*	*Unit*	*Romania*		*EU-28*	
			Starting value	*Latest value*	*Starting value*	*Latest value*
SDG6-Clean water and sanitation						
Sanitation	Population having neither a bath, nor a shower, nor indoor flushing toilet in their household	% of population	33.7	25.6	2.2	1.7
	Population connected to at least secondary wastewater treatment	% of population	35.3	46.5	N/A	N/A
Water quality	Biochemical oxygen demand in rivers	Mg O_2 per litre	3.33	3.22	2.06	2.00
	Nitrate in groundwater	Mg NO_3per litre	N/A	N/A	19.2	19.1
	Phosphate in rivers	Mg PO_4 per litre	0.096	0.098	0.096	0.093

Source: Own selection- extract from country report Romania, 2020 European Semester (SWD (2020) 522 final) [2].

As may be seen (Table 3), the importance of access to environmental infrastructure is supported by the presence of some multifunctional indicators, which certify the synergistic link between some of the SDGs.

For instance, the population that has neither a bath, nor a shower nor an indoor toilet with running water in the household is a common indicator of sustainable development for the SDG1 Poverty-Free and the SDG 6 Clean Water and Sanitation.

In the case of sanitation, as seen from figure 2, compared to 2013, in 2018 there was a decrease in the percentage of the population who did not have access to a bathroom, shower and toilet in the house, from 33.7% to 25.6%; however Romania still remains well above the EU average of only 2% and comes first in the EU.

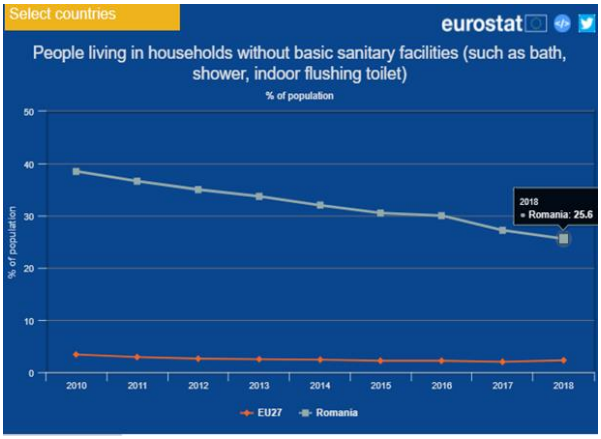


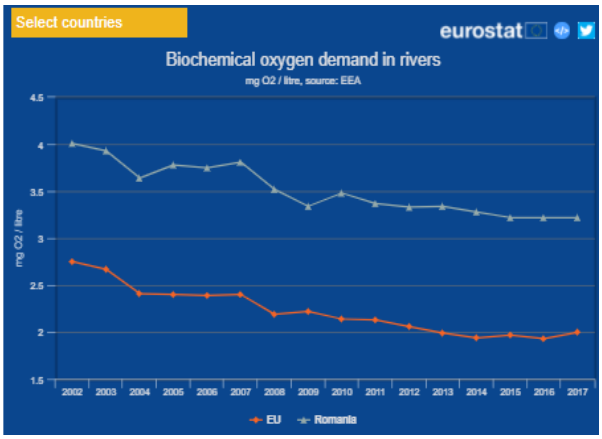
Fig. 2. Dynamics of the population rate without a bath with indoor toilet and running water in the household, in Romania and the EU 27
Source: Eurostat, 2020 [4].

In 2019, the recent estimate of this Eurostat indicator of poverty for Romania is a rate of 22.9% of the population without a bath, indoor toilet and running water in the household (with reference to the toilet in the home the rate is 24.2%); however, this is an outstanding progress considering the high initial rate of 41.5%, in 2007 (year of Romania's accession to the European Union).

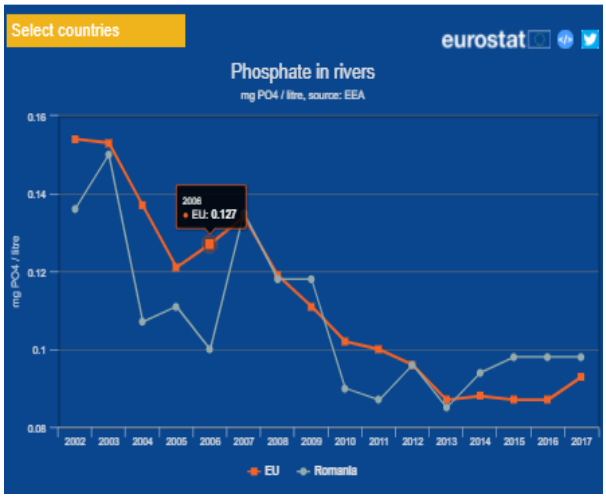
So the development of the WSS infrastructure through the ESI funds (through major projects by the SOP Environment 2007-2013 and respectively the L.I.O.P 2014-2020) has increased the number of inhabitants connected to water supply and sanitation services in

Romania, especially in poorly served rural areas. However, Romania continues to come first in the EU at this indicator of lack of access to WSS, which means a persistent deficit in sustainable development and an endemic state of poverty (a common indicator with SDG1 No poverty).

Also in terms of water quality, from figure 3 it is noted that although some progress has been made, this is not obvious, so that between 2012 and 2017 the biochemical oxygen consumption in rivers decreased by 4%, but this remains 60% higher than the average in the EU-28 (Figure 3 a). Phosphate levels in rivers have increased slightly in Romania and decreased in the EU, but are now almost similar (+/- 5%) (Figure 3, b).



(a)Biochemical oxygen demand in rivers, evolution in Romania and the EU



(b)Phosphate in rivers, evolution in Romania and the EU

Fig. 3. Water quality indicators of SDG6 – Clean water and sanitation, in Romania and EU

Source: Eurostat, https://ec.europa.eu/eurostat/web/sdi/clean-water-and-sanitation [4].

The modest progress under these SDG 6 - Clean water and sanitation, water quality and availability indicators is closely and directly linked to the too slow or insufficient implementation of the L.I.O.P (Priority Axis 3), previously analysed.

Development of water and sewerage network infrastructure, the construction and rehabilitation/ modernization of sewage treatment plants, sewerage networks and waste water treatment plants are still a priority of sustainable development in Romania.

CONCLUSIONS

As shown since the first chapter, in Romania in the transitional stage the concept of sustainable development was accepted more declaratively, as a result of appropriation of the UN documents in this field. However, this generous and complex concept was thoroughly studied and grounded quite early by researchers from the Romanian Academy.

After 2000, with the start of EU accession, sustainable development is an integral part of legislative and institutional construction, reflected in the main directions of state policy. It can be said that the adoption of the common environmental acquis and the application of agreed working instruments at EU level are the main driver of Romania's accelerated alignment with the principles and practices of sustainable development.

Normally, access to the European Structural and Investment (ESI) Funds can enable Romania to make increasing progress for local, sectoral and national sustainable development, synergistically and coordinated, at all 17 Sustainable Development Goals.

For this sustainable development in line with the UN 2030 Agenda, Romania has adopted Romania's National Strategy for Sustainable Development 2030, which allows it to channel ESI and national funds to implement these SDGs and also to:

-develop in a balanced way the regions left behind – addressing SDGs 1, 3, 6, 8, 10, 11;

-modernise transport and environmental infrastructure – addressing SDGs 6, 7, 9, 11, 13;

support rural development- addressing SDGs 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 15.

The overwhelming majority of resources allocated in the environmental section of the LIOP concern, as in the previous case of POS Environment, compliance with European Community legislation - the environmental acquis. The problem is that Romania has not yet managed full compliance with the EU environmental acquis, so investment and development efforts must continue, in order to progressively alleviate the existing important gaps but also to address in advance possible new environmental problems and challenges, such as those arising as result of the serious public health crisis triggered by the pandemic with Covid-19 (2020), which can have a particularly strong negative impact in the area of most Sustainable Development Goals.

Although investments in water and wastewater infrastructure (through major regional projects) have contributed to both reducing poverty and increasing population access to water and sewerage sanitation services, Romania still remains the poverty leader in the EU at the multifunctional indicator rate of the bathroom less population, without indoor toilet and running water in the household (SDG1-No poverty and SDG6-Clean water and sanitation).

In order to comply with the requirements of the SDG1, SDG3, SDG6, SDG 9, SDG 10 (and in synergy all the sustainable development needs of Romania) it is necessary to take into account the many problems in the provision of water and sanitation sewerage services, especially in the area of rural localities where households or even streets within the localities are not connected to the sewerage network.

In fact, it is important to be aware at least now, in the context of the epidemiological situation caused by the spread of the SARS-CoV-2 coronavirus, that ensuring adequate and equitable access to sanitation and hygiene for the whole population, with priority to schools and dispensaries, is a public health problem for which the state of emergency was established by Decree No. 195/2020 on the state of emergency on the territory of Romania, prolonged with numerous states of alert.

As regards the water supply and sewerage sector, financed by LIOP Priority Axis 3, specific objective 3.2., Romania receives funding of EUR 3.22 billion in the current programming period. With this contribution of 3 billion. €, future investments to be made will cover about 25% of compliance needs, substantial financing from other sources is required and some measures are expected.

There is much hope that support for the faster development of the WSS systems in poorly served areas can be provided through the NRRP.

The allocation proposal from the National Recovery and Resilience Plan (NRRP) for the water and sewerage network and irrigation systems would be a total of 4 billion. Euro.

It would represent maybe the last chance for Romania to recover the substantial gap in the sustainable and equitable development of the water supply and sanitation systems, since access to these utilities represents a basic need for fighting poverty and pandemics.

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COMPARATIVE ANALYSIS OF THE MAIN TECHNICAL INDICATORS FOR SUNFLOWER CROP IN ROMANIA

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Abstract

The sunflower crop is one of the most important crops from an economic point of view for Romania, being cultivated on large areas. The pedoclimatic conditions in our country allow the cultivation of sunflower in different areas, and the drought resistance of this crop helps farmers to obtain high yields. In this study, the main technical indicators were compared, such as: area, total production and average production for two distinct periods 1994-2006, respectively 2007-2019, thus delimiting the period before accession and after accession to the European Union. Based on these indicators were the comparisons of the averages of the two periods using the Student Test method, as well as the estimation of the main technical indicators until 2030. The aim of the paper was to determine statistically the dependence of the averages of the two periods the evolution of the main technical indicators.

Key words**:** *sunflower, surface, production, estimation, forecast, evolution*

INTRODUCTION

Sunflower cultivation along with rapeseed and soybeans are the main oil crops grown in the European Union. Despite the importance of these crops for human and animal consumption, there is no financial support mechanism for farmers at European level designed specifically for them [4, 5].

In Romania, sunflower cultivation is extremely important, occupying a leading place in the crop rotation structure and being one of the most cultivated oilseeds, along with rapeseed. Sunflower is of major importance because the seeds resulting from the cultivation process are used to obtain the oil used in human nutrition, but also to obtain sunflower meal used in the livestock sector. The seeds resulting from the harvesting process can also be used to produce biodiesel, a renewable energy source [6, 2, 3].

In 2019, in the European ranking, Romania occupied the first place in terms of cultivated area and total sunflower production obtained, registering a cultivated area of 1.3 million hectares and a production of 3.45 million tons. Along with the contribution that sunflower makes to the farmer, sunflower is an excellent honey plant being a source of pollen for bees and contributing to the amount of honey that beekeepers obtain during a year [7, 9, 10].

Given the climate change affecting the whole world, the natural drought resistance of sunflower plants is extremely important. This drought resistance is given by the existence of a rich and strong root system that penetrates deep into the soil. When there is heavy rain, the sunflower forms the so-called rain roots that populate the soil to the surface to extract as much water as possible [11, 1, 2].

Sunflower is a crop that is also important in terms of exports, being a highly traded commodity in Romania along with other products obtained in primary production. According to the data of the Ministry of Agriculture and Rural Development of Romania in January-September 2020 our country received from exports of sunflower seeds to domestic and non-EU countries over 235.3 million euros, while the value of sunflower imports for the same period was 113.9 million euros [6, 11].

MATERIALS AND METHODS

The processed data are obtained from the platform of the National Institute of Statistics, accessed on 17.01.2021. Thus, these data were processed both quantitatively and qualitatively, being analyzed the main technical indicators such as: area, total production and average production for sunflower cultivation. In the tables presented below they were analyzed every year, included in the two analyzed periods, but only the first and last year were mentioned in the table.

To determine whether or not the two analyzed periods are related, the Student Test was used, which is a decision method that helps us to validate or invalidate with a certain degree of certainty a statistical hypothesis, using the following formula:

$$Tcal = \frac{(M2-M1)}{\sqrt{\left(\frac{var1}{n1}\right)}+\sqrt{\left(\frac{var2}{n2}\right)}}$$

Also, for estimating the area, the total production, and the average production until 2030, the Forecast function from the SPSS Statistical program was used.

RESULTS AND DISCUSSIONS

At national level, in the period 1994-2006 the total area cultivated with sunflower registered a positive trend for all development regions of Romania. At the level of 2006, it is noted that a total area of 991.36 thousand hectares was established, while in 1994 the area occupied by sunflower at national level was 582.19 thousand hectares. Analyzing comparatively, it is observed that the area cultivated with sunflower increased by up to 70.3% compared to the area established in 1994. (Table 1).

At the level of development regions, the areas cultivated with sunflower registered an ascending trend for all development regions of Romania. The most significant evolutions of the areas established with sunflower are registered in the North-East regions (an evolution of the areas of 192.7% of the surface in 2006, compared to 1994), the Central region where there is an evolution of 144% of the area occupied by sunflower cultivation in 2006 compared to 1994 (Table 1).

Table 1. Comparative analysis of the cultivated area with sunflower in the periods 1994-2006, respectively 2007-2019 (thousand ha)

Region	1994	2006	%	2007	2019	%
Total	582.2	991.4	70.3	835.9	1282.7	53.4
North West	34.7	51.9	49.5	59.5	73.0	22.8
Center	1.9	4.6	144.0	4.6	17.9	285.7
North East	35.1	102.7	192.7	105.1	200.5	90.8
South East	197.5	370.2	87.4	287.5	335.5	16.7
South-Muntenia	187.4	303.5	62.0	247.6	267.9	8.2
Bucharest - Ilfov	6.1	14.2	131.5	7.4	10.5	42.6
South West Oltenia	61.8	73.9	19.6	67.7	208.3	207.9
West	57.8	70.5	22.0	56.6	169.1	198.6

Source: National Institute of Statistics data processing, Accessed on17.01.2021 [8].

In the period 2007-2019, the total area cultivated with sunflower at national level registered a positive evolution during the analyzed period. At the level of 2007, an area of 835.92 thousand hectares was established, while in 2019 the area occupied by sunflower crops at national level registered an evolution of 53.4%, being established by approximately 446.77 thousand hectares more than the area occupied in 2007 (Table 1).

At the level of development regions, the sunflower culture has maintained its positive trend registered at national level, so that the most significant evolutions of the area established with sunflower are found in the South-West Oltenia regions (an evolution of over 200 % of the area in 2019, compared to

2007), the Center region where there is an increase of the areas cultivated with sunflower of 198.6% of the area in 2019 compared to 2007. A positive trend in terms of the area cultivated is also noticeable in the North-East development region, where the area cultivated with sunflower increased by 90.8% in 2019 compared to the area cultivated in 2007 (Table 1).

At national level, the total production of sunflower in the period 1994-2006 registered an ascending trend, being influenced by the cultivated area at national level. Thus, at the level of 1994 a total production of sunflower of 763.70 thousand tons was registered, while in 2006 the registered production was almost double compared to the one registered at the level of 1994, being of 1526.23 thousand tone (Table 2).

With regard to total sunflower production in the development regions, it should be noted that all development regions recorded higher sunflower production in 2006 compared to production in 1994. The most significant increase in 2006 compared to the production recorded in 1994 are: the North-East development region where the sunflower production obtained in 2006 was 4.3 times higher than that recorded in 1994, in the Central region sunflower production was 3 times higher in 2006 than production in 1994. Another development region where sunflower production showed a significant evolution in 2006 compared to 1994 is the Southeastern development region, with a production evolution of 166.1% in 2006 compared to 1994 (Table 2).

Table 2. Comparative analysis of total sunflower production in the periods 1994-2006, respectively 2007-2019 (thousand tons)

Region	**1994**	**2006**	**%**	**2007**	**2019**	**%**
Total	763.7	1,526.2	99.8	546.9	3,569.2	552.6
North West	42.5	83.3	96.2	64.2	214.9	234.5
Center	2.4	7.4	206.8	5.8	48.4	739.2
North East	33.4	145.5	335.2	68.5	484.2	606.8
South East	224.7	598.0	166.1	211.5	879.7	315.9
South-Muntenia	271.3	461.5	70.1	101.5	699.5	589.1
Bucharest - Ilfov	10.0	16.6	66.5	3.0	27.9	840.2
South West Oltenia	97.0	111.6	15.1	26.9	629.9	2,242.7
West	82.4	102.3	24.1	65.6	584.7	791.7

Source: NIS data processing, Accessed on 17.01.2021[8].

At national level, the total production of sunflower in the period 2007-2019 registered a significant evolution. Thus, at the level of 2007 a total production of sunflower of 546.92 thousand tons was registered, while in 2019 the registered production was 6.5 times higher than in 2007, being 3,569.15 thousand tons (Table 2).

Regarding the total sunflower productions registered at the level of the development regions, it is noted that all 8 regions registered higher sunflower productions in 2019 compared to the productions registered in 2007. Thus, the regions that register the most significant developments in terms of total sunflower production obtained in 2019 compared to 2007 are: Southwest Oltenia with a production of 629.88 thousand tons, compared to 26.89 thousand tons that were harvested at 2007, being a production 23.4 times higher than in 2007. Also, the Western development region had a total sunflower production of 584.71 thousand tons in 2019, while at the level of 2007, the total sunflower production was 65.57 thousand tons, being approximately 9 times lower than the sunflower production recorded in 2019 (Table 2).

At national level, the average sunflower production in the period 1994-2006 registered an ascending trend, being influenced by the specific weather conditions in the critical vegetation phases for the sunflower crop. Thus, in 1994 there was an average yield per hectare in the case of sunflower of 1.31 tons/ha, while in 2006 the average production

per hectare was 17.6% higher than in 1994, being 1.54 tons/ha (Table 3).

Analyzing the average yields per hectare of sunflower in the development regions, it is noted that 6 of the 8 development regions recorded higher average yields per hectare in 2006 compared to the production recorded in 1994. The most significant increase in terms of average sunflower production per hectare obtained in 2006 compared to 1994 are the regions: Northeast with an average production per hectare higher by 464 tons/ha in 2006 compared to the average production recorded in 1994 (an evolution of 48.7%), the South-East region registers an evolution of the average yield per hectare of sunflower by 41.9% higher in 2006, compared to 1994 and the North region -West where the average production harvested per hectare of sunflower in 2006 was 31.2% higher than the production obtained in 1994 (Table 3).

Table 3. Comparative analysis of average sunflower production in the periods 1994-2006 and 2007-2019, respectively (tonnes/ha)

Region	**1994**	**2006**	**%**	**2007**	**2019**	**%**
Total	1.31	1.54	17.6	0.65	2.78	325.5
North West	1.23	1.61	31.2	1.08	2.94	172.6
Center	1.27	1.59	25.8	1.24	2.71	117.6
North East	0.95	1.42	48.7	0.65	2.42	270.4
South East	1.14	1.62	41.9	0.74	2.62	256.3
South-Muntenia	1.45	1.52	5	0.41	2.61	536.8
Bucharest – Ilfov	1.63	1.17	-28.1	0.4	2.65	559.6
South West Oltenia	1.57	1.51	-3.8	0.4	3.02	661.7
West	1.43	1.45	1.8	1.16	3.46	198.7

Source: NIS data processing, Accessed on 17.01.2021[8].

At national level, the average sunflower production in the period 2007-2019 registered a significant evolution, being influenced by the specific weather conditions in the critical vegetation phases for the sunflower crop, as well as by the investments made. Thus, at the level of 2007 there was an average yield per hectare in the case of sunflower cultivation of 0.65 tons/ha, while in 2019 the average production per hectare was about 4 times higher than that of 2007 (2.78 tons/ha average production in 2019) (Table 3).

Analyzing the average productions obtained per hectare cultivated with sunflower at the level of development regions, it is noted that all development regions recorded average average sunflower productions per hectare in 2019 compared to the productions recorded in 2007 (Table 3).

Table 4. Comparison of the averages of the periods 1994-2006 and 2007-2019 using the Student Test method regarding the cultivated area with sunflower

Region	**N1**	**N2**	**M1**	**M2**	**DF**	**S1^2**	**S2^2**	**tcalc**
TOTAL	13	13	900.8	975.7	24	23,918.0	20,343.0	1.3
Northwest	13	13	52.1	49.3	24	75.4	83.0	-0.8
Center	13	13	4.1	8.2	24	2.4	16.7	3.4
North East	13	13	81.4	119.8	24	697.0	817.6	3.6
South East	13	13	299.5	328.2	24	3,286.3	1,794.7	1.5
South-Muntenia	13	13	283.0	252.2	24	2,853.3	1,275.3	-1.7
Bucharest – Ilfov	13	13	13.0	9.5	24	11.5	2.4	-3.3
Southwest Oltenia	13	13	96.8	122.7	24	601.0	1,804.6	1.9
West	13	13	71.0	85.8	24	143.1	1,303.0	1.4
Critical values of the distribution of T	Probab. 0.05		2.1	*	significant			
	Probab. 0.01		2.8	**	distinctly significant			
	Probab. 0.001		3.7	***	very significant			

Source: NIS data processing, Accessed on 17.01.2021 [8].

Analyzing the two averages calculated taking into account the two periods under analysis (1994-2004, respectively 2007-2019) the following conclusions are drawn (Table 4):
- regarding the comparison of the averages of the two periods at national level, we find that the H1 hypothesis is true in their case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant with the value of 9.1 (probability of 0.001 ***).
- in case of the North-East region, the hypothesis H1 is true, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant having the value of 8.8 (probability of 0.001***).

Table 5. Comparison of the averages of the periods 1994-2006 and 2007-2019 using the Student Test method regarding the total production obtained from sunflower

Region	N1	N2	M1	M2	DF	S1^2	S2^2	tcalc
TOTAL	13	13	1,115.6	1,920.0	24	90,130.2	750,675.2	3.2
North West	13	13	69.5	99.0	24	498.9	2,064.8	2.1
Center	13	13	4.9	17.9	24	3.1	182.3	3.4
North East	13	13	101.9	225.1	24	1,888.0	15,384.2	3.4
South East	13	13	368.3	604.1	24	15,408.2	59,780.2	3.1
South-Muntenia	13	13	353.4	495.0	24	9,018.6	28971.8	2.6
Bucharest - Ilfov	13	13	15.4	17.2	24	22.0	56.0	0.7
South West Oltenia	13	13	106.2	251.9	24	1,310.9	28,609.1	3.0
West	13	13	96.0	209.7	24	783.7	21,012.6	2.8
Critical values of the distribution of T	Probab. 0.05		2.1	*	significant			
	Probab. 0.01		2.8	**	distinctly significant			
	Probab. 0.001		3.7	***	very significant			

Source: NIS data processing, Accessed on 17.01.2021 [8].

Regarding the analysis of the two averages calculated taking into account the two periods under analysis (1994-2004, respectively 2007-2019) the following conclusions can be drawn (Table 5):
- regarding the comparison of the averages of the two periods at national level, we find that the H1 hypothesis is true in their case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant with a value of 6.6 (probability of 0.001 ***).
- in the case of the Center region, we find that the hypothesis H1 is true in their case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant having the value of 4.8 (probability of 0.001 ***).

Table 6. Comparison of the averages of the periods 1994-2006 and 2007-2019 using the Student Test method regarding the average production obtained from sunflower

Region	N1	N2	M1	M2	GL	S1^2	S2^2	tcalc
TOTAL	13	13	1.2	1.9	24	0.0	0.5	3.4
North West	13	13	1.3	2.0	24	0.1	0.4	3.4
Center	13	13	1.2	2.0	24	0.1	0.3	4.5
North East	13	13	1.2	1.8	24	0.0	0.5	3.0
South East	13	13	1.2	1.8	24	0.1	0.5	2.9
South-Muntenia	13	13	1.3	2.0	24	0.1	0.5	3.5
Bucharest - Ilfov	13	13	1.2	1.7	24	0.1	0.3	3.0
South West Oltenia	13	13	1.1	1.9	24	0.2	0.6	3.1
West	13	13	1.3	2.2	24	0.1	0.4	4.6
Critical values of the distribution of T	Probab. 0.05		2.1	*	significant			
	Probab. 0.01		2.8	**	distinctly significant			
	Probab. 0.001		3.7	***	very significant			

Source: NIS data processing, Accessed on 17.01.2021 [8].

Analyzing the two averages calculated taking into account the two periods under analysis (1994-2004, respectively 2007-2019) the following conclusions can be drawn (Table 6.):

- regarding the comparison of the averages of the two periods at national level, we find that the H1 hypothesis is true in their case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant with a value of 4.4 (probability of 0.001 ***).
- in the case of the Center region, we find that the hypothesis H1 is true in their case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of the critical value of the distribution of T is very significant having the value of 4.6 (probability of 0.001 ***).

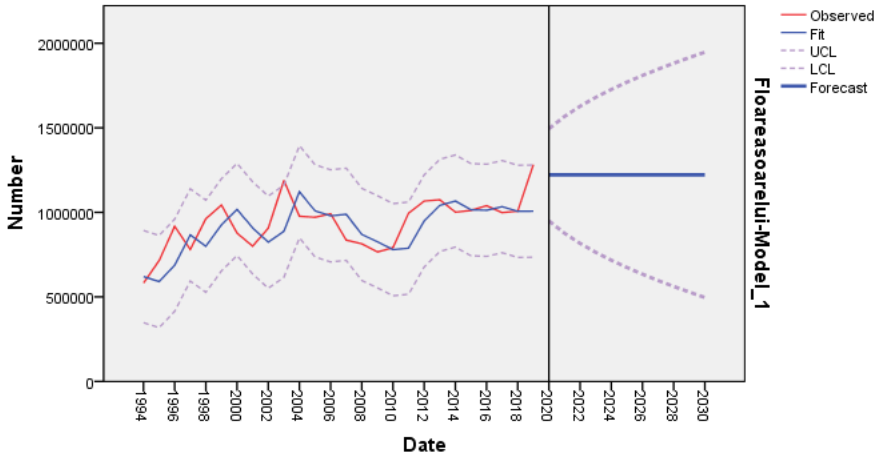

Fig. 1. Estimates on the evolution of the area cultivated with sunflower by 2030
Source: NIS data processing using SPSS, Accessed data on 17.01.2021 [8].

Regarding the estimation of the evolution of the cultivated area with sunflower, it shows a linear trend, and the cultivated area is forecasted to be 1.22 million hectares, decreasing compared to 2019. Also the pessimistic alternative estimates a cultivated area. with sunflower in 2030, of 500 thousand hectares, and the optimistic alternative estimates an area of 1.94 million hectares (Figure 1.).

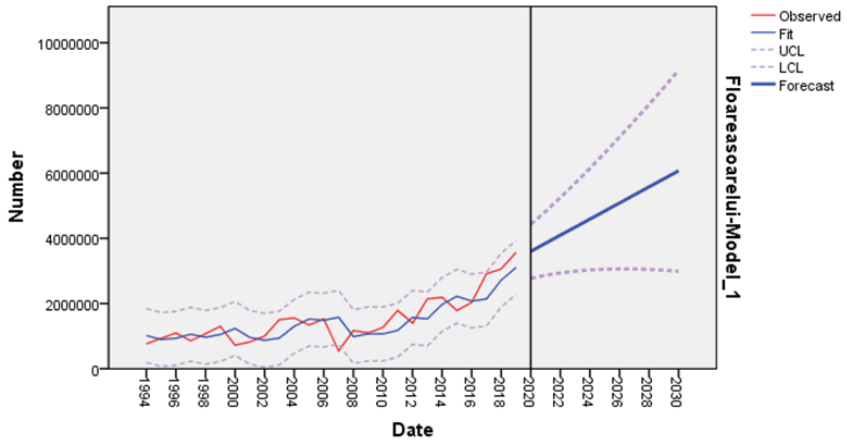

Fig. 2. Estimates of the evolution of sunflower production by 2030
Source: NIS data processing using SPSS, Accessed data on 17.01.2021[8].

Regarding the estimate of the evolution of the production obtained of sunflower, it shows an upward trend until 2030, when it is estimated that the production obtained will be 6 million tons, increasing compared to 2019. Also, the pessimistic alternative estimates a sunflower

production in 2030 of 2.9 million tons (Fig. 2).

CONCLUSIONS

In recent years, total sunflower production has increased significantly as a result of higher average yields. This was due to technological developments, access to quality inputs, high-performance varieties and hybrids, as well as high-performance agricultural equipments.

After Romania's accession to the European Union, there is a significant improvement of the main technical indicators, so that the financial support provided to farmers is also reflected in the productions obtained.

After comparing the two averages of the two analyzed periods, in the case of area, total production and average production, it was demonstrated from a statistical point of view that there is a significant link between the averages of the two periods.

Estimating the evolution of average sunflower production by 2030, the results obtained may be plausible in the context in which investments in agriculture will continue, so that farmers who have not yet made investments, can reach the productions obtained by high-performance farms in Romania .

The importance of sunflower cultivation will continue to grow, given the need to make more efficient use of renewable energy sources, and yields per hectare will need to be improved by hardy and high-performance varieties and hybrids to support global demand for biodiesel, in the next period by implementing the Green Deal plan.

In order to obtain superior yields, the cultivation technologies must be adapted in such a way as to allow the full potential of the cultivated varieties and hybrids to be exploited.

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COMPARATIVE ANALYSIS OF THE PRICE OF RAPESEED AND SUNFLOWER DURING THE PRE-ACCESSION AND POST-ACCESSION TO THE EUROPEAN UNION

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Abstract

Rapeseed and sunflower are the crops that recorded the largest increase in the selling price, in the analyzed period, determined by significant increases in demand for such products and determined by Romania's accession to the European Union, when new markets opened for the sale of agricultural production. In this paper was analyzed the evolution of the selling price of rapeseed and sunflower, for two distinct periods, respectively 1998-2006 and 2007-2019, calculating the main statistical indicators. The averages of the two periods were also compared, using the Student Test method, in order to determine from a statistical point of view the dependence of the averages of the two periods.

***Key words*:** *price, rapeseed, sunflower*

INTRODUCTION

The market for agricultural products is the economic system where agricultural products and services are produced, distributed and consumed. The market for agricultural products has undergone substantial changes over time, and is now characterized by a decrease in labor costs, which is gradually being replaced by modern equipment and technology and an increase in the costs of selling and distributing agricultural products.
Price is an important component of the marketing mix, and for agriculture, price is the monetary expression of the products that the farmer obtains on the farm. Price formation in agriculture in particular, but also in general is the confrontation of supply and demand for certain products [5, 6, 8]. Agriculture is considered an industry in developed countries at the European level, being supported and sustained from public sources to achieve a high level of performance and stability. The price for agricultural products is much different from other areas of activity. The cereals are traded on the stock exchange, and the prices on the stock exchange are relevant for the big players in the market, while for the smaller players on the market such as Romania the price of cereals is slightly influenced by the stock market prices, being most often influenced by the time of sale, the quantity sold and the distance of the producer from the Port of Constanta, the place where agricultural products are exported [3, 9]. In developing countries, where access to information is difficult, the lack of price information is particularly acute in agricultural markets and primarily affects small farmers. The lack of market and price information mainly affects small farmers living in remote areas, often isolated and where financial education is lacking. In the absence of essential information, small farmers sell their agricultural products to intermediaries and most of the time the price is set by the intermediary and depends on the quantity sold and the distance of the producer from the Port of Constanta, the main place where Romanian cereals are exported [1, 2, 7]. As farmers sell their products to intermediaries, they face

(among other things) a considerable disadvantage: more informed traders can exploit this information asymmetry and pay lower prices to the farmer. Agriculture is essential for economic growth and poverty reduction, and the cost of production is an important element in determining production prices. The selling price of agricultural products is important in terms of business profitability, greatly influencing the rural environment, investments and available jobs [4]. Internationally, in order to have a greater bargaining power in relation with traders, farmers have organized themselves into farmers' associations and cooperatives, which not only work their land together, purchase machinery, equipment and inputs together, but sell their production together and to have a certain predictability of the price obtained after one year of work. In Romania, cooperatives and farmers' associations are still developing, most of them specialize more in the joint purchase of the necessary inputs and less in the joint sale of the obtained productions [11]. Price fluctuations in Romania for agricultural products can also be attributed to the fact that most farmers choose to sell their produce from the time of harvest, sometimes directly from the field, when demand is declining, while supply it is quite high on the market and the sales price obtained is lower [12].

MATERIALS AND METHODS

The processed data were obtained from the platform of the National Institute of Statistics, accessed on 21.02.2021, being processed quantitatively and qualitatively. The main statistical indicators were also calculated: minimum, maximum, average, growth rate, standard deviation and coefficient of variation.

The Student Test was used which is a decision method that helps us to validate/invalidate a statistical hypothesis (with a certain degree of certainty), using the following formula:

$$Tcal = \frac{(M2-M1)}{\sqrt{\left(\frac{var1}{n1}\right)+\sqrt{\left(\frac{var2}{n2}\right)}}}$$

Also, to estimate the selling price of rapeseed and sunflower until 2030, the Forecast function from the SPSS Statistical program was used.

RESULTS AND DISCUSSIONS

For rapeseed cultivation, the basic price registered a significant evolution in the period 1998-2006.

If at the beginning of the analyzed period a ton of rapeseed was sold for 125 lei, in 2006 the price reached 740 lei/ton, representing an increase of 492%. The price obtained for a ton of rapeseed during the analyzed period maintained its upward trend, explained on the one hand by the increase in demand for this type of products and on the other hand by the access of Romanian agricultural products on international markets (Figure 1).

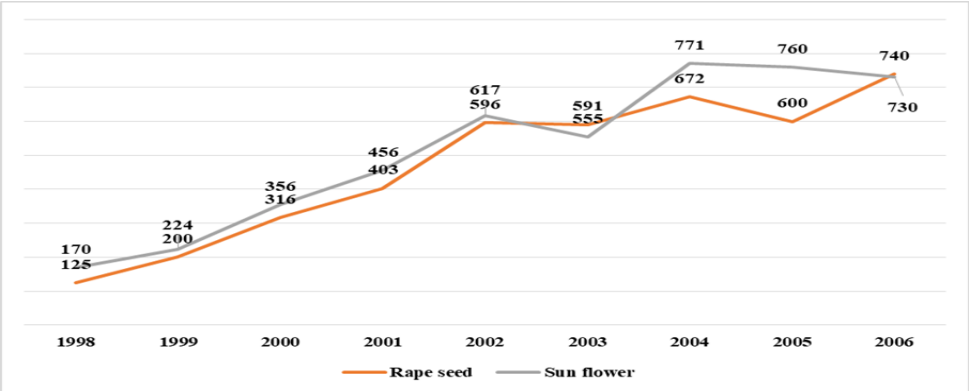

Fig. 1. Evolution of the basic price for sunflower and rapeseed in Romania during 1998-2006 (lei / ton)
Source: NIS data processing, Accessed on 21.02.2021 [10].

And in the case of sunflower cultivation, the price obtained for a ton of this product registered an upward evolution for the entire analyzed period. If in 1998 a ton of sunflower was sold at the price of 170 lei/ton, in 2006 a farmer received for the ton of sunflower sold a price of 730 lei/ton, increasing by 329.4% compared to the price obtained for a ton of sunflower in 1998. The maximum selling price of a ton of sunflower in Romania is registered in 2004, when a ton of sunflower was worth 771 lei (Figure 1).

The minimum of the period in terms of the basic price of rapeseed was 125 lei/ton, while the maximum of the period was 740 lei/ton, being determined an average price of the analyzed period of 471.1 lei/ton and a rate annually of 24.9% with a standard deviation of 218.3 lei/ton. Regarding the coefficient of variation, it has a value of 46.3%, which indicates a degree of heterogeneity of the analyzed data (Table 1).

Table 1. Analysis of the main statistical indicators regarding the evolution of the price for rapeseed and sunflower in the period 1998-2006

Product	Min	Max	Average	Annual rhythm	Standard deviation	Coef. of variation
	lei/ton	lei/ton	lei/ton	%	lei/ton	%
Rape	125	740	471.4	24.9	218.3	46.3
Sunflower	170	771	515.4	20.0	228.1	44.3

Source: NIS data processing, Accessed on 21.02.2021 [10].

In the case of sunflower, the minimum price was 170 lei/ton, while the maximum of the period was 771 lei/ton, being determined an average price of the analyzed period of 515.4 lei/ton and an annual rate of 20% with a standard deviation of 228.1 lei/ton. The coefficient of variation has a value of 44.3%, which indicates a degree of heterogeneity of the analyzed data (Table 1). At the level of 2019, a ton of rapeseed was sold at the price of 1,510 lei, while in 2007 the price for a ton of rapeseed was 790 lei. The price recorded in 2019 for a ton of rapeseed was 91.1% higher than the price obtained in 2007. The highest price for the sale of a ton of rapeseed was obtained in 2012, when a farmer received 1,830 lei/ton, and the lowest price for selling rapeseed was obtained in 2007 - 790 lei/ton (Figure 2).

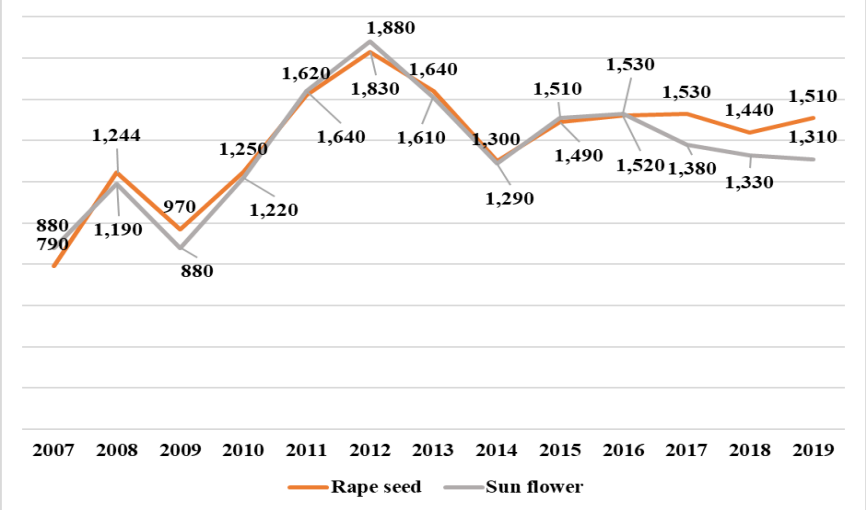

Fig. 2. Evolution of the basic price for rapeseed and sunflower in Romania during 2007-2019 (lei/ton)
Source: NIS data processing, Accessed on 21.02.2021 [10].

Analyzing the basic price for sunflower cultivation in the period 2007-2019, it is noted that the price fluctuated from year to year, influenced by international markets, but also

by the supply of such products in the Romanian market. Compared to 2007 when a ton of sunflower was 880 lei, in 2019 the registered price for a ton was 1,310 lei/ton, increasing by 48.9% compared to the price obtained in 2007. Also in the case of sunflower cultivation the maximum price obtained is registered in 2012, being 1,880 lei/ ton, while the minimum price is registered both in 2007 and in 2009, being 880 lei/ton (Figure 2.).

The minimum of the period in terms of the basic price of rapeseed was 790 lei/ton, while the maximum of the period was 1,830 lei/ ton, being determined an average price of the analyzed period of 1,394.9 lei/ton and a rate annually of 5.5% with a standard deviation of 282.5 lei/ton. Regarding the coefficient of variation, it has a value of 21.1%, which indicates a degree of heterogeneity of the analyzed data (Table 2).

Table 2. Analysis of the main statistical indicators regarding the evolution of the price for rapeseed and sunflower in the period 2007-2019

Product	Min	Max	Average	Annual rhythm	Standard deviation	Coef. of variation
	lei/ton	lei/ton	lei/ton	%	lei/ton	%
Rape	790	1,830	1,394.9	5.5	282.5	20.3
Sunflower	880	1,880	1,357.7	3.4	285.9	21.1

Source: NIS data processing, Accessed on 21.02.2021 [10].

In the case of sunflower in the analyzed period 2007-2019, the minimum price was 880 lei/ton, while the maximum price of the period was 1,880 lei / ton, being determined an average price of the analyzed period of 1,357.7 lei/ton and an annual rate of 3.4% with a standard deviation of 285.9 lei/ton. The coefficient of variation has a value of 21.1%, which indicates a relatively heterogeneous degree of data analyzed (Table 2).

Table 3. Comparison of the averages for the periods 1994-2006 and 2007-2019 using the Student Test method regarding the price for rapeseed and sunflower

Product	N1	N2	A1	A2	DF	S1^2	S2^2	tcalc
Rape	9	13	471.4	1,394.9	20	47,654.0	79,791.7	8.6
Sunflower	9	13	515.4	1,357.7	20	52,032.0	81,719.2	7.7
Critical values of the distribution of T	Probab. 0.05		2.1	*	significant			
	Probab. 0.01		2.8	**	distinctly significant			
	Probab. 0.001		3.8	***	very significant			

Source: NIS data processing, Accessed on 21.02.2021 [10].

Analyzing the two averages calculated according to the two periods taken into account (1998-2006, respectively 2007-2019) the following can be deduced (Table 3):

• regarding the comparison of the averages of the two periods in the case of the price for rapeseed, we find that the H1 hypothesis is true in this case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of critical value of the distribution of T is very significant with a value of 8.6 (probability of 0.001 ***).

• in the case of comparing the averages of the two periods in the case of the price for sunflower, we find that the H1 hypothesis is true in this case, as the data are related to each other (are dependent) from a statistical point of view, and in terms of critical value of the distribution of T is very significant having the value of 7.7 (probability of 0.001 ***).

Based on the data existing until 2019, it was possible to estimate the evolution of the basic price for rapeseed until 2030, which shows an increasing trend reaching the value of 2,235 lei/ton, increasing by 48% compared to the price recorded in 2019 (Figure 3).

Based on the data existing until 2019, it was possible to estimate the evolution of the basic price for sunflower until 2030, which shows an increasing trend reaching the value of 1907 lei / ton, increasing by 45% compared to the price recorded in year 2019 (Figure 4).

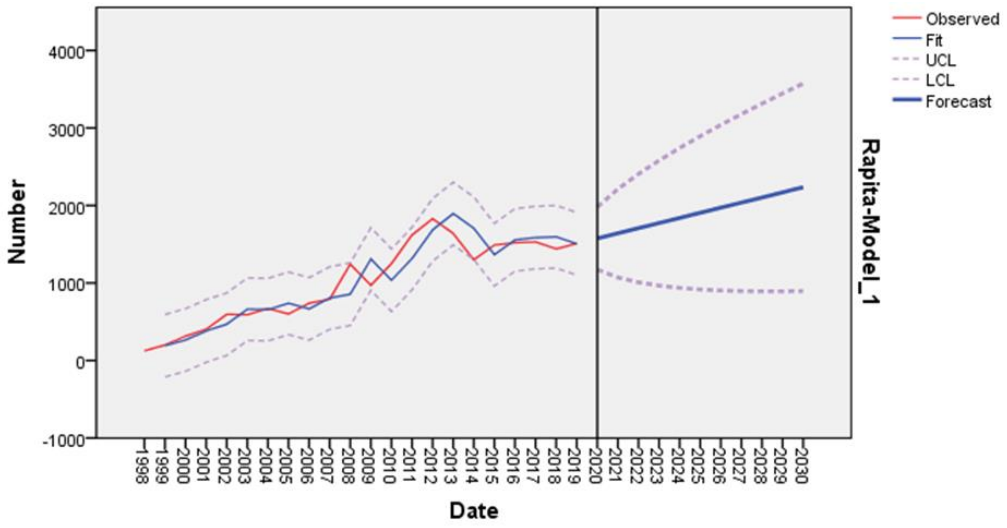

Fig. 3. Estimates on the evolution of the basic price for rapeseed by 2030
Source: NIS data processing, Accessed on 21.02.2021 [10].

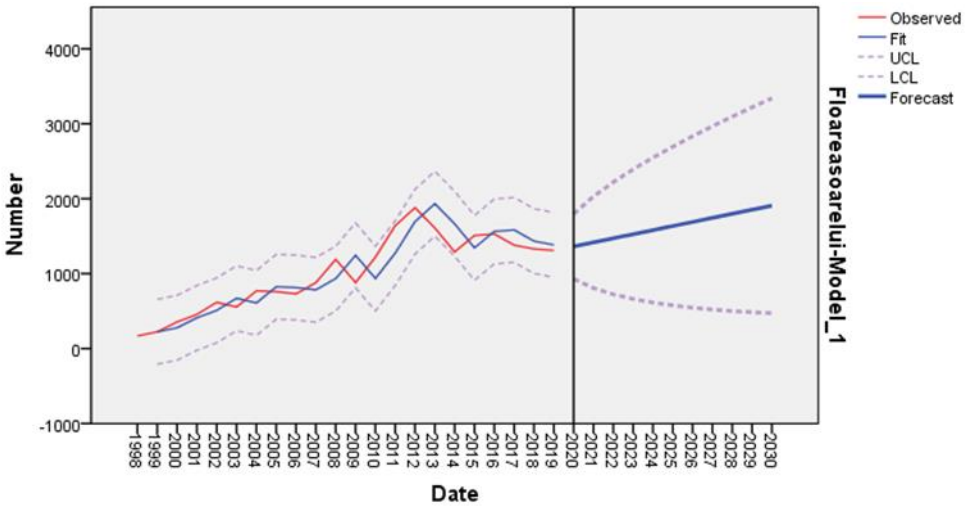

Fig. 4. Estimates on the evolution of the basic price for sunflower by 2030
Source: NIS data processing using SPSS, Accessed data on17.01.2021 [10].

CONCLUSIONS

International trade in oil products has grown substantially in recent years, influenced by an increase in demand for such products, both for human consumption and animal feed, or for obtaining renewable energy sources, such as biodiesel. Under the influence of these aspects, the price of oil products registered significant increases on the Romanian market as well.

If in the period 1998-2006 the price obtained for a ton of rapeseed or sunflower registered significant increases, reaching a ton of rapeseed to have a price in 2006 by 492% higher than the price obtained in 1998, the evolutions registered after Romania's accession to The European Union were somewhat more stable, reaching a ton of rapeseed to be sold in 2019 at a price of 1,510 lei / ton, an evolution of 91.1% compared to the price obtained in 2007. Thus, we can conclude that starting with 2007, the year of Romania's accession to the European Union, the price of agricultural products stabilizes, and the registered evolutions are not as significant as those registered in the period 1998-2006.

Analyzing the prices recorded for the marketing of sunflower and rapeseed crops until 2019, an estimate was made of the evolution of the selling price for these crops

until 2030. The results obtained indicated that in 2030 the price obtained for a ton of rapeseed could reach the value of 1,907 lei/ton, increasing by 45% compared to the price recorded in 2019, while for sunflower the value of one ton could reach 2,235 lei, increasing by 48% compared to the price recorded in 2019.

Oilseeds are much more perishable than cereal crops and for this reason the quality of the seeds is extremely important in setting prices. Thus, the storage of rapeseed and sunflower harvest in order to obtain the best price is justified only if the farmer has efficient storage spaces.

The rate of price increase for the two crops, recorded in the two periods analyzed, determines a high risk of price increase for the estimated period - 2030. Most likely a decrease in demand will moderate this momentum of the price increase recorded in the case of the two crops, but given the global population growth, it will be unlikely.

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CIRCULAR ECONOMY AND FOOD PRODUCTION SYSTEMS: TRACING LINKAGES AND EXPLORING SYNERGIES

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Abstract

Food production systems have been in the spotlight for a sustainable conversion due to their environmental, economic, and social impacts. On the other hand, the concept of circular economy has been promoted as a promising alternative for various production systems. By decomposing the agri-food supply chain to its core components, i.e. primary production, food processing and distribution, certain interventions may be assessed through the lens of circular economy. In this paper we focus on the stages of food processing and manufacturing in order to analyze how the application of circular economy perspectives in closing material loops contributes towards minimizing the economic and environmental impacts of food production systems, in opposition to the widely applied linear economy model. Moreover, we explore from a managerial perspective the new technological advancements for waste minimization and valorization and critically discuss the new business models that emerge, along with the redefined value chains.

Key words*: food production system, circular economy, food processing, food manufacturing, value chain*

INTRODUCTION

Due to the perishability of food products, food supply chains can be considered of high importance and perplexity. The world population continues to grow and food production increases with a high cost by putting pressure on the natural milieu. On the other hand, 1.3 billion tons of food are annually lost or wasted, which accounts for 1/3 of all food produced for human consumption [5 , 3].

As mentioned in the UN 2030 Agenda, the goal is "to ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality".

Food normally has a short life cycle; therefore the objective should be about preventing food loss and waste and eventually finding new ways to use surplus food (for human consumption or as animal feed) [21].

In addition it is important for food products to reach the right customer, at the right time, with the right quality, within suitable shelf life and in the right way in order to sustain competitiveness [19, 16].

This brings to the spotlight another matter for the evolution of the food supply chain where both sustainable consumption and sustainable production are essential conditions for sustainable development [2]. According to the United Nations, both combined means "doing more and better with less". Keeping in mind that customers' demands are the focal point of supply chains, customers are particularly interested for the safety of food products while concerns such as food security, damages and quality constitute a significant problem worldwide [16].

Dora et al. (2020) mention that food losses and wastes can be attributed to four main factors [3]:

-Over production, which is a major issue in developed economies. In particular, cosmetic defects are the main reason for losses at production and manufacturing.

-Poor forecasting, which is affected by many factors, such as seasonality, the weather and marketing instruments.
-Technical inefficiency in operations such as farming, storage, and transportation.
-Consumer behavior, which is shopping habits and nutritional attitudes.
The analysis of these factors will definitely assist reaching educated decisions and improving the sustainability and resilience of food production systems.
In this paper we focus on the stages of food processing and manufacturing in order to analyze how the application of circular economy perspectives in closing material loops contributes towards minimizing the economic and environmental impacts of food production systems, in opposition to the widely applied linear economy model. Moreover, we explore from a managerial perspective the new technological advancements for waste minimization and valorization and critically discuss the new business models that emerge, along with the redefined value chains.

MATERIALS AND METHODS

For the scope of this paper, we used relevant bibliography which deals with the emerging paradigm of circular economy and its application in food manufacturing. The approaches discussed in these papers formed the basis for identifying potential interventions in food production systems that serve the purposes of circular economy.
The societal needs and demands are rapidly evolving and set the ground for:
-the development of new policies and regulations for producers
-the need for transparency across the food supply chain, where the consumer knows exactly how the product was handled from farm to fork
-new improved techniques in food manufacturing with stable final food products that meet consumers' expectations during manufacturing by applying sustainable production techniques, and
-ways to make the information associated with the above flows accessible to stakeholders.
Towards this end, circular economy is an emerging paradigm which strives to modify human and organizational behavior and practice patterns. Circular economy aims at improving the way organizations are producing goods [1]. It aims to preserve the value of products and materials and to reduce waste and consumption of resources based on a thinking that prevents waste, uses products until the end of their useful life cycle, and extends its usability through end-of-life product repurposing by application of the 6Rs (Recover, Reduce, Reuse, Remanufacture, Redesign, Recycle) [21]. The innovation and technological development can ultimately contribute to sustainable development and corresponding value creation in products, processes and systems [4]. As Närvänen et al. (2020) mention, circular economy is a regenerative and restorative approach aiming to extend the value and usability of resources as long as possible and contribute to the objectives of sustainable development, especially with respects to our commitments to future generations [14].
Circular economy and sustainable manufacturing are sometimes interchangeably used in the academic literature. There is, however, a major distinction between them: circular economy is a generic model of the entire economy, while sustainable manufacturing is ipso facto limited to manufacturing. Therefore, the latter is an approach which promotes circular economy [4].
There are great possibilities to the matter of circular economy in food manufacturing by incorporating new technologies that would minimize unsustainable handling and innovations on how food by-products can be used as input materials. There is big potential in Data and IT that needs to be explored in order to support the food supply chain procedures towards circular economy implementation. Food manufacturing by-products, due to their nature are free of dangerous contaminants and hold great concentrations of nutrients and chemical

compounds which renders them as valuable resources.

RESULTS AND DISCUSSIONS

Food manufacturing is the link between agricultural production and the customer. The agri-food supply chain can be divided in the following consecutive stages, the first one being supply of raw materials followed by production, processing, packaging and finally storage of a final product before being channeled into retail distribution or wholesale [17]. This long chain is in short mentioned using the phrase "from farm to fork". In a production system, even the simplest process can add up to unsustainability and therefore it is a necessity for a transition to a more sustainable production by reforming the stages of the supply chain by exploring new solutions and implementing existing successful methods. In the sequel we focus on specific dimensions of food production systems which can be directly linked with circular economy, namely Industry 4.0, food waste valorization and packaging.

Industry 4.0

In order to explain transition in sustainable manufacturing model products, processes and systems should be reconsidered and undergo a sustainable conversion with a goal to increase value and bring economic growth to an industry [4].

Industry 4.0 applications hold great potential towards the circular economy model. The ways to incorporate technologies such as Internet of Things (IoT), Big Data Analytics and Blockchain Technologies in food manufacturing is a field that is currently under research. Achieving a sustainable food supply chain is very complex matter given the limited life and abundance of raw materials and of final products, compared to simpler supply chains where processes are easier to keep a track of. This complexity raises the levels of uncertainty to the risks related to food production and generates questions and concerns about how possible is a sustainable transition in the economic, environmental and social performance of this sector [11].

The key drivers of digitalization of the supply chain process are increasing the flexibility and speed of response of the industrial/logistics systems, as well as improving the strength and flexibility of the agricultural food supply chain. In addition, to meet the quality standards requirements of large chain and food retailers, there is a demand for food companies to use recognized quality management and traceability systems. Investing in digital technology also promotes automation of access to a new range of operators, data management, and management tools [11].

A literature review by Enyoghasi & Badurdeen (2021) presents that the interest is shifting towards the identification of potential opportunities for a conversion towards sustainable manufacturing and incorporation of circular economy through Industry 4.0 technologies in general [4]. There is major limitation of frameworks and models presented that lack to emphasize on the current methods of the sustainability methods of assessment such as the total lifecycle or the 6R-based approach for example. Also, none of the studies collectively considers the benefits or opportunities offered through Industry 4.0 for product, process, and system level especially in food supply chains.

Implementing Life Cycle Assessment (LCA) and collecting reliable data is a significant challenge due to the complexities such as incorporating input and output monitoring or quantification at multiple stages of the supply chain. Blockchain technology provides a rich solution to overcome the challenge of sustainable supply chain management. Its use in combination with IoT and Big Data Analytics and Visualization can help organizations achieve operational excellence in LCA operations and improve the supply chain stability [22].

Jagtap et al. (2021) studied ways on how to have higher resource efficiency in food manufacturing and proposed the integration of the IoT to reduce losses in the food supply chain. They suggested adopting an integrated resource management of the food production systems using digital technologies in order to obtain detailed data, which could be

depending on resource use and waste generation not only by looking broadly at the whole production, but focusing at a more specific part of the production that being a specific process or even a piece of the equipment [6].

Food waste valorisation

The food sector is considered inefficient due to the large amount of food waste and the amount of energy and water resources consumed. This problem extends more if we consider stricter regulations and the increasing costs associated with the processes of disposing and the treatment of food waste, carbon emissions and wastewater generation. As a result, efficient use of resources is a major factor to sustainable food systems [6]. Finding more efficient ways to manage waste is stated as the challenges identified by the 2030 Agenda for Sustainable Development of the United Nations. This state of wastage contradicts the current state of increasing number of people suffering from malnutrition as well as the depletion of natural resources. Key solutions focusing on the conversion of output materials into useful products are discussed.

There are concepts such as waste biorefineries that have the potential of producing green energy as well as work under a state of zero waste production technologies. This is a motivation for industries to develop products which are friendlier to the environment, that have lower carbon footprint and minimum water consumption. Therefore, in order to meet the goals of the circular economy, waste biorefineries must be able to generate stable market-related products or products that can be used in power industries. The development of these industry plants is highly relevant to increase the value of local raw materials, make the process economically sustainable and contribute to the development of a certain region [20].

Another great example is discussed by Jiménez-Castro et al. (2020) on possible uses of orange peels. This specific food waste was studied as a potential substrate in order to produce different types of bioenergy related products such as biogas, bio-ethanol bioelectricity etc. but also flavonoids for pharmaceutical use by applying a variety of treatments [7].

A study was conducted by Naziri et al. (2014) about the possible was to valorize the agri-food by-products generated in agriculture related businesses and waste from Central Macedonia (Greece) in order to explore potential resources of compounds that could be used as alternatives in food manufacturing [15]. In this specific geographical area, there are three major industry categories: production of olive-oil, wine production and rice production. In olive oil industry by-products are being further analyzed in order to produce carotenoids and bioactive compounds. In wine industry by products are being processed in order to produce squalene and bioactive phenolic compounds from the seeds, bioactive phenolic compounds are also found in rice hulls. All of these products can be used as additives for the production of other products and hold a great position on creating a link between industries while implementing the zero-waste concept in order to minimize waste and close material loops.

Kandyliari et al. (2020) did a research on fish by-products as a possible lipid source. Several types of lipids were found in by-products, but they also found some very important proteins that have the potential to be used in new product development as a source of lipids and protein nutrients and is an example of applying circular economy in practice [10].

In any case, several approaches such as LCA may be used by industries to support deviations from the waste hierarchy, which is the term used in bibliography to describe the steps a company should follow in waste management plan: prevention, minimization, reuse, recycling, energy recovery and disposal. By reviewing a small number of studies, the awareness of the complexity in the abundance of food manufacturing output materials rises and demonstrates the great potential of a transition into the circular economy model.

Packaging

The circular economy model can also create a complex output of materials, but in this case, this complexity leaves fertile ground for

sustainable growth since there is space for the development of several new applications.

At the moment, there is a growing concern on the large amounts of plastics that are being generated worldwide since about 80% of these are not being recycled or otherwise re-used. This is a reason of high level of pollution. Big manufacturing companies are committing towards shifts in their processes to reduce the use of plastic packaging, but this shift does not imply their elimination or that this conversion has a beneficial effect on other indices (CO_2, water, etc.) important for the assessment of the sustainability of the company suggesting that circular models are the most beneficial.

On the other hand, science community is working towards creating solutions on this problem suggesting bioplastics, which hold the characteristic of biodegradability and/or are produced using renewable resources, to make up a sustainable solution for traditional plastic materials used in packaging of products [8].

Kakadellis & Harris (2020) conducted a thorough review and found that bioplastics offered the advantage of blocking biodegradable waste from ending up in landfills or being incinerated by channeling them into 'greener' streams [9]. Those greener streams are composting and anaerobic digestion which are important methods of implementing the concept of circular economy. Biodegradable bioplastics should be encouraged as a replacement to traditional plastics especially in cases where recycling is not an option. These cases are the multi-layered plastics or highly contaminated by food residues plastic materials. Creating functional solutions by setting the polymer preference and by designing the right packaging. Still there are circumstances where bioplastics do not provide the appropriate characteristics and properties to preserve food products and extend their shelf-life.

Interesting ongoing research on waste leaves from tea waste processed in order to produce bio plastic films [12] or waste from seed oil production which until now has been used as animal feed, is now a material of interest to be used as a resource in bioplastics production (Mirpoor et al., 2021) with the possibility to be utilized also as food packaging material [13].

The concept of bioplastic has been gaining ground on for their beneficial environmental possibilities but in their study (Scarpi et al., 2020) researched the antecedents of consumers' willingness to alternate their choices towards food waste bioplastic products [18].

Consumers value different characteristics of the products to be more important, those being the quality of the product, the cost of the product rather than their sustainability characteristics which can be for example the implementation of resource management on natural resources, indices such as water consumption or carbon emissions or the handling of the product after or near the expiration date. All of these parameters make switching to sustainable products a very delicate and complex matter for the economy of the food manufacturing industry and is a representation of how strong the interconnection between economy, environment and social aspect of sustainability are.

Taking into consideration current trends in consumers' diets and lifestyle habits such as veganism, is an index of how consumers are transitioning into a sustainable way of life. Even though currently this is a small group of consumers, the rest of the consumers that are not following or are even opposed to this lifestyle are not necessarily eager to even examine such alternatives let alone adopting them.

Our primary motivation in this paper was to identify the potential of incorporating the concept of circular economy in food production systems. Circular economy is a concept that is strongly working its way to enter industries since all parties, policy makers, industries and consumers are realizing its significance. All pillars of sustainable development may be affected and in all cases cost-benefit analyses have to be conducted.

Food manufacturing contains an abundance of industries, each one with a certain process/system which makes it very complex

matter to approach. The abundance of raw materials, manufacturing techniques and by-products leaves ground for a great variety of interventions. Further analysis of the matter in order to unravel this complex subject and reach solutions on how and at what extent the concept of closing material loops has been effectively implemented is of great importance.

Consumers are the driving force of the market and they affect the trends in the food sector by increasing demands on diet habits, lifestyle, and production characteristics as well as transparency and green strategies applied along production. More extensive research on how this possibly affects the concept of circular economy will be valuable.

Currently it seems that the focus is on specific applications such being waste valorization, by-product valorization, biorefineries and a switch towards biomaterials. There is space for further and broader research and development to generate more nodes which can be part of a circular economy system, by developing new products, by implementing new technologies and by creating synergies across sectors. Moreover, supply chain optimization could further enhance this objective.

Packaging has a vital role for most of the final products of a food manufacturing industry, but trends like zero plastics in consumers' behavior could even suggest a zero-packaging mentality with forcing change in companies and setting the ground for further development of sustainable innovations in the field of food packaging.

Data have been drilling their way into manufacturing, but there is still enough space for evolution in the field of food production and manufacturing but also across the whole agri-food supply chain. Until now data analysis had a different approach in food manufacturing focusing more on bringing quality or presenting the consumer with details about the product in hand which is of course essential but at this crucial state of the planet it is of major importance to include additional dimensions.

The circular economy model is getting well-established, but it should also be evolved in the context of Industry 4.0. The IoT, and the Big Data Analytics hold great potential towards the optimization of manufacturing processes and towards a production with higher efficiency.

CONCLUSIONS

Nevertheless, agri-food supply chains are not always easy to cluster and employ the same set of approaches, tools, and technologies. It is clear that there are many researched solutions from several fields proposing methods which can change food manufacturing. Multiple factors such as different geographical regions or consumers' willingness to change, for example, can even have an effect on how this matter is approached and on what is considered most important between economic, environmental and the social aspect of sustainability making it a multifaceted issue. This is a determinant in the case interventions which aim to circular economy objectives. However, collaborative approaches and the systematic sharing of knowledge and experience may be the catalysts towards this transition. What currently needs to be done is for further actions to be taken from stakeholders in order to create links between these fields. A significant number of studies have been conducted and now what needs to be done is to combine the obtained knowledge and implement it in ways that can have an effect on the current state of food supply chains.

Despite the fact that the incorporation of these technological techniques are still costly procedures for food manufacturers, the 2030 Agenda towards sustainable development is a sufficient motive for stakeholders to take action.

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THE IMPACT OF COVID-19 ON COMPETITIVENESS OF AGRI-FOOD PRODUCTIS FROM THE REPUBLIC OF MOLDOVA

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Abstract

The World Economy was stricken by COVID-19 virus in 2020, which influenced negatively the economic processes determining the decreasing of the global productivity of labour, the decreasing of the productivity of agricultural products and at the end the decreasing of the competitiveness of states all over the World. In this scientific research is analysed the impact of COVID-19 on competitiveness of agri-food products from the Republic of Moldova, the problems regarding the exports of agri-food products, the markets of agri-food products and are proposed measures to get out from the crisis situation determined by the COVID-19.

Key words**:** *agri-food products, competitiveness, exports, markets, COVID-19*

INTRODUCTION

Competitiveness of products consists of the capacity to satisfy the customers of a market with products which have a high level of quality at lowest prices compared to the products of the competitors in order to satisfy the needs of the customers [7, 9, 3].

To be competitive means to be at least as good as the competitors in the market [2, 4].

The economy of the Republic of Moldova shows poor development conditions. Compared to the states from the European Union, in Republic of Moldova, the agricultural sector has the biggest share from GDP (10-14%), which determines a high level of export of agricultural products from the total export of the country [6].

In the same time, we can mention a low level of productivity of labour compared to our neighbours (Romania, Ukraine, Georgia, Russian Federation), in this sense, influencing negatively the competitiveness of the country.

In 2020→ countries, all over the World were affected by the COVID-19 virus, which determined significant changes in World Economy [5, 8].

After introducing in 2020, during March,17-May, 15, the state of emergency in Republic of Moldova, this influenced significantly the economic development of the country, the way of running things.

The COVID-19 virus influenced the competitiveness of agri-food products, the agricultural producers, registering significant losses [10].

In this scientific paper was analized the impact of COVID-19 on the agri-food products competitiveness, the markets of agri-food products during COVID-19, the problems faced by agricultural producers and are proposed solutions to overcome this crisis situation.

MATERIALS AND METHODS

The scientific researches were performed based on the data from:

- ✓ *The National Bureau of Statistics of the Republic of Moldova,*
- ✓ *The National Institute for Economic Research,*
- ✓ *Ministry of Agriculture and Food Industry*
- ✓ *Other economic sources connected to the investigated area.*

In this scientific paper was used the following research methods:

- ✓ *Analysis,*
- ✓ *Deduction,*
- ✓ *Comparative method,*
- ✓ *Graphical method.*

RESULTS AND DISCUSSIONS

The pandemic restrictions imposed by the government of the Republic of Moldova during 2020 determined the decreasing of the economic activity of the majority of enterprises, especially the enterprises from HORECA domain of activity.

For agricultural producers, the pandemic situation also influenced very negatively their activity, because they could not sell their early production.

In the same time, they contribute to GDP more in the second and third quarter of the year, but this is directly linked to first quarter. In this sense, because of pandemic situation, the agricultural works from first quarter was more difficult to be performed.

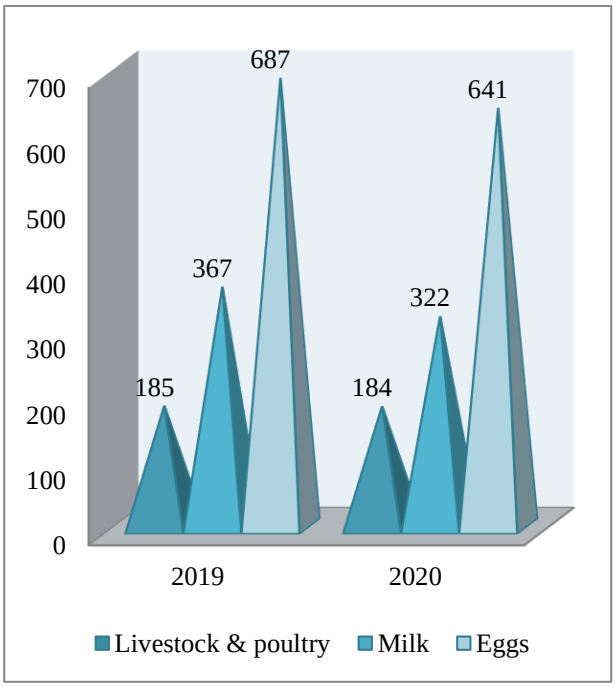

Fig. 1. Production of main agri-food products in households of all categories, (thousand tons)
Source: elaborated by authors based on data from [1].

Analysing the production of main agri-food products in households of all categories we can reveal that in 2020 the production of livestok and poultry constituted 184 thousand tons, which is less than in 2019 by 1 thousand tons; the production of milk constituted 322 thousand tonns which is less than in 2019 by 45 thousand tons and the production of eggs also decreased in 2020 by 46 thousand pieces, constituting 641 thousand pieces.

From Fig. 2, livestock and poultry in 2020, was mostly produced in agricultural enterprises from - 94.2 thousand tons and in population households being produced 89.7 thousand tons; milk was produced mostly in population households – 298.5 thousand tons and in agricultural enterprises being produced 23.5 thousand tons and eggs were produced mostly in population households - 374 thousand pieces and in agricultural enterprises 267.3 thousand pieces.

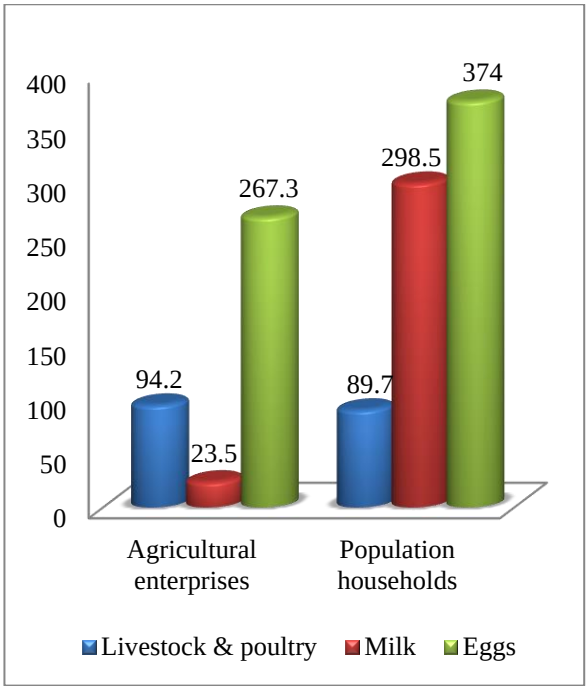

Fig.2. Agri-food production by categories of producers in 2020 (thousand tons/pieces)
Source: elaborated by authors based on data from [1].

Thus from the Fig.1 and Fig.2 we can reveal that the main agri-food production in 2020 decreased, this is because of the drought which affected the agricultural sector but also because of the difficult situation related to COVID-19, when the majority of the agricultural enterprises stopped their activity, registering low level of productivity and also low level of sales, in this sense influencing negatively the competitiveness of the agri-food products [8, 10].

The agri-food products from the Republic of Moldova are sold to the consumers in:

1. Open-air markets – here are sold the mostly of the agri-food products. The quality requirements for this channel are not so high, and the competitiveness is mostly based on

price. The consumers choose products based on their available incomes.

During the pandemic period of COVID-19 the open air markets of agri-food products suffered a lot, because of the restrictions: from the beginning of the pandemic period the open air markets were closed, after which the working hours were reduced by 2-3 hours. In this sense, the agricultural producers have no place to sell their agri-food products, influencing negatively the competitiveness of the agri-food products.

2. Supermarkets – here the agri-food products were sold mostly during the pandemic period COVID-19, because the open air markets were closed. The prices were higher compared to open air markets, but the advantage is that the agri-food products were sold well packed and the purchased products originate from delivery companies which respect all the ISO standards of quality.

3. Small vegetables/fruits/meat shops -these small shops were dedicated to intensely populated rayons of Chisinau. The prices are not so high compared to the prices from the open air markets. During the pandemic period, these markets also have customers, they worked in the same regime as the supermarkets – untill 10 o clock in the night.

4. Export markets – the agri-food products sold through export markets decreased during the pandemic period COVID-19, because of international travelling restrictions.

Fig. 3. Main agri-food markets from the Republic of Moldova
Source: elaborated by the authors.

The agri-food products are sold in Republic of Moldova through 4 large wholesale markets
→ 3 of them being located in Chisinau,
→1 being located in Balti.

In the same time, in Republic of Moldova exist 138 retail markets, out of which 38 markets located in rayons and 100 local markets.

From the analysis above, we can reveal that the agricultural producers who sold their products in open air markets suffered because of the pandemic period COVID-19, because of the imposed restrictions by authorities they could not sell their products and other situation with the supermarkets, small vegetables/fruits/meat shops who sold their products in normal regime.

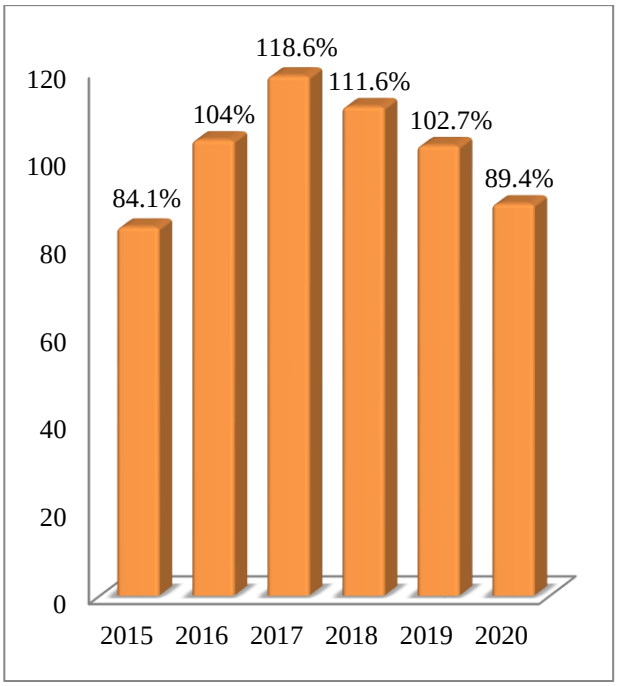

Fig. 4. The evolution of the value indices of the exports of goods during 2015-2020 (in % compared to the previous year)
Source: elaborated by authors based on data from [1].

Related to the export markets, the indices of exports of goods in 2020 compared to previous year, decreased by 13.3%, constituting 89.4%. This decrease was determined by the pandemic situation COVID-19, which imposed many restrictions to international trade.

In 2020, in Republic of Moldova was registered the lowest index of export compared beginning with 2017, when was

registered the highest level of exports: 118.6%.

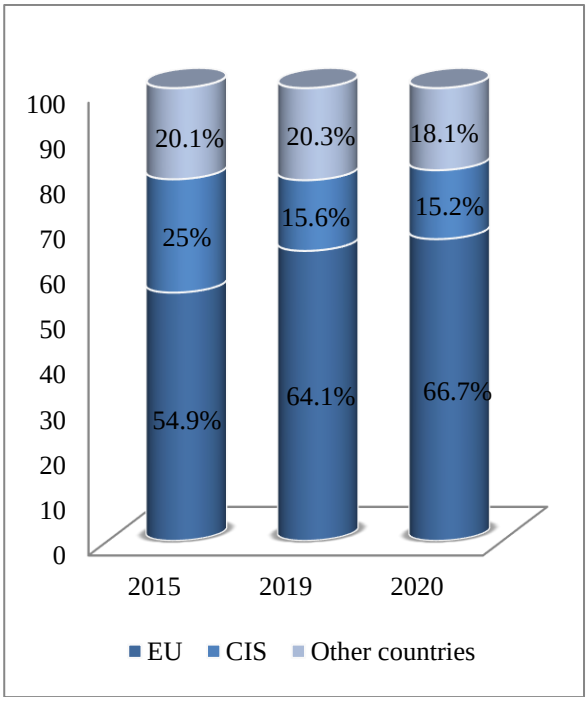

Fig. 5. The structure of exports of goods by groups of countries during 2015-2020 (%)
Source: elaborated by authors based on data from [6].

Analyzing the Fig. 5 we can reveal that the exports of Republic of Moldova are mostly oriented to European Union countries, which constituted in 2020→66.7% exports, registering an increasing trend from 2015, when this indicator constituted 54.9%. The exports to CIS countries have a negative trend, registering in 2020→15.2%, compared to 2015, when this indicator constituted 25%.

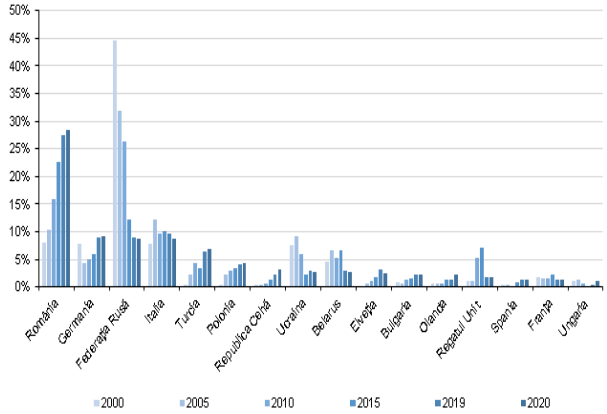

Fig. 6. The structure of exports of goods by countries of destination during 2000-2020 (%)
Source: elaborated by authors based on data from [1].

The pandemic situation COVID-19 all over the World influenced negatively the exports of goods by countries of destination in 2020, which decreased by 11.9% compared to 2019. The delivey of goods decreased to the following countries (fig.6): Romania (-7.7%), Italy (-20%), Russian Federation (-13.2%), Belarus (-18.1%), Greece (-31.2%), Ukraine (-13.3%), Austria (26.7%), Lebanon (-19.1%), Armenia (-63.8%), China (-28.3%), UAE (-63.8%), Montenegro (-90.8%), Brasil (-63.2%), etc.
The restrictions generated by the COVID-19 virus affected the exports to the majority of partners of the Republic of Moldova, in this sense influencing negatively the economic development of the country and the competitiveness of the agri-food production.

Table 1. The structure of exports by types of goods during 2019-2020, %

Years / Goods	2019	2020	Deviation of 2020 compared to 2019
Agri-food products and live animals	22.9	21.2	-1.7
Beverages and tobacco	7.9	7.5	-0.4
Inedible Raw Materials	10.7	10.7	-
Mineral fuels	0.4	0.6	+0.2
Oils & fats	2.5	4.2	+1.7
Chemical products	5.2	5.1	-0.1
Manufacturing products	6.2	7.2	+1.0
Transport machines and equipments	23.3	22.8	-0.5
Manufacturing articles	20.9	20.9	-

Source: elaborated by the authors.

In 2020, the export of agri-food products and live animals reduced by 1.7% compared to 2019, especially decreased the exports of [1, 6]:
- cereals and solutions based on cereals by 47.3%,
- oilseeds and seeds by 14.7%,
- sugar, solutions based on sugar and honey by 14 %,
- meat and meat products by 30.1%,
- milk products and eggs by 17%.

The decreasing of exports of agri-food products determined low competitiveness of these products, all of this being result of the restrictions imposed by authorities due to pandemic situation COVID-19, which stricken the World Economy, as well as the

Republic of Moldova, being necessary to take urgently measures to overcome the effects of COVID-19 pandemic situation.

CONCLUSIONS

As a result of the performed investigation, we can reveal the following conclusions and recommendations:

- The Republic of Moldova as a result of the COVID-19 pandemic situation is facing a major economic crisis, being characterized by decreasing level of exports of agri-food products, low level of productivity which influences negatively the competitiveness of the country as a whole;
- Due to the fact many of the agricultural producers in 2020 could not sell their agri-food products on the local open air markets, registering high losses, it is necessary to offer support from state in form of subsidies to help the agricultural producers to perform agricultural activity, many of them being in bankruptcy situation;
- It is necessary to continue to support agricultural producers who registered high losses because of pandemic situation COVID-19 by offering tax incentives (reducing of rates, fiscal vacancies), guaranteeing loans for companies which are facing difficulties, exempting from paying the rent payments for the period of forced cessation of activity;
- It is necessary at the level of state to approve a competitiveness policy which will give possibility to identify the weak points in increasing the competitiveness and to act promptly to remove all the barriers in increasing the competitiveness of the country;
- The COVID-19 affected the World Economy, as well as the Republic of Moldova, in this sense being necessary a pro-active involvement from the state authorities as well as from the civil society in the removal of the negative consequences of this great danger.

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THE IMPORTANCE OF AGRICULTURAL PRODUCTION AND VARIATION OF BACTERIAL MICROFLOWER ON THE QUALITY OF POULTRY MEAT IN VARIOUS MARKETING CONDITIONS

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Abstract

The scientific research reflected in this investigation had the purpose to study the importance of agricultural production and the variation of bacterial microflora on the quality of certain categories of poultry meat in different commercial conditions. In the scientific paper were analysed the indices of the volume of agricultural production in different categories of households during the last period and highlighted the aspects of its increase and decrease. In the same time, by laboratory microbiological methods were evaluated the results of the saprophytic and pathogenic microflora of three categories of poultry meat under various commercialization conditions. The results of the study confirmed that all categories of commercialized poultry meat showed an insignificant number of coccic microorganisms both in the surface layers and in the depth of the meat, which corresponds with the commercialization requirements and is acceptable in human food.

Key words**:** *agricultural production, bacterial microflora, bacterial colonies, poultry meat, marketplace*

INTRODUCTION

Poultry is an important source of protein in the normal growth and development of the human body. On average, the man consumes 30 tons of food during his lifetime, under various versions of the diet. Generally speaking, they are a mixture of chemicals, which constitute four main categories: nutrients, natural toxins, contaminants and additives. According to bibliographic studies, a food is safe when its consumption does not alter or affect the health of the consumer [6, 13].

Microorganisms have a special role by modifying the organoleptic and nutritional properties of meat, which by its chemical composition is a very favorable nutritional environment for their development. In order to prevent their development, it is important to know the microbial species, the conditions in which they develop and the risk of triggering some food poisoning infections [5].

Due to its chemical composition, varied and rich in the main groups of nutrients necessary to the organism (proteins, fats, carbohydrates, minerals and vitamins), poultry meat contributes to its normal functioning and to maintaining good health [16].

The fact that poultry is the most complete food is reflected in over a hundred nutrients necessary for human life, which it contains: proteins, vitamins, minerals, enzymes and other substances [2, 4].

The microorganisms that act unfavorably on food are: bacteria that cause food poisoning (*Salmonella*, *Escherichia*, *Staphylococcus*, etc.), molds that causes rotting (*Penicillium*, *Aspergillus*, *Mucor*) and yeast that cause fermentation. The meat registers in particular processes of bacterial spoilage of putrefaction and rotting and is a valuable food product that represents a very good environment for microorganisms, benefiting from a pH = 6.4-6.5, easily assimilable substances (glycogen and lactic acid) and nitrogen-assimilable substances [14].

The essential link in food safety consists of the following categories of basic operations: protection of food from harmful contamination, preventing the development and spread of harmful contamination. Also, we may add efficient removal of contamination and contaminants [8, 15].

Therefore, considering the analyzed bibliographic studies and the practical investigations performed in the microbiological laboratory, the aim of the presented paper is to study the importance of agricultural production and variation of bacterial microflora on the quality of certain categories of poultry in various commercialization conditions.

MATERIALS AND METHODS

The scientific researches were performed in the microbiology laboratory of the Faculty of Veterinary Medicine of the State Agrarian University of Moldova.
As a research material were used 3 categories of poultry commercialized in Chisinau, namely: Central Square from Chisinau, supermarket and house meat.
For this purpose, was studied the superficial and in-depth microflora of these 3 categories of poultry meat. To research food microflora were used laboratory microbiological methods.
In the same time, as research methods were used: comparative analysis, logical analysis, analysis and synthesis, graphical method, induction and deduction. The statistical data was used from National Bureau of Statistics of the Republic of Moldova.

RESULTS AND DISCUSSIONS

Global agricultural production in households of all categories, according to the National Bureau of Statistics in 2020 was 72.9 % compared to 2019, which represent a decrease by 27.3%.
The decrease in global agricultural production (by 27.1%) was determined by the decrease of vegetable production by 35.9% (which caused the reduction of the general index of global agricultural production by 26.1%) and animal production - by 3.8% (-0.1%) (Fig.1).
In households of all categories of agricultural producers on January,1st, 2020, compared to the same date of the previous year there was registered a decrease in livestock of all species, except for the number of bovines and swines, where the number increased, respectively, by 2, 6% and by 11, 7%.

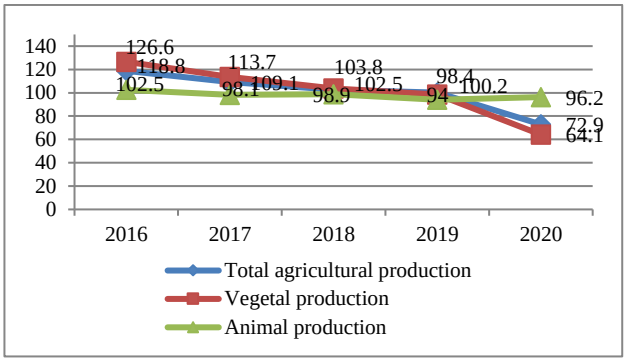

Fig. 1. Indices of the volume of agricultural production in households of all categories, 2016-2019 (previous year = 100)
Source: elaborated by authors based on [1].

The livestock of poultry on January, 1st, 2020 constituted 3,891.2 thousand capita, which represent a decrease compared to previous year by 12.7% (Figure 2).

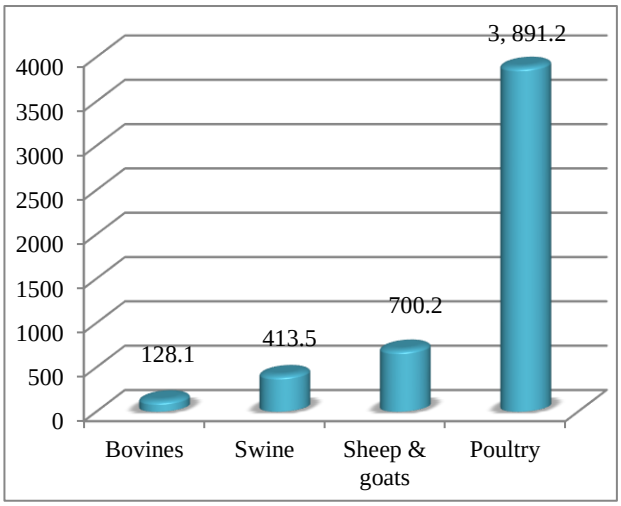

Fig. 2. The livestock of animals in all categories of producers as of January, 1st, 2020, (thousand capita)
Source: elaborated by authors based on [1].

The status of the zootechnical sector continues to be mainly determined by the situation in populations' households, in which on January, 1st, 2020, was concentrated 85.6% of the total number of cattle, out of which: cows - 94.4%, 44.8% of swines, 97.2% of sheep and goats and is produced the most of the animal production (bovines and birds - 54.1%, milk production - 93.6%, egg production - 57.7%).
Analysing the data from Figure 3 regarding the meat production, we can reveal that in

Republic of Moldova in 2018 was produced 122 thousand tons of meat, which represent a decrease compared to 2016, by 15.8 thousand tons when this indicator constituted 137.8 thousand tons and an increase compared to 2017 by 4.5 thousand tons. From total produced meat, the poultry meat constituted 45.2 thousand tons, being surpassed by pork meat, which constituted 65.9 thousand tons. After poultry meat, on the third place regarding production of meat, is placed beef, with 8.1 thousand tons (BNS, 2019).

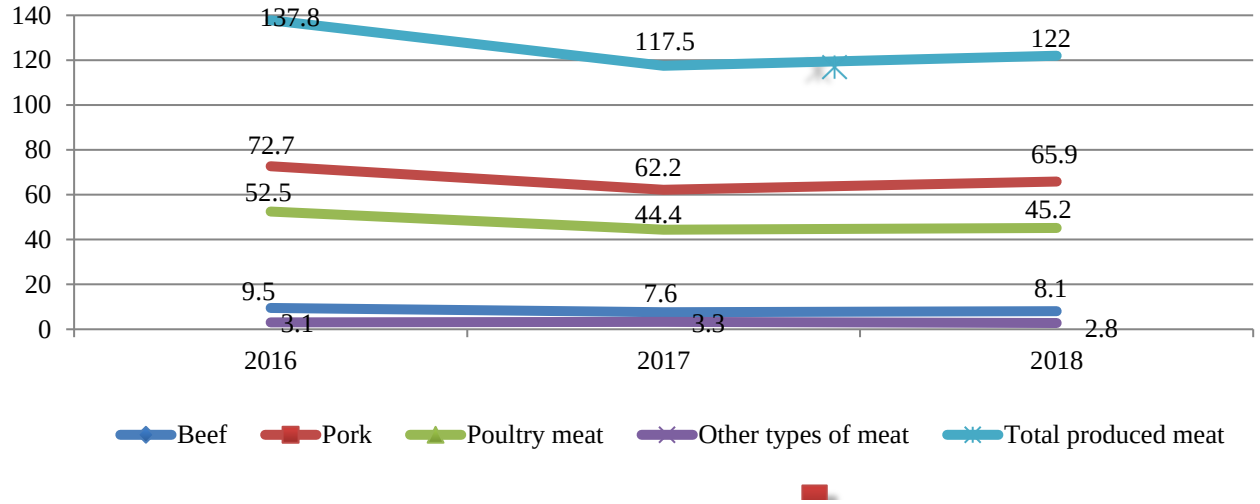

Fig. 3. The meat production during 2016-2018 in Republic of Moldova, thousand tons
Source: elaborated by authors based on [1].

Scientific researches were focused on studying the bacterial microflora of different categories of poultry meat sold in the industrial network from Chisinau municipality. The investigation of the microbiological aspects of this product was performed using the laboratory bacteriological methods. According to bibliographic sources, it is known that the microbiological study of meat investigation divides the commercialized meat in three categories: fresh meat, where the microflora is up to 10 cocci on microscopic visualization; meat with dubious freshness, where the bacterial microflora constitutes up to 30 cocci under microscopy and outdated meat, where the bacterial microflora constitutes more than 30 cocci, or some stick shape bacteria are also present.

The microbiological results of poultry meat commercialized at the central square in Chisinau and in supermarket reflect different aspects of the recorded indices, representing the quantitative bacterial microbiological aspects of the number of bacterial colonies and the number of microorganisms in the microscopic research fields.

The data from Figure 4 reveal 64 bacterial colonies in the superficial microflora of poultry meat sold at the central square, compared to the number of colonies of meat sold in the supermarket shown in Figure 5, which constituted a number of 5 colonies in the supermarket meat on the superficial microflora.

Regarding the number of colonies on the nutrient agar medium of the profound bacterial microflora, the data of figure 5 shows important aspects in the poultry meat sold in the supermarket, where a smaller number of microbial colonies was found constituting 1 colony, compared to the data of Figure 4, where the number of bacterial colonies of meat sold in the central square was 28 colonies.

These data confirm that the poultry meat sold in the supermarket is fresh, compared to the meat commercialized in the central square which is outdated.

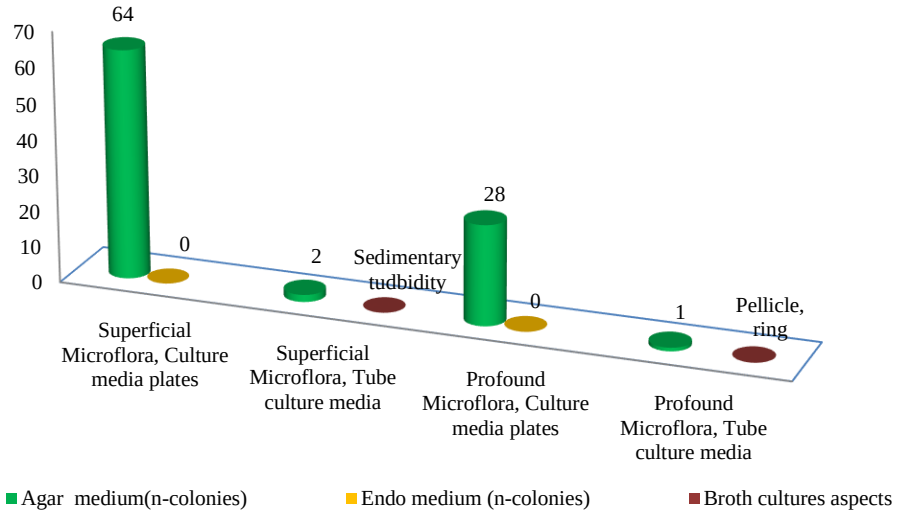

Fig. 4. Quantitative aspects of the bacterial microflora on the poultry meat culture media sold at the central square in Chisinau
Source: elaborated by authors.

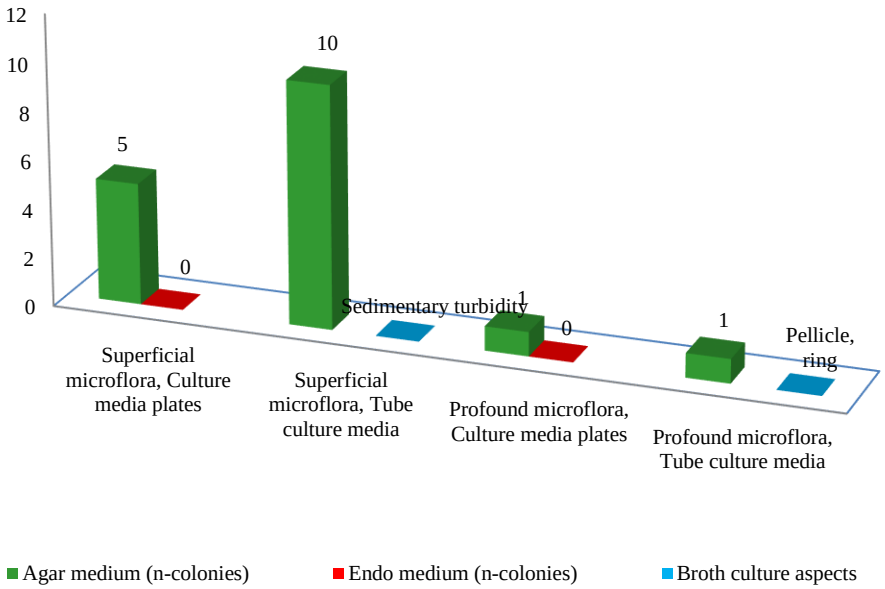

Fig. 5. Quantitative aspects of bacterial microflora on culture media of poultry meat sold in the supermarket
Source: elaborated by authors.

Regarding the passages on the special culture medium Endo in order to identify pathogenic microorganisms (E.coli, Salmonella) in poultry meat of all commercialization categories were not recorded the development of microbial colonies, which indicates that pathogenic microorganisms are absent in the poultry meat. Aspects of the development of microorganisms in poultry meat in the liquid broth medium are highlighted by the development of microorganisms in the form of turbidity, sediment, surface film, ring, in most cases the liquid medium is transpicuous. At the same time, important characteristics are highlighted on the agar medium in tubes, which denotes quantitative indices comprising the number of colonies best determined in the poultry meat sold in the supermarket, the superficial microflora constituting 10 colonies, compared to meat commercialized in the central square, where were determined 2 colonies. Regarding the profound bacterial microflora in both categories of commercialized poultry meat, the number of

colonies was insignificant, constituting 1 colony in both cases. These aspects confirm that both poultry meat sold in the central square and meat sold in the supermarket can be used in human nutrition. Important results during the microbiological investigations were highlighted in the house poultry meat which was commercialized, registering a superficial microflora of the number of colonies on the agar medium in number of 2, compared to the meat commercialized in the supermarket and in the central square, where this number of colonies was higher insignificantly.

The profound microflora in the researched poultry meat determined only one colony, which indicates that the bacterial microflora is insignificantly present, can be used safely as food and compared to the bacterial microflora of poultry commercialized in the central square and in the supermarket, do not present danger and meets the microbiological requirements (Table 1).

Table 1. Quantitative aspects of bacterial microflora on house poultry meat culture media

Samples	Culture media plates		Tube culture media	
	Agar (n-colonies)	Endo medium (n-colonies)	Agar (n-colonies)	Broth culture aspects
Superficial microflora meat	2	0	3	Turbidity
Profound microflora meat	1	0	1	Pellicle, ring

Source: elaborated by authors.

Important microbiological indices regarding the bacterial microflora of poultry meat are revealed in Tables 2 and 3.

Table 2. Quantitative aspects of bacterial microflora on smears of poultry meat commercialized on the central square

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	35	Cocci, Gram positive
Profound microflora meat	10	Cocci, Gram positive

Source: elaborated by authors.

Thus, the scientific researches were focused on bacterioscopic investigations, on performing bacterial smears from poultry meat samples and coloring according to the Gram method.

The detailed analysis of Tables 2 and 3 shows that in the poultry meat purchased from the central square the superficial microflora constituted 35 bacteria, compared to the meat from supermarkets - 9 bacteria. The number of bacteria determined in the profound poultry meat in the supermarket - 6 bacteria, compared to the results of the investigation of poultry meat in the central square, which constituted 10 bacteria. Therefore, these quantitative aspects of micro-organisms in poultry meat indicate that the poultry meat in supermarket is fresh, compared to the poultry meat procured from the central square (with outdated freshness).

The number of bacteria in profound meat on smears determined the following results in supermarkets - 6 bacteria, compared to the investigations of poultry meat in the central square - 10 bacteria on the microscopic fields. Therefore, these quantitative aspects of micro-organisms in poultry meat indicate that poultry meat in supermarkets is fresh, compared to poultry meat traded on the central square, which has outdated freshness.

Table 3. Quantitative aspects of bacterial microflora on smears of poultry meat commercialized in supermarket

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	9	Cocci, Gram positive
Profound microflora meat	6	Cocci, Gram positive

Source: elaborated by authors.

The bacterial microflora of the quantitative aspects of poultry meat on the smears investigated and the results are presented in Table 4.

It was determined the superficial microflora consisting of 4 cocci bacteria, compared to the superficial microflora of meat sold at the central square and supermarket, where this number of bacteria was 35 and 9 bacteria.

Table 4. Quantitative aspects of bacterial microflora on smears of house poultry meat

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	4	Cocci, Gram positive
Profound microflora meat	2	Cocci, Gram positive

Source: elaborated by authors.

Regarding the results of the profound microflora, the results from table 4 determined 2 cocci bacteria, compared to the categories of meat sold at the central square and supermarket, which constituted 10 and 6 cocci bacteria.

Therefore, based on the results of the previously investigations, we confirm according to the microbiological requirements, that the freshest commercialized poultry meat is house meat, where the number of bacteria is in all cases of microbiological investigation the lowest, compared to other categories of meat, which also meet the microbiological requirements and can be used in nutrition.

As a result of research on the microscopy of smears of poultry meat, Gram coloration, the morphological aspects of cocci germs are detached, which were presented on the microscopic field by spherical bacteria, Gram positive, constituting a normal microflora of meat.

Bacteriological and bacterioscopic investigations of poultry meat of different commercialization categories according to the investigations show that all categories of poultry meat by their dietary and nutritional value, are favorable and beneficial to be used in nutrition.

High importance is the house poultry meat, which in our microbiological research study confirmed that it is the most fresh meat after conducting the microbiological examination, which confirms that this category of meat is contaminated with a smaller number of saprophytic microorganisms represented by Gram-positive cocci.

Regarding the aspects of investigating the presence of pathogenic microorganisms determined by passages on the special Endo culture medium for the detection of E.coli germs, Salmonella, which frequently cause food poisoning, in poultry meat of the 3 commercialization categories were not recorded the development of pathogenic microbial colonies, which reveals that pathogenic microorganisms are absent in the examined poultry meat.

In this sense, in the process of production and commercialization the poultry meat, it is necessary to continuously carry out actions to improve the quality of production through quality management.

The quality management designates the responsibilities of all levels of management of enterprises, which need to be managed by the highest level of management. According to Kelada, "*the quality management represents the entire activities which have the purpose of realization the objectives by using optimally the resources of the enterprises*" [11].

These activities include: *planification, organization, coordination, control* and ensuring the quality [7, 12, 9, 10].

Kelada considers that each enterprise has to realize the following objectives: economical, social, technical, commercial which are performed using operational objectives.

Following the discussions above, Juran considers that quality is "*the ability to meet the needs or the extent to which the product successfully meets consumer expectations*" [10].

In opinion of Ishikawa, quality is "the opposite of the adverse influences (losses) caused to society by the provision of a product / service"[7].

Feigenbaum A. V. considers that "*Quality is the only important force that contributes and leads to the economic growth of companies in international markets"* [3].

Through the quality management, the enterprise has the purpose to obtain such products which satisfy a necessity or correspond to an well determined objective, which satisfy the customers expectations, which are in compliance with the standards, with the applicable specifications and with the requirements of the society, which respect the

requirements regarding protecting the nature and which are offered at competitive prices and obtained in conditions of profit.

According to bibliographic scientific studies, we remark with certainty that the rules of hygiene and good practice in the food industry are aimed at protecting food against contamination, effective temperature control to prevent and disseminate contamination. Therefore, the essential tools of food safety in food processing units or those that sell them are food safety microbiological investigations. In this context, based on the presented analyzes, we mention the importance of the functionality of the non-pathogenic saprophytic bacterial microflora available in the poultry we researched, which represents a normal bacterial microflora. At the same time, this research in food microbiology is of particular interest, because it allows us to deduce that the poultry food frequently sold in the retail network is qualitative and is acceptable and meets the commercialization requirements.

CONCLUSIONS

From this research, teh following conclusions were drawn:

-The poultry meat of all categories which is commercialized in Republic of Moldova on different markets (supermarkets, central square) has shown an insignificant number of cocci microorganisms both in the superficial layers and in the profoundness of the meat, and meets the commercialization requirements and is acceptable in human nutrition.

-Quantitative aspects of the number of microbial colonies in the commercialized poultry meat determined fresh house meat and meat commercialized in supermarkets - 2/1 and 5/1 colonies; aged meat sold at the central square - 64/28 microbial colonies

-Quantitative aspects of the bacterial microflora of poultry commercialized meat, revealed on smears the category of fresh traded house and supermarket meat - 4/2 and 9/6 cocci bacteria and 35/10 bacteria detected in poultry meat commercialized in the central square.

-Poultry and supermarket meat commercialized in the retail network are fresher according to microbiological research indicators, showing non-pathogenic saprophytic microflora.

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ECONOMIC EVALUATION OF AMARANTH PLANT GROWN BY DIFFERENT DRIP IRRIGATION METHODS AND STRATEGIES

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Abstract

This study was carried out to determine the effect of different irrigation treatments and economic analysis on surface and subsurface methods in amaranth under the Mediterranean climate conditions at the experimental fields of the Alata Horticulture Research Institution during 2018 and 2019 growing seasons in Turkey. In the study, surface drip and subsurface drip methods and six irrigation strategies (Full irrigation, FI; conventional deficit irrigation, DI-50 and DI-75; DI-25; Partial Root-Zone Drying, PRD-50 of full irrigation treatments and Rainfed) also a rain-fed treatment (RF) were considered. There was significant differences (P<0.01) for yields both irrigation system and irrigation method. Maximum yield was obtained from the FI treatment as 3,790 and 3,950 kg ha^{-1}; and the lowest yield was obtained from the rainfed treatment (RF) as 1,840 and 1,960 kg ha^{-1}, in the experimental years, respectively. The experimental design was split plots with four replications. Net profit ranged between 9,143 to 18,047 $ ha^{-1} in 2018 and 9,742 to 19,454 $ ha^{-1} in 2019 according to the irrigation treatments. Full irrigation treatment (FI) under subsurface drip irrigation method generated the highest net profit.

Key words**:** *Amarant, surface drip, subsurface drip, net return*

INTRODUCTION

Continuous and rapid increase in the country's population; increased that feeding, dressing, and other needs for life. The needs of people are increasing numerically by population growth, while also multiplying by the addition of the standard of living, which is raised by technological development. To meet the food requirement of the growing population and to agricultural sustainability, (a) effective management of existing water sources and increasing water usage efficiency, (b) development of additional water resources for irrigation, (c) the development of new products that are tolerant of stress conditions and can deliver more efficiency with less water is among the measures to be taken [9]. For this purpose, the production of more nutrients (vitamins, minerals, proteins, etc.) than the unit area, with plant types and varieties that can be easily grown in a variety of ecological conditions. It's starting to matter. The kinoa and amarant plants, which can grow in different geographical conditions, are the focus of interest, because they have a broad adaptability to climate and soil conditions today [5, 16].

Amarant (*Amaranthus* spp.) C4 is a drought-tolerant plant [8] via photosynthesis and medium-strength plant to salinity [12, 3, 13]. Amarant seeds, high protein and fat content are very important because they provide the appropriate amino acid structure for human nutrition [11]. The content of the lyse is much higher than the other grain seeds [4]. Amarant is considered a promising plant, with high nutritional values, wide adaptability to different environments, being able to grow in marginal soil areas [1, 7].

One of the most important objectives of irrigation water is to protect the product that was raised during dry periods. While products raised in winter in our region do not usually show a sign of thirst, early yield or drought period can result in a significant drop in yield from the water insufficient. In these cases, the use of the new generation of irrigation technologies, as well as the use of irrigation programming, which includes the time of

irrigation and the determination of the amount of irrigation water to be delivered, allows optimal use of limited water sources [11].

Amarant can be easily cultivated under current precipitation conditions in the half-drought climate zone [8], [6] and low severe drought do not cause reductions of amaranth yield [4].

The results of research on agricultural product costs are a tool that governments can apply to in determining price policies. Agricultural product costs are widely used in businesses, especially in determining the usage levels of physical production inputs, labour planning, financing programs and preparing product budgets [2].

In this study, the additional income for the amarant plant, which will generate the financial values of the yield differences caused by different irrigation methods and different irrigation treatments in the Çukurova region, has been concrete for the amarant plant.

MATERIALS AND METHODS

The research was carried out at the Alata Horticultural Research Institute Tarsus Soil and Water Resources Location in 2018 and 2019 cultivation periods. The average altitude of the experimental research area from the sea is 10 m and located at latitude is 36.894885°; longitude is 34.960193°. According to the climate station data of Alata BKAE Directorate Soil and Water Resources, the long annual rainfall average of the region (1950-2019) is 616 mm. The long annual temperature average in the region is 17.8ºC. The annual evaporation for long years measurements is 1,487 mm.

During the research years (2018 and 2019), 103.4 and 97.1 mm of precipitation occurred during the plant growing season. In general, temperatures and humidity values in the 2018 and 2019 amaranth growing period were similar to the long annual average values.

Along the 60 cm profile layer of the trial area soil; having clayey structure, the pH of the soil according to the layers, 7.8-8.1; salt content 0.5-0.6 dS m^{-1}; volume weight 1.30-1.44 gcm^{-3}. Field capacity water content on the basis of volume varies between 30.07-31.44% and the wilting point between 18.05-18.98%. The total amount of usable water in the depth of 60 cm of the soil profile is 96 mm.

The research was carried out in four replications according to randomized blocks divided plots trial design. In the research, two different irrigation methods (Surface drip (SD) and subsurface drip (SSD)) and six different irrigation treatments were considered.

Irrigation systems (surface drip and subsurface drip are assigned to the main plots, irrigation treatments are assigned to the sub plots). Full irrigation (FI) in which soil water defcit was replenished to feld capacity when 50% of available water at 60 cm was depleted. Defcit irrigation treatments (DI75, DI50 and DI25) which received 75, 50 and 25% of full irrigation, respectively. Regulated defcit irrigation (RDI) received 50% of FI until fowering growth stage, then received 100% of water requirement. Rainfed (RF), in which no irrigation was applied except during emergence and crop establishment period.

Photo 1. A2 amarant variety
Source: Original.

The plant material used in the research was selected as the A2 *Amaranthus cruentus* L. variety with the highest yield as a result of the preliminary study conducted a year ago with 5 different amarants proposed as a result of the researches carried out at Çukurova University within the scope of the EU 7th Framework Project (SWUP-MED Project). A2 amaranth

variety is a variety that is grown both as a grain and a vegetable (Photo 1).

The soil of the experimental area was corrected a few days before the planting of the goble-disc and made ready for seedling planting. Amarant seedlings were hand-planted on trial plots on March 25, 2018 and March 10, 2019. In each plot, 6 rows of plants with a length of 6 m were placed with 70 cm between rows and 20 cm above rows. With the planting, 75 kg ha^{-1} N and 75 kg ha^{-1} P^2O^5 pure substance basis 20-20-0 compound fertilizer were applied to the trial plots. After planting, irrigation water was applied equally to all trial subjects. The second fertilization was carried out at the beginning of flowering and 46% urea was applied on the basis of 75 kg ha^{-1} N pure substance. After reaching physiological maturity, the Amaranth plants were hand harvested on August 15, 2018 and August 10, 2019, by leaving a row from each side and one meter gap from the heads (4 m long middle rows) in each plot.

In both drip systems, the main pipe consisting of PE pipes, manifold and lateral pipes were used in the transmission system and these pipes were placed on the soil surface. Laterals are 16 mm in diameter and included in-line drippers with 40 cm intervals (Netafim). The dripper flow rate is 2.0 l h^{-1} at 100 kPa operating pressure. The dripper range and flow rate were determined, taking into account the infiltration properties of the soil.

Soil water content were monitored in traditional (gravimetric) in 0–60 cm and innovative manners (TDR) in 0–40 cm. Soil water content sensors (SM-150, Delta T) were placed between the two plants in the crop row at 20 and 40 cm depth at one replication for each irrigation treatment with data loggers.

Information regarding production costs and sale prices were obtained from the Chamber of Farmers' Association and the Agricultural Provincial Directorate in Mersin. Production costs include land rental, fertilizer, seed, soil cultivation, plant protection and labour cost for irrigation, harvesting and transportation costs. For the calculation of the total cost of eggplant production for one year, the sum of crop production costs, the yearly cost of the irrigation system, irrigation labour and water cost are taken into account.

Analysis of variance was performed to evaluate the statistical effect of irrigation treatments on eggplant yields and components, WP and ET using the JMP Statistical software developed by SAS (SAS Institute, Inc., Cary, NC, USA). Treatment means were compared using LSD test [15].

RESULTS AND DISCUSSIONS

Irrigation water amounts and grain yield values related to different irrigation methods and subjects during the research years are given in Table 1.

At the beginning of the 2016 growing season, all treatments received 49 mm of irrigation water in two applications in order for establishing a good plant stand. In SD irrigation method, the total amount of irrigation water applied to FI issue was 453 mm, while 356 mm water was applied to DI-75, 257 and 158 mm to DI-50 and DI-25. In the RDI application, 50% of the irrigation water was reduced until the flowering period, and after this date, all of the missing water in the root area was covered. Thus, the total amount of irrigation water for RDI was 401 mm. In SSD application, 356 mm irrigation water was applied for FI, 282 mm for DI-75, 208 and 134 mm for DI-50 and DI-25. 304 mm irrigation water was given to the subject of TD irrigation method RDI.

In the second year of the study, a total of 50 mm of water was applied to all trial subjects in order to ensure uniform plant growth in the trial plots. While the total amount of irrigation water applied to FI subject in SD irrigation method was 488 mm, 378 mm was applied to DI-75 and 269 and 159 mm to DI-50 and DI-25, respectively. 413 mm irrigation water was given to the RDI issue.

Table 1. Irrigation water amounts and grain yield values of different irrigation methods and treatments during the research year

Years	Irr. System	Irrigation Treatments	Seasonal Irrigation (mm)	Yield (kg ha^{-1})
2018	SD	FI	453	3,790
		RDI	401	3,590
		DI-75	355	3,300
		DI-50	257	2,750
		DI-25	158	2,210
		RF	60	1,840
	SSD	FI	356	3,910
		RDI	304	3,680
		DI-75	282	3,450
		DI-50	208	2,920
		DI-25	134	2,320
		RF	60	1,840
2019	SD	FI	488	395
		RDI	413	376
		DI-75	378	345
		DI-50	269	270
		DI-25	159	225
		RF	45	196
	SSD	FI	404	406
		RDI	347	390
		DI-75	315	360
		DI-50	227	282
		DI-25	138	237
		RF	45	196

Source: Authors' results.

Table 2. LSD grouping on yield in amarant plant during research years

IM (SY)	Irrigation Treatments						IM Ave.
	FI	RDI	DI75	DI50	DI25	RF	
SSD	3,910a	3,680c	3,450e	2,920 g	2,320 ı	1,840 k	**3,020 a**
SD	3,790b	3,590d	3,300f	2,750 h	2,210 j	1,840 k	**2,910 b**
IT Ort.	**3,850a**	**3,630 c**	**3,370 b**	**2,840 d**	**2,270 e**	**1,840 f**	
	SY: LSD (0.05)=3.17; P=0.0018** SK: LSD(0.05)=2.88; P=0.0001** SY*SK: LSD(0.05)=4.08; P=0.0001**						

Source: Authors' results.

In SSD application, irrigation water was 404 mm in FI, 347 mm in DI-75, 227 and 138 mm in DI-50 and DI-25, respectively. 347 mm irrigation water was applied to RDI irrigation. The total amount of irrigation water applied to the subjects in the second year of the study was higher than in the first year. This is because the precipitation recorded in the second year during the growth period is less than the precipitation in the first year.

The amount of irrigation water applied in the study is similar to the previous studies. Patel et al. (2005) [10] , in their study on amaranth plant in India, the amount of irrigation water they applied was between 120-420 mm, Rule (2007) [14] investigated the effects on the yield of amaranth in dry and wet conditions in Manhattan, and the grain yield varied between 203-356 mm.

Pulvento et al. (2015) [12], in their study to determine the water requirements of amaranth in Italy, varied between 46-234 mm. The reason for using much less irrigation water than our study is thought to be due to the fact that the amount of rainfall is much higher.

Grain yields obtained from amaranth irrigated by using different irrigation methods and irrigation treatments were 3,910 kg/ha with 184 kg/ha in the first year; In the second year, it changed between 1,960 kg/ha and 4,060 kg/ha. The highest grain yields of 3,910 and 4,060 kg/ha were obtained in the 2018 and 2019 trial years of the SSD irrigation method, respectively.

It may be possible for producers to adopt the proposed new cultivation technique only if they gain more economic returns. Economic analysis of different drip irrigation methods and irrigation issues are given in Table 3-6 in detail.

In the first year of the trial, according to the economic analysis results covering investment, operating and production costs, net income in different irrigation issues varied between 4,451-11,995 $/ha in surface drip irrigation. The highest net income for FI at different irrigation levels was 11,995 $/ha, followed by RDI (11,056 $/ha).

Subsurface drip irrigation issues varied between 4,497-12,053 $/ha. The highest net income for FI at different irrigation levels was at 12,053 $/ha, followed by RDI 1,114 $/ ha. Net income decreased with decreasing irrigation water in the research year. A net income of (3,133 $/ha) was obtained for non-irrigation RF.

Table 3. The summary of the combined economic analysis of the different irrigation treatments in surface in 2018

Treatments	**Irrigation Water (mm) (1)**	**Irrigation Water ($m^3 ha^{-1}$) (2)**	**Irrigation duration for the irrigation season (h) (3)**	**Labor cost for irrigation ($ h^{-1}) (4)**	**Total cost for irrigation labor ($) (3x4) (5)**	**Water price ($ m^{-3}) (6)**	**Water price ($ ha^{-1}) (2x6) (7)**	**Crop production costs (8)**
YDTS	453	4,530	25	3	76	0.1	453	6,010
YDRDI	401	4.005	22	3	67	0.1	401	6,010
YDKS75	355	3.548	20	3	59	0.1	355	6,010
YDKS50	257	2.565	14	3	43	0.1	257	6,010
YDKS25	158	1.583	9	3	26	0.1	158	6,010
RF	60	600	3	3	10	0.1	60	6,010
Treatments	Irrigation systems for 1 ha ($ ha^{-1}) (9)	Annual cost for the irrigation system ($ ha^{-1}) (9/6 year) (10)	Total cost for 1 year ($ ha^{-1} yıl^{-1}) (5+7+8+10) (11)	Yield (kg ha^{-1}) (12)	Amarant sales price ($/kg) (13)	Gross income per ha ($/ha/year) (12x13) (14)	Net income ($/ha/year) (14-11) (15)	
YDTS	2,500	416.6667	6,955	3,790	5	18,950	11,995	
YDRDI	2,500	416.6667	6,894	3,590	5	17,950	11,056	
YDKS75	2,500	416.6667	6,841	3,298	5	16,488	9,647	
YDKS50	2,500	416.6667	6,726	2,748	5	13,738	7,012	
YDKS25	2,500	416.6667	6,611	2,213	5	11,063	4,451	
RF	0	0	6,080	1,843	5	9,213	3,133	

Source: Authors' results.

Table 4. The summary of the combined economic analysis of the different irrigation treatments in sub-surface in 2018

Treatments	**Irrigation Water (mm) (1)**	**Irrigation Water ($m^3 ha^{-1}$) (2)**	**Irrigation duration for the irrigation season (h) (3)**	**Labor cost for irrigation ($ h^{-1}) (4)**	**Total cost for irrigation labor ($) (3x4) (5)**	**Water price ($ m^{-3}) (6)**	**Water price ($ ha^{-1}) (2x6) (7)**	**Crop production costs (8)**
TDTS	356	3,560	20	3	59	0.1	453	6,010
TDRDI	304	3,040	17	3	51	0.1	401	6,010
TDKS75	282	2,820	16	3	47	0.1	355	6,010
TDKS50	208	2,080	12	3	35	0.1	257	6,010
TDKS25	134	1,340	7	3	22	0.1	158	6,010
RF	60	600	3	3	10	0.1	60	6,010
Treatments	Irrigation systems for 1 ha ($ ha^{-1}) (9)	Annual cost for the irrigation system ($ ha^{-1}) (9/6 year) (10)	Total cost for 1 year ($ ha^{-1} yıl^{-1}) (5+7+8+10) (11)	Yield (kg ha^{-1}) (12)	Amarant sales price ($/kg) (13)	Gross income per ha ($/ha/year) (12x13) (14)	Net income ($/ha/year) (14-11) (15)	
TDTS	3,000	375	6,897	3,790	5	18,950	12,053	
TDRDI	3,000	375	6,836	3,590	5	17,950	11,114	
TDKS75	3,000	375	6,787	3,297.5	5	16,487.5	9,701	
TDKS50	3,000	375	6,676	2,747.5	5	13,737.5	7,061	
TDKS25	3,000	375	6,566	2,212.5	5	11,062.5	4,497	
RF	0	0	6,080	1,842.5	5	9,212.5	3,133	

Source: Authors' results.

In the second year of the trial, according to the results of the economic analysis covering investment, operation and production costs, net income in different irrigation treatments varied between 4,637-12,754 $/ha in surface drip irrigation. The highest net income for FI at different irrigation treatments was 12,754 $/ha, followed by RDI 11,891 $/ha. Subsurface drip irrigation issues varied between 5,304-13,444 $/ha. The highest net income for FI was 13,444 $/ha at different irrigation levels, followed by RDI 12.710 $/ha. Net income decreased with decreasing irrigation water in the research year. A net income of 3,732 $/ha was obtained for non-irrigation RF.

Table 5. The summary of the combined economic analysis of the different irrigation treatments in surface in 2019

Treatments	**Irrigation Water (mm) (1)**	**Irrigation Water (m^3ha^{-1}) (2)**	**Irrigation duration for the irrigation season (h) (3)**	**Labor cost for irrigation ($ h^{-1}) (4)**	**Total cost for irrigation labor ($) (3x4) (5)**	**Water price ($ m^{-3}) (6)**	**Water price ($ ha^{-1}) (2x6) (7)**	**Crop production costs (8)**
TS	488	4,880	27	3	81	0.1	488	6,010
RDI	413	4,130	23	3	69	0.1	413	6,010
KS75	378	3,780	21	3	63	0.1	378	6,010
KS50	269	2,690	15	3	45	0.1	269	6,010
KS25	159	1,590	9	3	27	0.1	159	6,010
RF	50	500	3	3	8	0.1	50	6,010
Treatments	Irrigation systems for 1 ha ($ ha^{-1}) (9)	Annual cost for the irrigation system ($ ha^{-1}) (9/6 year) (10)	Total cost for 1 year ($ ha^{-1} $yıl^{-1}$) (5+7+8+10) (11)	Yield (kg ha^{-1}) (12)	Amarant sales price ($/kg) (13)	Gross income per ha ($/ha/year) (12x13) (14)	Net income ($/ha/year) (14-11) (15)	
TS	2,500	417	6,996	3,950	5	19,750	12,754	
RDI	2,500	417	6,909	3,760	5	18,800	11,891	
KS75	2,500	417	6,868	3,450	5	17,250	10,382	
KS50	2,500	417	6,741	2,700	5	13,500	6,759	
KS25	2,500	417	6,613	2,250	5	11,250	4,637	
RF	0	0	6,068	1,960	5	9,800	3,732	

Source: Authors' results.

Table 6. The summary of the combined economic analysis of the different irrigation treatments in sub-surface in 2019

Treatments	**Irrigation Water (mm) (1)**	**Irrigation Water (m^3ha^{-1}) (2)**	**Irrigation duration for the irrigation season (h) (3)**	**Labor cost for irrigation ($ h^{-1}) (4)**	**Total cost for irrigation labor ($) (3x4) (5)**	**Water price ($ m^{-3}) (6)**	**Water price ($ ha^{-1}) (2x6) (7)**	**Crop production costs (8)**
TS	404	4,040	22	3	67	0.1	404	6,010
RDI	347	3,470	19	3	58	0.1	347	6,010
KS75	315	3,150	18	3	53	0.1	315	6,010
KS50	227	2,270	13	3	38	0.1	227	6,010
KS25	138	1,380	8	3	23	0.1	138	6,010
RF	50	500	3	3	8	0.1	50	6,010
Treatments	Irrigation systems for 1 ha ($ ha^{-1}) (9)	Annual cost for the irrigation system ($ ha^{-1}) (9/6 year) (10)	Total cost for 1 year ($ ha^{-1} $yıl^{-1}$) (5+7+8+10) (11)	Yield (kg ha^{-1}) (12)	Amarant sales price ($/kg) (13)	Gross income per ha ($/ha/year) (12x13) (14)	Net income ($/ha/year) (14-11) (15)	
TS	3,000	375	6,856	4,060	5	20,300	13,444	
RDI	3,000	375	6,790	3,900	5	19,500	12,710	
KS75	3,000	375	6,753	3,600	5	18,000	11,248	
KS50	3,000	375	6,650	2,820	5	14,100	7,450	
KS25	3,000	375	6,546	2,370	5	11,850	5,304	
RF	0	0	6,068	1,960	5	9,800	3,732	

Source: Authors' results

CONCLUSIONS

As a result of the economic analysis, marginal revenues were taken from full irrigation irrigation for both irrigation methods. When compared with irrigation methods, higher net income was obtained in SSD irrigation methods compared to SD irrigation method.

High net incomes have been calculated on DI-75 and RDI issues after full irrigation. Marginal income values decreased due to decreasing amount of irrigation water. For these reasons, RDI and DI-75 issues are seen as a good alternative to FI topic for Çukurova conditions.

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QUALITY MANAGEMENT IN RURAL TOURISTIC BOARDING HOUSES

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Abstract

The main purpose of this paper was to assess quality in Romanian rural touristic boarding houses by completing a questionnaire-based survey. The survey was made in the summer of 2020 by interviews with 139 managers from 28 villages from Maramures County. The research was based on over 100 items questionnaire structured on 40 questions and 4 sections: the description of the buildings and facilities, the description of the environment, the characteristics of accommodation facilities, the characteristics of the offered services (food, cleaning, hospitality). The main results of our survey revealed that the analyzed rural touristic boarding houses have procedures and methods to assure the quality of buildings and services which are implemented for years. In this way the adaptation to safety measures needed to assure the quality of accommodation and services during COVID period is easier to be implemented.

Key words**:** *rural tourism, quality of accommodation facilities, quality of services, quality management in tourism*

INTRODUCTION

Rural areas offer unique resources to touristic sector, especially in Romania [14, 13] where the development of touristic activities is considered by local communities like a necessity for the economic growth [11]. Despite the higher number of recognized touristic boarding houses from rural areas, there are many rural accommodation facilities which are not certified according with Romanian legislation [5] and their existence affect the perception of quality of rural touristic products and services [8]. Also, in certified accommodation facilities there are management decisions regarding costs which can affect the quality of tourist accommodation services and products, like the ones related with water and energy consumption [7].

Many studies are trying to assess the quality in rural tourism [2, 4]. Some of them are oriented towards the perception of tourists over the quality but this kind of researches are subjective and are based on the profile of the tourists and their expectations [3], [10]. Other studies tried to develop tools and quantify the quality of different rural touristic households by benchmarking processes but they are difficult to adapt to a national context [1], [6], [9], and [12]. We refer here also to the national laws which provide the legal framework for the classification of the tourist accommodation units.

In our vision, the quality of a rural touristic boarding house can be measured mainly by two general dimensions: the accommodation facilities status and the touristic services offered. Off course is very difficult to assess the real dimension of quality if we don't have at our disposal objective tools of quantification of different characteristics such as a national database. So, our approach was mainly qualitative and it was trying to identify the way in which different aspects of quality are fulfilled in Romanian rural touristic boarding houses (like touristic and agroturistic pensions) and to find solution to adapt the existing situation to the more actual demanding conditions due to the pandemic period.

MATERIALS AND METHODS

Our assessment is based on a questionnaire-based survey which took place in the summer of 2020 in Maramures county. We used 40

questions which permitted us to collect data regarding: the general description of the accommodation, the general description of the pension' environment, the characteristics of accommodation facilities, the characteristics of the offered services (food, cleaning, hospitality). Regarding the methodology, we want to specify the following: we selected accommodation facilities which are rural touristic boarding houses or agro-touristic boarding houses (139 cases, from 28 villages); the selection was random and is based only on the willingness to respond to our survey; the survey interval was June-September 2020; we used IBM SPSS Statistics for data processing and evaluation. We assessed over 100 items related with touristic quality assurance with the purpose to identify the main factors which contributes to a good management in the field.

RESULTS AND DISCUSSIONS

The managers of the analyzed rural accommodation households were the owners (81.3%) or a family member of the owners (13.7%) and only 5% were employees. Over 70% of these managers have between 36 and 55 years old and 69.8% of them were women. Regarding their education, almost 60% have university degree, 36% have studies in touristic field and the majority of them have a good proficiency in English.

The quality of accommodation facilities

The investigated touristic boarding houses had the following characteristics:

- category of comfort: - 3 (around 56%) and 2 stars (around 44%);
- in the accommodation structure, double rooms represent over 75% (65.5% of the respondents);
- 56.1% are legal authorized persons and 41.0% are family enterprises;
- 54.0% offer between 11 and 20 places and 27.3% between 6 and 10 places;
- 37.4% offer only accommodation, 27.3% offer B&B (bad and breakfast) and 28.8% half board services.

Regarding the evaluated elements of quality of the accommodation facilities, we observed a real concern of the managers for keeping in good condition the buildings and the afferent annexes. Our findings can be summarize as presented in Table 1.

Table 1.Quality assessment of accommodation facilities

Investigated element	Results
Building conservation status	95.7% are in very good shape and only 4.3% have some problems with the buildings but with no direct impact on the touristic activities
Building architecture	78.4% present the traditional architecture features of the area but 21.6% are a built with modern features
Designated areas for tourists	The host and his family does not use the areas provided to guests for personal purposes. The staff of the guest house does not enter the rooms rented to tourists. The rooms are adequately insulated against noise. Guests can lock the door both inside and out. Guests receive a room key upon arrival at the guest house
Room facilities	Complete furniture, including cabinets and chairs; TV; Internet connection (99.3%); Shared bathroom with other rooms (23.0%); Central heating system (98.6%); Air conditioning (74.8%); Hairdryer (80.6%)
Utilities	91.4% of boarding houses are connected to the public water distribution network (other sources: well, spring).Hot water distribution systems: 13.7% - boiler; 33.8% - wood heating; 2.2% - gas power plant; 50.4% - electric heating plant. 86.3% of boarding houses are connected to the public sewerage network (only 13.7% have a septic tank). 85.6% of boarding houses are connected to the public electric network and only 14.4% have complementary solar panels.

Source: Own assessment based on questionnaire survey.

The quality of gastronomic services

Many rural boarding houses offer gastronomic services under different forms (96.9%). 55.4% of them put a kitchen at tourist disposal and 29.5% offer access to the host kitchen (access to stove, refrigerator, etc.). Only 12.2% offers access to restaurant facilities.

The managers in tourism field from Maramures County are trying to integrate the local food products in their activity. A large part of the products are obtained inside their

own households. Additionally, to get food that is not produced in their own household, 34.5% collaborate with neighboring households (for local specialties like bacon, sausage, smoked meat, honey, etc) and 15.1% with farms (for vegetables and fruits). Also, the manager is willing to offer on request special menus such as gluten-free, but this facility is not included in the menus in the present.

The quality of cleaning services

When we talk about the quality cleaning services in tourism we refer to internal and external procedures to deal with this matter. Regarding the waste resulted from touristic activities, the touristic boarding houses depend on the contracts made by the city halls (92.1%). Based on these contracts, in 71.2% of boarding houses the garbage is picked up weekly and in 28.8% at 2-3 days. But only in 87.8% the manager applies a garbage selection procedure. In the villages where there are not public waste collection services, the managers made contracts directly with specialized firms (5.8%) or take care of the situation by themselves. Regarding the cleaning services provided for tourists, in 94.2% of the accommodation units they are provided by family members or employees and in 12% the managers resort to the employees of a specialized company. Based on the pattern of the travel of tourists, the cleaning services are provided as such: 54% at 2-3 days; 22.3% daily; 16.5% weekly; 5.0% in weekend and 2.2% at the end of the stay.

The quality of hospitality services

Our approach to evaluate the quality of hospitality services take in consideration the interactions between the host (manager, family members, employees) and the tourists, divided it into two categories: printed or verbal. In this way we established the flux of information and the methods used to interact with tourists to assure hospitality (Table 2).

As we may observe, there are many information made available to tourists, but the managers prefer a direct and verbal contact regarding: the assistance on long stays, the ways to contact the hosts if they are need it or the transfer of knowledge regarding the use of some equipment. The printed documents offer information regarding: certificates of authorization; instructions regarding internal rules, prices, equipment, touristic activities in the area, etc.

Table 2. Quality assessment of hospitality services

Investigated element	Verbal %	Edited %
Assistance from the host, if tourists stay for a long time.	72.7	27.3
How and where can I contact the host if I need to contact them	45.3	54.7
Instructions regarding the equipment used and the facilities offered: (sauna, swimming pool, massage)	37.4	62.6
Information on payment documents and payment method (invoices, etc.)	22.3	77.7
Area information	18.0	82.0
Information on the facilities of the unit	12.9	87.1
Price information	11.5	88.5
Information about the sights in the area	11.5	88.5
Instructions on the prices applied and how to settle	9.4	90.6
Instructions on the rules of the accommodation unit (smoking, garbage sorting, etc.)	7.2	92.8
Presentation of information about health services in the area	5.8	94.2
PSI authorization	1.4	98.6
Presence of fire extinguishers inside the pension	1.4	98.6
Consumer protection telephone number	0.7	99.3
Sanitary authorization on hygiene conditions	0	100.0

Source: Own assessment based on questionnaire survey.

Ways to improve the quality

Many managers look for ways to improve quality in their touristic boarding houses (around 88%). In most of the cases they make decisions based on the recommendations of the tourists (Table 3).

However, we observed that the opinion regarding the facilities are usually recorded in writing (in 62.6% of cases) and the opinion regarding the leisure services are recorded in writing only in 46.8% of cases.

Table 3. Methods to improve quality

Investigated element	Verbal %	Edited %	No
Opinion on accommodation facilities	37.4	62.6	0
Opinion on tourist and leisure services	51.1	46.8	2.2
Proposals to improve services	33.8	43.9	22.3

Source: Own assessment based on questionnaire survey.

Ways to improve quality and safety in COVID times

Our survey permitted us to collect some measures to assure the safety of the tourists selected by the managers. These measures were selected from a list created based on the last year proposed recommendation of the authorities for HORECA. Like we may observe form the following table, managers of rural boarding houses were more than capable to implement safety protocols.

Table 4.Measures to improve quality during COVID

Investigated element	Verbal %	Edited %
Online payments	100.0	13.1
Alternative accommodation (one free room, one occupied)	89.2	11.7
Disinfection at the end of the stay	100.0	13.1
Gastronomic services will be made only by designated staff	100.0	13.1
The distance between tables of 2 meters; no more than 8 people at the table	100.0	13.1
One maid per each room	82.0	10.7
Equipped staff according with COVID 19 safety recommendation	96.4	12.6
Employment of medical staff	12.9	1.7
Change of sheets will be made by the tourist to avoid COVID infection	83.5	10.9
	-	100

Source: Own assessment based on questionnaire survey.

They couldn't provide an increase of staff (maids or medical staff) but they even agreed with the implementation of safety tools like buying protection equipment or temperature measuring devices.

CONCLUSIONS

Using the frequencies for comparing the responses from our survey we can draw the following conclusions regarding the assurance of the quality in rural touristic boarding houses from Maramures County:

- the touristic buildings are, in general, well preserved, respect the traditional architecture and create a generous space to assure the privacy of the tourists;
- the rooms are fully destined for touristic activities and satisfy basic needs for accommodation (no noises, furniture, TV, internet, etc.), the only negative point being that only 77% have en-suite bathroom;
- the building is usually connected with public utilities networks but some of them (30-50%) have another types of heating or sewerage systems;
- all the managers integrated in the gastronomic services local products from their own household, the neighbors or local farms;
- the waste collection systems are functional in almost all the villages with the help of local authorities and the internal cleaning services are provided by the hosts especially within a 2-3 days interval or weekly.

The main conclusion of our research is that in rural areas from Maramures County exists a real preoccupation to assure quality in rural tourism from building to hospitality services. The implication of the managers (owners or not of the business) revealed the possibility to implement safety measures needed in this COVID times. We consider that these type of accommodation facilities don't have to be assimilated with hotels and that they can be promoted like an alternative for families or individual tourism.

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CHANGE IN THE FUNCTIONAL STRUCTURE OF AGRICULTURAL CONSULTING IN THE CONDITIONS OF TRANSITION TO THE DIGITAL AGRARIAN ECONOMY

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Abstract

Agroconsulting plays an important role in helping farmers to sustainably develop and modernize agricultural production. Nevertheless, the classic set of services provided has become less and less satisfying the needs of consumers and almost everywhere falls below their expectations. At the same time, the development of digitalization processes in industries is uneven; differentiation in the use of innovative solutions in agricultural production among large, medium and small forms of business is increasing. The proposed hypothesis consists in that global digital trends require a significant expansion of the scientific and production infrastructure, transformation of the functions of the elements of the institutional system, leading to a change in their significance. To disclose this hypothesis, this paper examines the impact of digital trends on changing small farm advisory practices. The analysis of the current level of development of agricultural consulting in the Russian Federation; the structure of users and their requests is investigated; the data obtained are compared with the indicators of the use of digital technologies in agriculture. It is proposed to improve the efficiency of consulting services by including "digital" components in the classic set of functions.

Key words**:** *agriculture, consulting, digital economy, system, model, economic efficiency*

INTRODUCTION

The agricultural consulting system is the most important connecting element of the innovation system, bringing modern development trends to the attention of agricultural producers. It is the specialists of the consulting services (CS) who know the peculiarities of agricultural production and work directly with farmers. They provide them practical assistance in mastering advanced production experience, helping to increase their financial stability and modernization of production through the introduction of innovative developments.

At the same time, the international community was highlighted the continued effectiveness and importance of advisory services [14, 18]. One of the strategic priorities of the European Union is to provide farmers with timely access to knowledge and information, as well as training and education. Achievement of these objectives should be facilitated by policy programs in which agricultural research and extension services play a key role.

The European Commission, through the Horizon H2020 program, is successfully promoting cross-cutting instruments such as the Farm Advisory System and the European Innovation Partnership [28]. The Regulation of the European Parliament and of the Council No. 1306/2013 noted the importance of agricultural consulting in the modernization of farms, increasing their competitiveness, adapting to climate change, sectoral integration, introducing innovations and applying new knowledge. During the 41st Session of the UN FAO Regional Conference, countries in Europe and Central Asia encouraged the organization to continue its efforts to share knowledge on policies and best practices, in particular with a focus on smallholders and family farmers, and to build a regional platform for knowledge sharing and supporting the implementation of national e-agriculture strategies for Europe and Central Asia. The importance of ensuring family

farms have access to innovative technologies through not only financial mechanisms, but also the provision of information and advisory services, was noted in the UN FAO report "The future of food and agriculture: alternative paths to 2050" (The future of food and agriculture: Alternative pathways to 2050) [11]. At the same time, economists note that the return on agricultural production in richer countries is almost twice as high as in poorer countries. Earlier this pattern was identified by Lio M. and Liu M. [21], studying the impact of information and communication technologies on agricultural production using data for 81 countries for the period 1995-2000 [6]. They argued that developing regions with small farms, low levels of infrastructure development and insufficient investment in human capital incur higher transaction costs for providing the necessary advice and services. As a result, low levels of agricultural advice and warning systems lead to a cycle of inefficient production.

In general, the agricultural consulting system remains active and at the same time the least costly mechanism for the transfer of innovative solutions to agricultural production. Understanding the peculiarities of agro-industrial production, a variety of innovative opportunities and the possession of methods of consulting activities presuppose the use of various adapted forms of knowledge transfer. Therefore, the transition of developing countries to a digital agricultural economy should be accompanied by the continuous active work of the agricultural consulting system.

For a long time, the consulting centers performed a set of classical functions and met the information needs of rural producers [4, 7, 8]. But with the development of economic relations, technological breakthroughs, and the emergence of new challenges and threats, the requirements of farmers to the list and volume of consulting services began to grow [26, 39]. The current procedure for completing the portfolio of CS proposals began to not fully meet the expectations of consumers, which in many respects was the reason for the lack of demand for consulting services on the part of representatives of the real sector of the economy [2, 6, 33]. The changed socio-economic conditions came into conflict with the outdated concept of modernization of the agricultural production management system. Global digitalization processes require a significant expansion of the composition of the research and production infrastructure, changes in the functions of the elements of the institutional system, which leads to a change in the weight of their importance. All of this requires a change in consulting practice, going beyond the usual disciplinary knowledge and the classic set of suggestions for consultants. In response to modern challenges and the dynamics of the digital trend, the vector of consulting services development should be aimed at expanding the disciplinary experience of consultants and changing consulting practices, which will create new opportunities for the development of agricultural consulting.

The purpose of this study is to substantiate promising directions for improving the functional structure of the Russian agricultural consulting system based on an analysis of trends and features of its development in the context of the transition to a digital agricultural economy.

MATERIALS AND METHODS

The methodological basis of the research: the work of Russian and foreign economists in the field of research on the innovative development of the agri-food complex based on information infrastructure.

To determine the nature of the existing agricultural consulting system in Russia, we conducted a retrospective analysis.

It is believed that the first surge of interest in the formation of a system of consulting services for agricultural production in Russia occurred in the mid-nineties of the last century, when an agreement between the Ministry of Finance of the Russian Federation and the World Bank on the allocation of a loan for the creation of the ARIS project (Agriculture Reform Implementation Support) was signed. However, in reality, the history of

this issue goes back more than 120 years. Back in 1765, the Imperial Free Economic Society was organized in Russia, the purpose of which was to train local peasants in advanced farming skills [41]. Graduates of the school were allocated land for the organization of educational facilities, at the expense of society, books were purchased for them, agricultural schools and libraries, experimental farms and stations were opened, where tests of modern agricultural technology were carried out at that time [22]. It was the members of this society who were the initiators and main organizers of the first All-Russian Exhibition of Agricultural Products in 1850.

In 1913, the Institute of Local Social Agronomy was created, which in its essence laid the foundation for a centralized agricultural consulting system in Russia. Its staff included 9,000 consultant agronomists, serving both individual owners and rural communities in general. Two years later, the League of Agrarian Reforms appeared, among the leading specialists of which were well-known Russian scientists: N.P. Oganovsky, S.L. Maslov, A.V. Chayanov, N.P. Makarov and others. In 1924 A.V. Chayanov published a work on the organization of an agricultural consulting service "Basic ideas and methods of work of public agronomy". For the first time, they paid attention to the difference in the sources of information necessary for making an optimal management decision. In his writings, he revealed the significant potential of informatization, considering it as a structure that ensures an increase in the volume of production without increasing costs and contributes to an increase in the rate of development of agriculture based on the use of new scientific discoveries and advanced knowledge about market opportunities [3].

Research in the development of agricultural consulting, theoretical and methodological substantiation of the role of consulting services in agricultural production, analysis and characteristics of classical functions began to be carried out on a large scale since the early 1960s and are still relevant [34, 16, 1, 23]. Van den Ban paid a lot of attention to the differentiation in thinking among farm managers who were ready to embrace innovation and traditional peasants [38]. In his research, he notes that "It is the most highly educated producers who make the most use of the consulting service" [39, 40]. E. John Russell and A. Fisher adhered to a similar point of view. They repeatedly emphasized the importance of international exchange of information in the field of agriculture and viewed advisory services as a source of knowledge and experience, acquisition of practical skills for more efficient use of resources to increase production productivity and improve living standards [36, 42]. In the works of V.G. Savenko, M.Ya. Veselovsky, I.S. Sandu, G.M. Demishkevich, the main approaches to the organization of activities are clarified and the principles and methods of consulting are disclosed [7].

For a long period of time, the agricultural consulting system, fulfilling a set of classical functions, satisfied the information needs of rural producers, but as economic relations developed, their requirements for the list and volume of agricultural consulting services began to increase. Rural producers around the world have begun to move away from the traditional forms of regional agricultural advisory services, increasingly searching for information on the Internet. The outdated functions of consulting services began to be replaced by new ones, connected, first of all, with the formation of a database of innovative developments, products and services that are significant for the subject area, the provision of marketing services for the determination and selection of the most promising options for technical and technological support of production, as well as on the formation of a regional package of orders for applied scientific research in the field of agriculture.

To date, few works have studied the processes associated with the change in consulting practice caused by the transformation of the socio-economic space and the development of digitalization processes. Some elements of the analysis of new styles and methods of consulting services functioning can be found in the works of R. Birner, K. Davis, J. Pender, and others. The study of the processes of qualitative change in the practice of

consulting the farming sector was carried out by a group of Australian scientists R. Nettle, A. Crawford, P. Brightling [26]. The criteria for evaluating the effectiveness of the work of consulting services are presented in the works of Semina L.A., Sandu I.S. [35].

Considering the high importance of the conducting information infrastructure in agriculture, both in Russia and in the EU countries, it is surprising that the scientific community has a small amount of analytical information on the development and effectiveness of the agricultural consulting system in these countries. Farmers' opinions on the results of using advisory services are rarely studied. In Russia, in particular, it is difficult to find indicators reflecting the effectiveness of the work of consulting services in agricultural production at the regional or municipal level. First, the financial performance of each individual farm is a trade secret. Secondly, the coverage of indicators provided by federal and regional statistics services does not correspond to the dynamics of the development of innovative technologies in real sectors of the economy. Thirdly, the data of the statistical survey in agriculture become available with a long time lag. This significantly complicates a deeper study. As a result, the author relies mainly on the data submitted until 2016 published by the national statistical offices, as well as on the results of surveys conducted in 2018 by the Kuban State Agrarian University on the use of digital technologies in agriculture in Russia and the Federal Center for Agricultural Consulting and Retraining of the Russian agro-industrial complex on the effectiveness work of the agricultural consulting system.

The research was based on data from the Federal State Statistics Service (Rosstat), Eurostat, World Bank Group, MARS, FAO, as well as analytical materials from the Ministry of Agriculture of the Russian Federation and reports on the work of regional consulting services of the agro-industrial complex. To compare Russian and foreign experience and assess the qualitative development of the national agricultural consulting system, the results of reports compiled at the request of the European Commission were used: "Agricultural Knowledge and Information System (AKIS)" (Service of agricultural knowledge and information systems), "Farm Advisory System (FAS)" (National Farmers Advisory System).

When working with statistical data sets, methods of economic and mathematical analysis were used, which made it possible to study the structure of users of agricultural consulting services and their requests, to determine the economic efficiency of the introduction of innovations by individual categories of farms with the participation of consulting services.

The methodological base was formed by the methods of systemic, comparative and factor analysis. This made it possible to compare the data obtained with the indicators of the use of digital technologies in agriculture, to determine the most popular areas of consulting for different groups of agricultural producers.

The results obtained and the conclusions drawn on their basis will serve as the basis for developing recommendations for improving the functional structure of the agricultural consulting system, taking into account the growing influence of the digitalization trend.

RESULTS AND DISCUSSIONS

The development of a system for the dissemination of agricultural knowledge is one of the most important tasks of innovative agri-food policies in developed and developing countries. Russia is no exception. A characteristic feature of the Russian agro-food complex is the predominance in its structure of small producers, whose economic activities are concentrated in rural areas. Agricultural production is less a place of work than a way of life for most farmers. But in the mass consciousness of rural residents, "traditionalist" values still prevail - adherence to the usual, fear of change, paternalistic expectations. The conservative mentality of the bulk of the rural population, the irrationality of social institutions, hinder the change of priorities in the value system of the rural population from maintaining a stable existence to focusing on accelerated

development and renewal of society, and will largely hinder the positive perception of innovations. A high proportion of the influence of informal institutional factors, the isolation of most agricultural producers from research organizations and enterprises that sell high-tech products impose their own restrictions on the process of spreading innovations in the agri-food complex and necessitate such a structure as a system of agricultural consulting. Agroconsulting remains today the most important element of the institutional system, contributing to the acceleration of the transfer of intersectoral innovative technologies in agriculture. The agricultural consulting system has the ability to directly interact with scientific organizations, governing bodies and business entities, covering the macro-, meso- and micro-levels of management.

The Russian system of agricultural consulting is a set of interrelated structural elements, which are based on consulting organizations at the regional and district levels [32, 4, 25]. They are closest to agricultural producers and directly work with them, providing practical assistance in the development of advanced production experience, innovative developments, as well as in the adoption and implementation of managerial, organizational, economic and technical decisions. In 2018, in 62 out of 85 constituent entities of the Russian Federation, 87 organizations provided consulting services in the field of agro-industrial complex and rural development at the regional level and 190 at the district level. In 2018, 554 consultants worked in district structures, on average 3 consultants per center [30].

With all the variety of forms of agricultural consulting system organization, the Ministry of Agriculture of the Russian Federation has chosen to form a vertically hierarchical one, in which most services are structural subdivisions of sectoral governing bodies or created on the basis of large regional multidisciplinary universities. This scheme has become more and more susceptible to criticism by agricultural producers, since it is considered poorly adaptable to external factors. Since the beginning of the 2000s, foreign governments began to abandon the division into federal and regional consulting services in favor of commercial consulting, working according to individual customer schemes with a wide range of services provided. In most EU countries, agricultural advisory services are predominantly provided by commercial organizations. Flexible policy of budgetary co-financing of consulting services removes part of the financial burden from farms.

Table 1. Main characteristics of agricultural consulting systems in Europe and the Russian Federation

Country	Subsidizing contracts for the payment of consulting services %	Share of expenses for consulting services in % of income
Hungary	80%	1.11%
Italy	80%	0.80%
Lithuania	80%	2.19%
Belgium	80%	1%
Finland	80%	0.28%
Estonia	75%	0.51%
Luxembourg	70%	0.41%
Latvia	70%	0.41%
Sweden	70%	0.58%
Czech Republic	68%	1.10%
Germany	60%	0.81%
Netherlands	50%	2.22%
Denmark	0	2.02%
Russian Federation	0	>3%

Source: Compiled by the author based on data [10].

Table 1 shows the amount of subsidies for contracts for payment of consulting services and the share of expenses for consulting services to income in Europe and the Russian Federation.

Table 1 shows that in Germany government subsidies for contracts for the payment of commercial services in the field of agricultural consulting amounted to about 60%, while the share of farmers' expenses does not exceed 0.81% of the total profit. In Finland, Lithuania, Hungary, Belgium and Italy, the state compensated up to 80% of the costs of agricultural producers for consulting services. The share of own expenses of farmers in the listed countries for agricultural consulting services ranged from 2.19% to 0.8% of their annual income [12]. In Russia, consulting activities in most constituent entities are supported from regional budgets, therefore basic consulting services are free for agricultural producers. Russian regional consulting centers provide individual or group services to customers on a wide range of issues within their competence: they conduct field research, training events, seminars, exhibitions and specialized conferences. However, consulting services in the field of economics and organization of production, software development, geoanalytics are paid. As a result, the costs of these services have a high specific weight relative to their income.

The results of the research projects "Evaluation of the Implementation of the Farm Advisory System" and "Prospects for Farmers' Support: Advisory Services in European AKIS", published by the European Commission, show that consulting services are increasingly in demand in the EU countries in recent years. The latter are associated with the search for additional sources of increasing production efficiency through the use of resource-saving technologies (renewable energy sources (40.1% of requests), ecology and environmental protection (33.1%), diversification of production (27.8 %). The demand for software maintenance services among farmers in European countries, as well as services in the field of rural development, is, on average, three times higher than the Russian level. Such a structure of requests points on the vector of farmers' strategic planning with focus on long-term development, while a characteristic feature of Russian agricultural producers is an orientation towards achieving short-term goals.

Analyzing the structure of services of Russian regional agricultural consulting centers, the following can be noted. The provision of professional assistance in the field of crop and livestock production, as in all countries, is in stable demand among consumers. The structure of other directions of inquiries of clients of consulting services from 2002 to 2018 has changed significantly. Answers to questions related to software and informatization, despite their relatively high cost in comparison with other paid services of CS, have become more in demand (from 0.3% to 6%). Also, a positive trend in the number of consulting services provided was noted in the field of economics and organization of production (from 9 to 13%). However, in recent years, farmers have become more selective about the sources of information, seeking to independently apply new knowledge in business planning and production design. In the structure of consulting services provided by agricultural consulting organizations, accounting services from 2002 to 2016 first increased from 8 to 11%, then in 2018 they decreased to 7.6%. The issues of legal support remained at the level of 5% [8]. The share of consulting services in the field of marketing fell from 10% to 1.7%, mechanization from 9% to 4.1%, land relations - from 5% to 1%.

The study of the experience of the most effective consulting services of the Russian Federation regions shows that the implementation of the consultants' proposals can contribute to a multiple reduction in the risks of making erroneous management decisions and form an increase in the sustainability of the development of farms. Regulatory information on the ratio of supply and demand in the market, prices for food products provides an opportunity already at the planning stage not only to rationally distribute the totality of labor and material and

technical resources, but also to adequately correlate the position of the organization in relation to its main competitors.

Figure 1 shows the dynamics of the share of various categories of recipients of services of regional and municipal consulting services for 2012 – 2018.

Analysis of the structure of users of services of agricultural consulting organizations in the regions of the Russian Federation shows the predominance of small forms of farming. In 2016, compared to 2012, the share of peasant-farm households (PFH) in the structure of consumers of services increased from 31% to 45% [31]. By 2018, the share of PFH decreased to 35.5%, while the total share of small enterprises in the structure of service recipients was 53.7%.

The number of hits from representatives of large agricultural organizations in 2016 decreased (the share was 23%) with a noticeable increase to 30.7% in 2018.

Small farmers are little able to effectively use modern equipment and technologies. A small seasonal profit and a low level of capital concentration do not allow to ensure the acquisition of a complex of innovative developments and to employ several highly qualified specialists (agronomists, livestock specialists, accountants, lawyers, programmers, etc.) [17, 19].

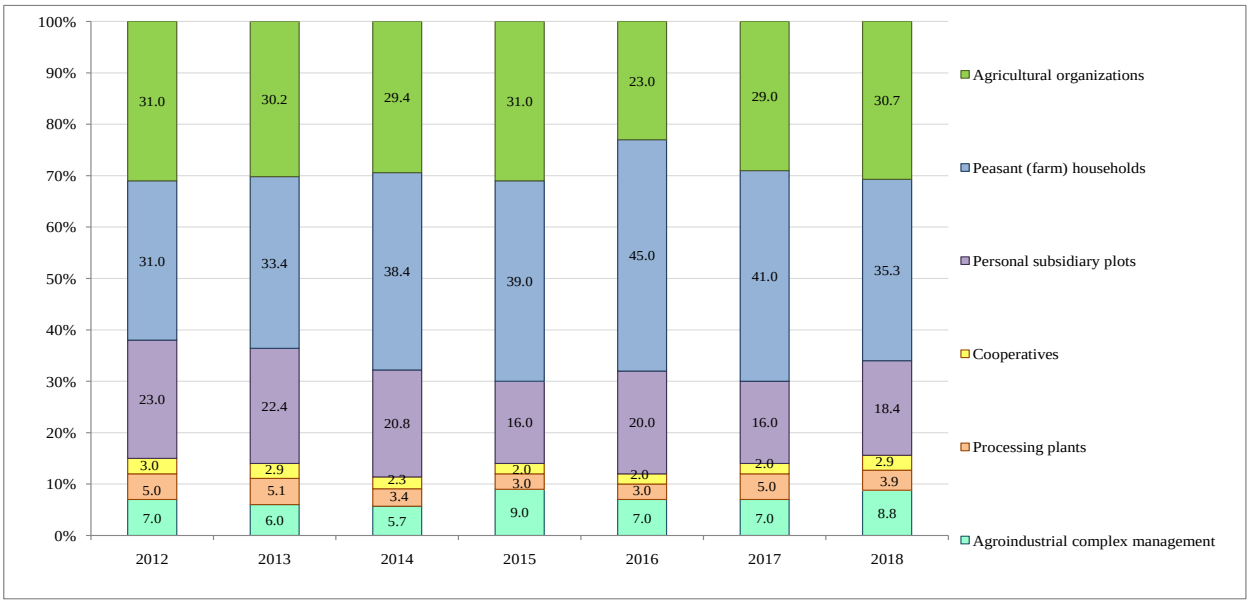

Fig.1. The structure of recipients of services of regional and municipal consulting services for 2012 - 2018, in %. Source: [30, 31].

Figure 2 shows how much the share of small farms that used innovative technologies in 2018 is less than large agricultural organizations. Every year, the differentiation in the use of innovative solutions in agricultural production among large, medium and small forms of farming is increasing. The largest share among the introduced innovative technologies was the system of wastewater disposal and treatment of industrial effluents, as well as the construction of treatment facilities at livestock farms. This is largely due to the need to comply with the standards in accordance with changes in legislation in order to implement the Decree of the President of the Russian Federation dated 05/07/2018 No. 204 "On national goals and strategic objectives for the development of the Russian Federation for the period up to 2024" in terms of ecology [5]. Already in 2018, more than 15% of agricultural organizations implemented the system of precise driving and diagnostic quality control of technological processes. Among small farmers, the most popular are biological methods of protecting plants from pests and diseases, individual feeding systems for livestock, a system of drainage and treatment of industrial effluents.

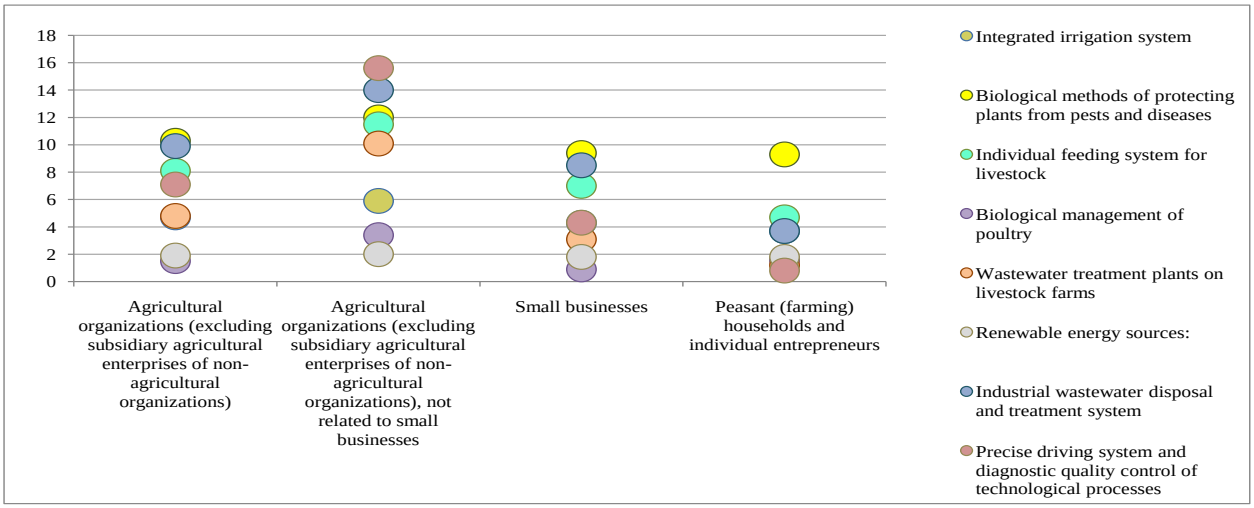

Fig. 2. The share of agricultural organizations, peasant (farmer) households and individual entrepreneurs using innovative technologies in 2018, in %
Source: [20, 27].

Systems of precise driving and diagnostic quality control of technological processes are used by only 4.3% of small enterprises and 0.8% of PFH.

The analysis of innovative activity indicators in the agri-food complex of Russia shows that the rate of introduction of new technologies in agricultural production does not correspond to world standards. According to federal statistical observation, the share of innovative goods, works and services produced by Russian agricultural organizations in 2017 amounted to 1.7% of the total, the intensity of expenditures on technological innovation reached only 0.7% [15]. In 2019, the indicators increased slightly. The share of innovatively active agricultural organizations in the total number was 5.8%, the share of innovative goods, works and services produced by them was 2.36% of the total [13].

Table 2 presents the results of the implementation of innovations by individual categories of farms with the participation of Russian agricultural consulting services in 2016. The generalization of data on innovations introduced by agricultural producers directly with the help of consulting services and the resulting economic effect indicates the significant potential of agricultural consulting.

Table 2. The results of the introduction of innovations by individual categories of farms with the participation of consulting services of the agro-industrial complex in 2016

Industries and areas of innovation	Service recipients							Innovation efficiency	
	Agricultural organizations		PFH		Personal subsidiary plots		Others	Expected economic effect, thousand rubles	The resulting economic effect, thousand rubles
	units	in the number of farms	units	in the number of farms	units	in the number of farms			
Introduced innovations in crop production	119	17,633	52	78	23	260	2	243,701	221,944
Implemented innovations in animal husbandry	139	116	58	56	30	59	20	906,946	371,917
Introduced innovations in the field of economics and organization of production	47	35	28	24	12	36	4	60,870	30,371.1
Number of innovation and investment projects *(developed/mastered)*	240	121	251	112	221	178	26	1,101,895	558,704

Source: Compiled by the author based on data [31].

Analysis of the results of innovative activities of services by recipients of services showed that in 2016 the percentage of development was about 80 points. In agricultural organizations, every second innovation and investment project in the field of organizing production, crop production and animal husbandry was mastered.

One of the main directions of innovative development of agriculture and its subsectors is the large-scale implementation of digital technologies. In 2019, the Ministry of Agriculture of the Russian Federation proposed a departmental project "Digital Agriculture" [9]. The goal of the project is to transform agriculture through the introduction of digital technologies and platform solutions to ensure a technological breakthrough in the agro-industrial complex and achieve a 2-fold increase in productivity in digital agricultural enterprises by 2024. In accordance with the objectives of the project, the share of specialists from agricultural enterprises who have undergone retraining and have competencies in the field of the digital economy to work with digital products and technologies,% (of the total number of specialists employed in agricultural enterprises) should be 50% by 2024.

In the same year, the Center for Forecasting and Monitoring the Scientific and Technical Development of the Agro-Industrial Complex in the field of precision agriculture, automation and robotization [37] conducted a survey of more than 80 farmers and heads of agricultural enterprises, as well as experts in the field of management and development of the agro-industrial complex According to the survey results, the requirements for the qualifications of employees in agricultural enterprises vary depending on their size. Thus, 46% of respondents noted that they accept workers mainly with secondary vocational education (not excluding higher education), 22% want to have employees only with higher education, and 32% (mainly small enterprises and peasant (farm)) do not impose requirements at all on the level of education of their employees. At the same time, 73% of representatives of small businesses have already realized the need to use digital technologies to improve the efficiency of production and management, but more than half of agricultural producers believe that the share of economic entities that have introduced elements of digital technologies into production will not reach 50% declared in the Project by 2024.

According to the respondents, the acceleration of the digitalization of the agricultural industry will be facilitated by subsidies and preferential loans for the acquisition of elements of digital technologies, as well as an increase in the share of IT specialists in the total number of employees. But according to the Analytical Center of the Ministry of Agriculture of the Russian Federation, today there is an acute shortage of IT specialists in the industry (the number of people employed in agriculture is 4,706 thousand people (6.5%), of which ~ 113 thousand people are in IT). The shortage of IT specialists in the Russian agro-industrial complex is at least 90 thousand people [24]. One of the main reasons for the shortage of personnel for the transition to the digital economy of the agro-industrial complex is the lag of the teacher training system behind the modern requirements of educational standards, which contributes to the reproduction of competencies inherent in the analogue economy in subsequent generations of workers. The growing level of technological equipment of modern industrial complexes, as well as the ever higher expectations that the digital economy places on them, require not only retraining of agricultural workers in new high-margin segments (organic farming, production of specific non-mass agricultural products), but also more in-depth non-agricultural training [2]. To eliminate personnel imbalances in the short term, consulting services can be assigned an intermediary function to find partners for IT outsourcing and other services in the field of agricultural production. When clients contact them, they can recommend both their own personnel and external specialists, using crowdsourcing technologies [33]. In the future, as a solution to the problem, it is necessary to create a system for training specialists for agricultural enterprises in the

field of digital agriculture and retraining specialists for agricultural enterprises on the basis of educational and experimental farms of the Ministry of Agriculture of the Russian Federation, consulting services of the agro-industrial complex and commercial enterprises. The expediency of creating such centers of competence was noted by 98% of the respondents. The need to adapt as quickly as possible to digitalization conditions transforms the classic set of functions of consulting services, including "digital" components. Figure 3 shows the classic, innovative and digital directions of work of the consulting services of the Russian agro-industrial complex.

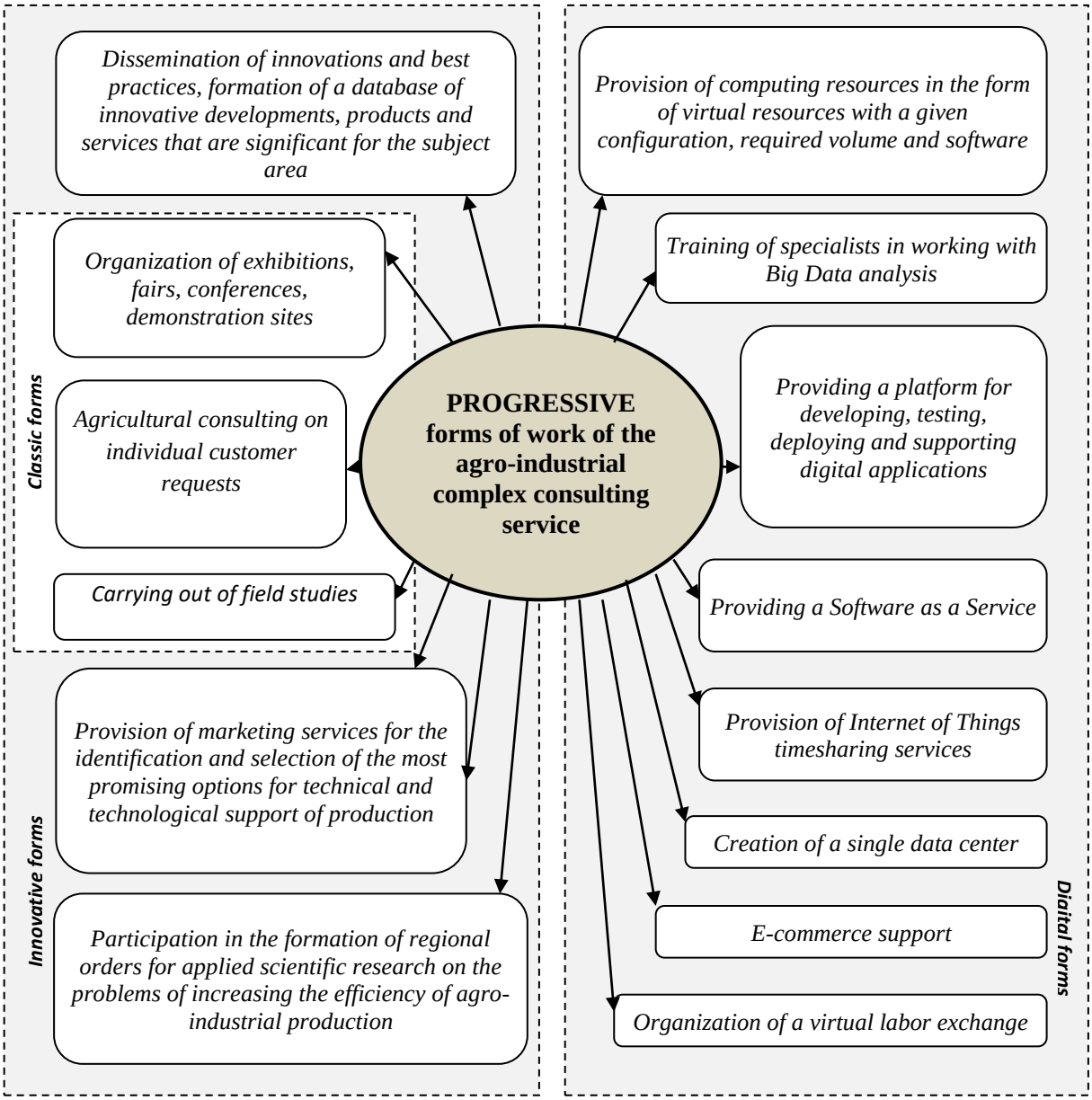

Fig.3. Progressive forms of work of consulting services of the agro-industrial complex of the Russian Federation
Source: [2, 17, 33].

The classic forms of consulting services work successfully with innovative directions that took shape 15 years ago. Until now, the most effective way for the dissemination of promising varieties of agricultural crops, breeds of productive animals, machinery and equipment is the organization of demonstration objects (fields and farms) by employees of consulting services. According to the annual reports on monitoring the provision of consulting assistance to agricultural producers and the rural population

of the Russian Federation, 78 exhibitions were held in 2014, and in 2016 their number increased to 407 (187 regional and 220 district levels), 356 demonstration objects were organized (104 regional, 93 district and 159 under agreements with agricultural organizations), as well as 315 "Field days". Maunder also believes that extensive advisory methods without demonstrations and field practice have very little effect and should therefore be retained as a classic feature set [1]. Thus, while acquiring new functions, consulting services retain their basic functional structure due to the predominance of biological processes in agriculture and the associated risks and uncertainties. For example, most IT startups avoid field trials by using “fast” data collection and analysis techniques to get to market as quickly as possible. However, farmers cannot afford to make a mistake when introducing new technology, in this regard, the organization of demonstration sites, experimental stations by specialists, as well as conducting thematic seminars will remain in demand, both on the part of farmers and commercial enterprises.

Agriculture is becoming an object of research with a large set of digital data. According to the forecast prepared by the Higher School of Economics, by 2030 the global market for self-driving vehicles based on micro-geolocation will grow 70 times and will amount to 157.5 billion dollars. The use of GPS/GLONASS sensors and RFID-tags (Radio Frequency IDentification), which carry out radio frequency identification for the logistics of agricultural production, will increase by 1.7 times, the market of integrated control and accounting systems in agriculture, combined with telematics systems, will grow by 1.73 times, and aerospace services, including geolocation, remote sensing and hydrometeorological information, 1.72 times [29]. This will contribute to an increase in interest in remote informing about the state of farmland and in a decision support system for farmers through online services. Therefore, we believe that the distribution of software, both highly specialized and general purpose, should be among the functions of the next generation of consulting services.

As part of the planned activities of the Departmental Project "Digital Agriculture", the Ministry of Agriculture of the Russian Federation has compiled a Catalog of digital solutions for the analysis, study and subsequent scaling of the most successful cases in the field of big data and artificial intelligence, the Internet of things, robotization of processes and various specialized services (digital platforms and systems). The catalog contains digital developments in the field of the agro-industrial complex, as well as companies that implement them in practice. Specialists of consulting services are able to adapt one or another innovative development to the specific conditions of the farm, draw up a business plan and help make a rational management decision. In addition, the replication of innovative developments remains one of the basic functions of agricultural consulting. Activities to promote innovation among agricultural producers are fully subsidized by the state.

In accordance with the informatization plan of the Ministry of Agriculture of the Russian Federation, back in 2016, the Federal Network for the Exchange of Knowledge and Technologies in the Field of Agriculture was launched, developed to provide consultants of the agricultural consulting system with competent information to improve the quality of the consulting services provided. The information platform is a repository of industry data on innovations, technologies, business; statistical materials; regularly updated industry directories; technological solutions (tools for collecting and processing information, contact center solutions integrated with a CRM (Customer Relationship Management) solution). The communication platform provides an opportunity for agricultural consulting to interact with the industry community. Consulting platform is an integrated web-based solution for providing a wide range of paid consulting services. Thus, by providing agricultural producers with access to state automated information systems, platforms for developing, deploying and supporting digital applications, distributing the necessary

software for this and training specialists in working with the Internet of Things and big data analysis technologies, consulting services are developing new areas of activity, laying the digital vector of development. We believe that a promising direction for the development of agricultural consulting is the creation of platforms for testing the best foreign practices in the use of digital technologies in the field of agriculture. This will facilitate their natural transfer and adaptation to specific Russian conditions.

The expansion of end-to-end digitalization of agriculture is also associated with the creation of optimal product chains that unite, in addition to producers and consumers of agricultural products, trade and processing enterprises, building logistic transportation schemes, fixing price information, coordinating the work of tax, customs and other authorities in the field of agriculture. The activity of agricultural consulting services improves the institutional structure of regional agrosystems, the model of cooperation of its subjects, contributing not only to reducing the cost of production, but also speeding up the process of its implementation. After assessing the volume and structure of demand, the farmer independently interacts with the end consumer, reducing the number of links in the value added chain. The transition to direct supplies of products helps to reduce the level of prices for basic foodstuffs, will create preconditions for increasing the volume of lending to the industry, and will contribute to its investment attractiveness from private capital.

CONCLUSIONS

The study touches upon the problem of the disproportion between the possibilities of the dynamically developing digital technologies in the world and their insufficient use in solving urgent problems of agriculture. This digital divide can be explained by the peculiarity of agricultural production, lack of government funding for the industry, the predominance of small forms of farming in the agri-food complex, and a high proportion of the influence of informal institutional factors. A uniform standard set of measures to overcome the digital inequality is of little use for different regional agricultural systems. Therefore, the modernization of agriculture based on digital technologies requires a balanced approach, including a set of universal tools to support the modernization of agricultural production and a set of differentiated mechanisms for approbation and implementation of IT technologies, adapted to the conditions of the intra-industry environment.

The agricultural consulting system is one of the most important mechanisms for a balanced ecosystem of innovative development of the agri-food complex based on the use of digital technologies. But the current order of completing the portfolio of offerings of consulting services does not fully meet the expectations of consumers. This is largely the reason for the decrease in the demand for agricultural consulting on the part of representatives of the real sector of the economy.

The changed socio-economic conditions came into conflict with the outdated concept of modernization of agricultural production, which requires changes in consulting practice, going beyond the usual disciplinary knowledge and the classic set of consultants' proposals.

The digitalisation phenomenon is redefining the concept of consulting services by adding "digital" components to the classic feature set. In this regard, we propose several directions for improving the functional structure of the Russian agricultural consulting system that meets the trends of the digital economy.

This is assisting small and medium-sized businesses in the form of providing them with access to state automated information systems, supporting e-commerce, forming a package of orders for conducting the most popular applied scientific research, providing training for specialists of agricultural enterprises and expanding the disciplinary experience of the consultants themselves in the direction of working with the Internet. things, big data analysis technologies, spatial sensing materials and geoanalytic products.

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PROMOTING AND MAINSTREAMING SUSTAINABILITY PRACTICES IN AGRI-FOOD SUPPLY CHAINS

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Abstract

Sustainability consists one of the biggest challenges that the agri-food supply chains have to face. Examining agri-food supply chains from a "life-cycle" perspective has been promoted as an effective way to move towards more sustainable food production systems. The adoption of such viewpoints in the agri-food sector has a great impact on the environmental, the economic, the social and the institutional dimensions of agri-food supply chains. Relevant technical and managerial solutions have been gaining increasing relevance in the agricultural activities, and stakeholders have a variety of alternative solutions at their disposal to increase the efficiency of the agri-food supply chains. This review examines and categorizes the strategies that have been followed towards promoting sustainability in agri-food supply chains 'from farm to fork'. Moreover, our aim is to shape an analytical framework to accommodate decisions concerning supply chain design and operation towards sustainability.

Key words**:** *agri-food, supply chain, sustainability, strategies, stakeholders*

INTRODUCTION

In the last decades, sustainability has gained increasing interest worldwide and has become a focal strategic priority. The agri-food sector has a challenging role in this new canvas. The growing population, the continuous change of nutritional habits, the feeding challenges and the water crisis suggest the creation of more sustainable agri-food networks from the sides of all stakeholders [18].

Sustainability affects the agri-food supply chain in environmental, economic, social and institutional dimensions [15]. A sustainable agri-food supply chain aims to retain the environmental balance and not to adopt practices that negatively affect ecosystems. All those should be achieved while enhancing long-term economic growth of all stakeholders of agri-food supply chains. A sustainable agri-food supply chain system also benefits the society through the creation of synergies among stakeholders with different objectives and through fostering the well-being of the society. The institutional dimension is about the activities of institutions related to the facilitation of decision-making and putting sustainability policies into practice.

International efforts for the adoption of a "life cycle" perspective have been made, such as the Sustainable Development Goals (SDGs) 2030 Agenda, which includes 17 aspirational objectives with 169 targets about all dimensions of sustainable development [29]. The agri-food sector is linked with the SDGs in an important way since FAO's strategic framework is aligned with the SDGs, promoting an integrated approach to sustainability [12]. At the same time, a growing number of sustainability approaches are linked to the bio-based economy model and the strong sustainability paradigm which also apply to the agri-food supply chains [4]. For this reason, the agri-food supply chains come up with solutions in order to increase their efficiency and move towards sustainable models of food production and distribution.

This paper aims to provide a framework for the analysis, categorization and monitoring of approaches followed throughout the agri-food supply chains towards sustainability by focusing on primary production, processing, distribution and retailing.

MATERIALS AND METHODS

This paper presents the results of a selective study of the available literature concerning the sustainable strategies followed by the stakeholders during primary production; processing; and distribution and retailing of products of the agri-food supply chains. The results of this study were categorized in each stage depending on their target, range, and level of application. Finally, gaps in the application of the sustainable approaches described in the literature were detected and a framework was shaped in order to propose solutions towards the improvement and the adoption of new practices towards sustainability.

Primary production

The primary production is the first stage of the agri-food supply chain. The decisions taken in this stage have a great impact on the sustainability of the whole supply chain. The main issues that arise are food loss, especially in less developed countries with a high population where the availability of technical and economic resources is limited [10] and the excess use of natural resources and energy until the stage of manufacturing.

Examining the pre-harvest stage, especially for crop cultivation, food losses mainly occur due to changes in weather conditions which lead to disease and insect infections [21] and sometimes pre-mature harvesting [9] affecting both the quality and safety of the products. As a result, products are not appropriate for either consumption or further processing and in a lot of cases they do not meet the requirements of other stakeholders, which leads to an increase in food losses. Another potential cause of food losses that are connected to pre-harvest activities is the poor forecasting of demand which leads to the overproduction of crops [5] that remain in the field, especially in developed countries [10]. In order to manage the uncertainties that commonly exist in primary food production, stochastic programming and robust optimization models have been developed recently, helping to optimize agricultural activities [3]. Agricultural activities also involve the use of natural resources, such as soil and water. A small amount of the resources that are used in agriculture actually remains in the product since most of them are lost [14]. That is why water management is one of the main issues that farmers have to take into consideration. During harvest, the food loss often increases, due to the lack of technical skills and equipment, causing damages to the products. Post-harvest food losses mostly happen due to poor storage conditions. The lack of appropriate storage equipment especially in the case of fresh product supply chains can affect the product quality making it inappropriate to enter the manufacturing and consuming stage [13].

Food loss management has been approached from different points of view, most of them focused on the reuse of food that has been excluded from being part of the agri-food supply chains. The use of sub-products for animal feed is regarded as the most convenient way to manage food losses. There are cases where it is applied, like Japan and Korea [20] but in most countries, it is forbidden due to health and safety reasons. Recently, studies about the use of by-products on the encapsulation process and thus as an ingredient of new functional food have been gaining increasing interest in the agri-food sector. The application of converting food loss into food ingredients, which is still under research, is promising but still far from happening.

The consumption of energy is also an emerging issue since the need of the preservation of the quality of products, usually under low temperatures, leads to higher consumptions before, during and after transportation [19]. Although in the case of fresh products the model of short supply chains is mostly applied, the food losses can still reach up to 60% of the total volume [34].

The food losses and energy consumption problems are also affected by the way agricultural activities are practiced. In many countries a primary issue that farmers have to face is the fragmented agricultural activities due to the small landholdings [25]. The fact that a lot of farmers own one or more small parts of the land and not undivided parts, happens either due to the topography of the

area or law limitations of each country [25]. In such cases, small-scale farmers do not possess the means to follow an integrated framework in agricultural activities as the technological equipment at their disposal is limited and the production is lower and in some cases not enough to cover the demands [18]. That is why small-scale farmers try to create opportunities for cooperation with others and create a network of producers in order to achieve their sustainable goals [11]. The integration of different sectors of agricultural activities, such as livestock, tree cultivation, fish and crops is also a way of creating synergies in the primary production since these agricultural systems can exist at the same time taking advantage of each other due to their complementary needs by re-using nutrients and resources. Similar techniques are mostly applied in the case of greenhouses, where there is the re-use of carbon dioxide emissions of power plants as a booster to the plants' growth, but not in a wide range.

Innovative agricultural systems have been studied and applied during the last decade in order to optimize the agri-food supply chains and increase their efficiency using technological innovations and proposing new frameworks for organizing the stakeholders [30]. The scientific research behind this perspective is valuable and it has contributed to achieving its targets. The precision technologies that already find application in the agricultural sector have promoted and supported this perspective by updating the quality and increasing the efficiency of agricultural activities [7]. Besides, a multi-level perspective has also been developed within the agri-food supply chains, considering mostly the energy management and describing ways to move towards socio-technical changes, approaching a more sustainable system. The application of such socio-technical changes is difficult to be achieved in the case of highly institutionalized systems, where the rules and regulations provide stability and make them difficult to change and adapt to the new socio-technical circumstances [23].

Processing

In the case where products are not distributed for direct consumption, they enter the next level of the agri-food supply chain which is manufacturing. There is a lot of research on the sustainability approaches of the stakeholders at the level of food processing and packaging, alongside an interest in food safety and quality.

Examining the manufacturing stage of different kinds of products we observe that inappropriate handling during manufacturing and transportation is one of the main reasons for the food losses and quality degradation of the products [1] which leads to reduced profit. The lack of appropriate storage equipment, poor packaging and quality defects of products that emerge, lead to food losses even before transportation at both developed and less developed countries[10]. The use of these by-products has become an emerging issue for the agri-food supply chains as they negatively affect the environment in case they remain unused [2]. That is why the stakeholders in this stage tend to use new technological equipment, where possible, and use advanced packing and handling systems in order to avoid food losses [17]. Mechanical preservation technologies are widely used in food manufacturing aiming to extend the shelf life of the products and preventing their quality degradation [7]. The adoption of technologically advanced systems and materials especially during the stage of packaging has also a positive role towards achieving traceability, since high-quality packaging protects the quality of the product and gives all the necessary information about its background [22].

Distribution and Retailing

Depending on the kind of food product and its safety and quality standards, the procedures and requirements of the agri-food supply chain change. For example in the case of frozen products the energy needed to process, transport and store them is higher than in the case of fresh products, ending up though to a product with a longer shelf-life, giving the retailers the chance to create a stock [35]. The case of perishable products is also interesting. Even though in some cases the manufacturing stage slightly exists, such as the case of fresh

fruits, the handling and transportation of the products has a great impact on their quality and self-life [26]. On the other hand, the transport of non-perishable products is easier but still affects the quality of the products and possible losses in the next stages [26].

During transportation, there are temperature and humidity standards that have to be followed. Long-distance transportation and the lack of the appropriate equipment and trained staff causes losses of food due to pathogens and quality degradation [10]. As a result, traceability should also be assured at this stage. The requirements to achieve safe transportation include appropriate infrastructure, such as warehouses and equipment like packaging boxes but most importantly the technological capability of monitoring the transportation procedures in order to access all the information needed. Information sharing is highly important since the condition of each product should be accessible to all stakeholders in order to enhance the trust in the relationships between them [17].

Food losses also occur from the retailers' side. In some cases, the standards of each retailer are strict in order to offer products with higher quality and sometimes added value and as a result, products that do not have quality and safety problems are often rejected. Moreover, the bad storage conditions can expose products to microbiological dangers leading to non-confirmation of the food safety standards imposed by the law of each country. The inaccurate forecasting of the demand and the over-stocking of products in retailers' storage can lead to expiration before being sold and then rejection. In some cases retailers use methods of chemical preservation of products in order to avoid food losses due to expiration [7].

RESULTS AND DISCUSSIONS

Examining the strategies followed by the stakeholders of the agri-food supply chain we observe that even though there are some organized frameworks for sustainability, there is ground for substantial improvements. Some of the approaches described in the previous sections are still in an immature level or even not yet actually applied at the industrial level. In Table 1 there is a categorization of the strategies followed throughout agri-food supply chains considering the evolution of their application using the product/service life cycle curve, which is presented in Figure 1. The following continuum is used in order assess the level of application:

(1)Development: researchers have identified the potential of certain applications which are still under investigation.

(2)Introduction: the researched solution is regarded to have potential application and has been recently adopted by practitioners.

(3)Growth: the researched solution is adopted by a growing number of stakeholders.

(4)Maturity A: the researched solution is widely adopted and recognized by stakeholders.

(5)Maturity B: the researched solution is well established and recognized by stakeholders.

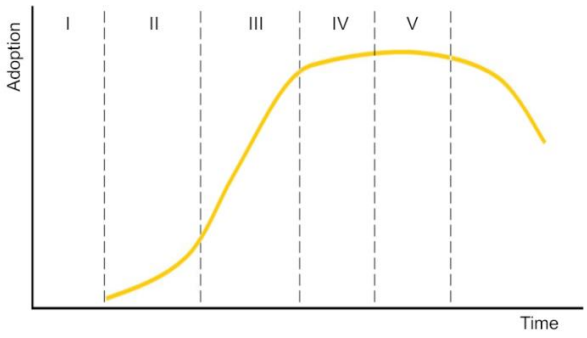

Fig. 1. The product/service life cycle curve
Source: Adapted and modified from [31].

Sustainability in agri-food supply chains is a focal priority. There is increasing interest in research around this topic, from environmental, economic, social and institutional points of view. In the last decade the increase of the published works on sustainability is remarkable [10, 32]. Most of the research is focused on environmental, economic and managerial aspects of sustainability and less on the social impact of it [8, 33]. However, a holistic approach is necessary in order to make fundamental changes towards sustainability in the agri-food supply chains focusing on overall efficiency and not dealing with the different

stakeholders as separate units, but as interdepended parts of a system.

Table 1. Evaluation of strategies followed throughout agri-food supply chains

Stage	Problem	Solution	Level of application
Primary Production	Weather conditions	Optimization models	III
	Use of natural resources	Water management	IV
	Food losses	Re-use of by-products	I
	Fragmented agricultural activities	Cooperation between farmers	II
Processing	Food losses	Technological equipment	V
		High quality packaging materials	V
Distribution	Quality degradation	Technological equipment	V
	Traceability	Information sharing	II
Retailing	Food losses	Better storage conditions	IV
	Over-stocking	Demand forecasting	III

Source: Authors' own analysis.

Although the technology in agricultural activity has been developed, the focus of the evolution lies in the post-harvest sector. As proposed by [7] the development of precision agriculture can reinforce the pre-harvest activities and manage uncertainties. In addition to this approach, the update of the skills of those who work in the primary production is necessary in order to adopt new practices and take advantage of the new technological implementations.

The environmental impact of the agricultural activities is increased since the managing of natural resources is highly involved. The preservation of soil and water, as the main sources of energy used in agriculture, and reduction of emissions have been a priority for the agricultural sector since climate change is a worldwide topic of discussion. For example, manure management has started to be applied, as it can reduce greenhouse gas emissions by being used in other agricultural activities, such as fertilization [16]. The governance has just started reinforcing eco-friendly activities and a lot of countries have committed to follow green practices [14]. Nevertheless, institutional changes are necessary, and the regulation should be modified in order to make the application of these frameworks easier for the stakeholders and motivate even small-scale farmers to align with the evolution in the agricultural sector. The cooperation between farmers, although being promising, it is not frequently adopted. As mentioned, mixed systems in agriculture slightly exist. The intensification process could help the stakeholders to increase the efficiency of the agri-food supply chain, deal with the problems caused by the limited land and equipment availability and meet the needs of the customer demand. The convergence of interests among farmers could be achieved by formal contracts and agreements, even in short agri-food supply chains and secure the commitment to achieving the goals from the sides of all coordinators [28]. All these strategies aim to increase the agri-food supply chain efficiency by achieving at the same time the best combination of safety and quality of products for the customers and thus provide products with added value. In order to monitor the condition of the products and ensure they retain their properties, we need a system of following the product through all the stages. Traceability is a very convenient solution for the agri-food supply chain and it can be achieved through the use of information technology systems that improve information management, such as blockchain technology [27]. The problem of food loss through all the stages of agri-food supply chains is dominant. The economic, environmental and social impacts are self-evident. The use of by-products from the stakeholders themselves or from their coordinators gives them the chance to utilize this food waste. In addition, when the food losses are increased as the products go through the agri-food supply chain stages, retailers may end up having at their disposal the less quantities than necessary, which in turn may lead to increases in the products' prices [24]. A decrease in food losses increases the number of the products available

for selling. There are several proposals for using the co-products, as it has already been described, but not all of them are applied in the same range. Depending on the reason why the products have been rejected, different methods of usage can be applied. In the case where the products are rejected due to inappropriate handling and not spoilage and the product cannot be used for its original purpose, they could be processed and be turned into another functional food or an ingredient for other kinds of products. For example, in the case of fresh fruits the use of them as an ingredient for juice or fruit-flavored snacks could be a way to reduce fresh food waste. On the other hand, when the product is not safe for further processing or use, this sub-product could be used for other purposes such as feed, as it has already been proposed [20]. Another way to reduce food waste and at the same time help to solve the major problem of poverty and feeding challenges is food donation. The regional donation of products that retain their quality and safety is a way to manage food waste and at the same time reduce social inequalities. However, bureaucracy is still an obstacle to this action [24].

The ability to apply this strategy at international level is not easy, as transportation among countries is difficult, mainly due to technical reasons. Opening new markets in countries where the food crisis is increased could be a way to increase food availability and at the same time reduce food waste in developed countries. To achieve this, an adjustment of laws and regulations is necessary in order to keep up with the local legislation of each country.

Examining the possible frameworks for sustainable practices in agri-food supply chains we notice that investments are required from all stakeholders. Sometimes, an investment in sustainability could reduce short-term profits [6].

CONCLUSIONS

Sustainability is linked to long-term strategic planning as it represents a change towards a different way of approaching the efficiency of agri-food supply chains. As a result, a change of perspective among stakeholders is necessary in order to take the next step towards the evolution of the agri-food supply chains and invest in a model adapted to the contemporary needs of the market. There still is room for improvement in the strategies that have already been followed by the stakeholders. Their adaption to new problems that emerge and their combination with new frameworks of solutions is the key to achieving sustainability in agri-food supply chains. This research was rather focused on the crop cultivation systems and the different kinds of products involved in such agri-food supply chains. The shape of new frameworks is an ongoing research examined from different viewpoints in order to achieve an integrated approach to sustainability.

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MARKETING STRATEGIES FOR RURAL TERRITORIES DEVELOPMENT IN UKRAINE IN THE CONTEXT OF DECENTRALIZATION REFORM

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Abstract

The goal of the paper was the analysis of marketing strategies for rural territories development in Ukraine in the context of the decentralization reform that started in 2014. A theoretical and methodological approach was made based on general scientific methods of cognition in relation to the problems of rural development (empirical, analytical, comparative and descriptive methods) as well as a systemic and structural-functional analysis in connection with the legislation in force regarding the new administrative-territorial structure of Ukraine, which was formed as a result of the decentralization reform. The success of decentralization practices is manifested, in particular, in the fact that a strong regional identity is being formed, which is able to strengthen the national identity. In the formation of marketing strategies for the development of rural areas, the concept of territory branding is important, as the territory brand contributes to a significant strengthening of regional identity. Under the condition of effective branding of rural areas, some areas may become more interesting in terms of investment attraction, various business projects development, tourist infrastructure formation and so on. In addition, territorial branding often leads to an increase in self-esteem of the population of certain rural areas, which contributes to the reduction of conflict potential at the local level. The initiators of the formation of marketing strategies for rural development should be local authorities. It is stated that successful branding of territories is able to act as a determinant of effective economic development of rural areas.

Key words**:** *rural areas, marketing strategies, decentralization, power, Ukraine*

INTRODUCTION

Ukraine is a post-communist country with a population of about 42 million people, which political system during the Soviet era was characterized by an administrative-command style of governance. In the process of power decentralization reforms, Ukraine has faced a number of problematic issues in the field of rural management. The power decentralization reform, which began in 2014, changed the administrative-territorial structure of the state [26]. The processes of problematic issues coordination at the legislative, financial, and institutional levels have been still ongoing [15].

The power decentralization reform was actually started in the country at war. Since 2014 Ukraine has been in a state of undeclared war. The southern part of Ukraine, the Crimea, is illegally annexed by the neighbouring state of Russia. In 2014 an armed conflict broke out in the eastern territories of Ukraine and hostilities continue to this day. The annexation of the Crimea and the fighting in the east of Ukraine have threatened the lives of thousands of people who have been forced to flee their homes and become internal migrants. In June 2015 1.4 million internal migrants (internally displaced persons) were registered in Ukraine.

Moreover, according to this indicator, Ukraine ranks ninth in the world [14].

Currently, the situation has hardly changed. As of February 8, 2021, the number of internal migrants in Ukraine is 1,459,862 [19]. These are internal migrants from the temporarily occupied territories of Donetsk and Luhansk oblasts and the Autonomous Republic of Crimea. Fighting in the eastern territories of Ukraine, a large number of internal migrants are a danger to the functioning of the state, threatening its political and economic development. This requires coordinated and effective activity of public authorities of Ukraine in order to avoid economic downturn and social upheavals in society.

One of the priority tasks of the power decentralization reform in Ukraine was the formation of effective local self-government on the ground, the creation of comfortable living conditions for residents of the most remote rural areas. After all, forced internal migrants, who moved en masse to peaceful areas of Ukraine with the start of hostilities, often chose rural areas to live in due to financial difficulties.

The status of rural areas in Ukraine has changed significantly in recent years due to the decentralization reform. Successful decentralization practices have emerged, and rural communities have experienced the benefits of the reform. Successful decentralization processes determine the reformatting of regional identities, creating conditions for the emergence of new constructive models of collective identity. The reformatting of regional identities in the context of decentralization is extremely important for the inclusion in new communities not only of permanent residents of rural areas, but also of internal migrants who have found new homes.

However, one of the key problems in the implementation of decentralization reform is psychological resistance to changes in society, distrust of innovations, and certain sabotage on the part of both rural residents and a few officials.

Accordingly, there is a need to strengthen cooperation at the «government-community» level for the success of decentralization practices in rural areas.

This requires a significant update of the arsenal of marketing strategies for rural development for the effectiveness of decentralization reform in Ukraine, which determined the subject and direction of the study.

MATERIALS AND METHODS

The theoretical and methodological basis of the study are general scientific methods of cognition in relation to the problems of rural development, in particular, empirical, analytical, comparative and descriptive. In addition, research methods are based on the principles of systemic and structural-functional analysis.

The normative and legislative base of Ukraine became the methodological basis for the analysis of the new administrative-territorial structure of Ukraine, which was formed as a result of the decentralization reform.

Four regions of Ukraine (western oblasts; central and northern oblasts; eastern oblasts; southern oblasts) were identified and the distribution of territories according to the number of rural territorial communities, population, area and number of village councils amalgamated in the decentralization reform process was analyzed using data from the site «Decentralization provides opportunities» [6].

The concept of territory branding and brand identity theory are used as the best for identifying the competitive advantages of rural areas in order to form effective marketing strategies [1, 2, 11], as the brand of the territory significantly strengthens regional identity.

The authors of the study monitored the practices of decentralization in rural areas of Ukraine during 2020 using the content analysis method, synchronous-diachronic method, etc. The regulatory framework of Ukraine, the websites of public authorities on decentralization issues and key electronic media were monitored. An analysis of successful decentralization practices was performed in order to identify key problems

of rural areas in different regions of Ukraine, which require specific marketing strategies in each case.

The study analyzed works by V. Borshchevskyi, M. Dziamulych, D. Filiuk, L. Korobchuk, I. Kravtsiv, I. Kulish, Y. Mazur, V. Nevlad, I. Shubala, S. Tkach, I. Tomashuk, I. Urban, V. Yakubiv etc. to identify priority marketing strategies for rural areas [3, 7, 13, 18, 24].

The method of brand construction by Smith, et al (2001) as a basis for the formation of effective marketing strategies for rural development in Ukraine is considered [19].

The focus is on the issue of collective identity (J. Gray, P.G. Kilmansegg, M. Guibernau, etc.), as the reformatting of regional identities in the context of power decentralization is extremely important for inclusion of rural residents in new communities [9, 10, 12].

RESULTS AND DISCUSSIONS

The decentralization reform in Ukraine, which began in 2014, actually started in 2015, when the Law of Ukraine "On Voluntary Amalgamation of Territorial Communities» (Law of Ukraine, 2015) was adopted [16].

The vast majority of Ukraine's territory is agricultural land. The number of rural settlements in Ukraine is over 95%, while urban settlements are only about 5% (Table 1).

Table 1. Number of settlements in Ukraine as of 01.02.2021

	Number of settlements in Ukraine	
	number	%
Number of urban settlements	1,343	4.52
Number of rural settlements	28,372	95.48
The total number of settlements	29,715	100

Source: VRU, 2021 [25].

But these data are sharply at odds with the number of people living in cities and villages. As can be seen from Table 2, the urban population in Ukraine is about 70%, and the rural population – about 30%. Table 2 presents data on the population of Ukraine as of 01.01.2020.

These data do not take into account the number of people living in the temporarily occupied Ukrainian territory of the Autonomous Republic of Crimea [23].

As for the territory of Ukraine, the situation is radically opposite: rural areas are much larger than urban ones.

Table 2. The number of rural and urban population in Ukraine as of 01.01.2020

	The number of rural and urban population in Ukraine	
	persons	%
The number of urban population in Ukraine	29,139,346	69.54
The number of rural population in Ukraine	12,763,070	30.46
The total number of population	41,902,416	100

Source: SSSU, 2021 [23].

In Ukraine, the total land area is approximately 60.3 million hectares. The area of agricultural land is 42.7 million hectares, or 70% of the total area of the country [5]. In connection with the power decentralization reform, the administrative-territorial structure of Ukraine was reformatted. The integration of settlements into territorial communities was based on the criteria of capacity [4]. Capable territorial communities of villages (settlements, cities) are able to provide themselves with an appropriate level of service provision (educational, medical, financial, social, cultural, etc.) as a result of voluntary amalgamation.

As a result of the decentralization reform, 1,469 territorial communities were created in Ukraine. However, in fact, there are fewer territorial communities, as by order of the Government of Ukraine, 31 territorial communities have been established in the occupied and temporarily uncontrolled territory within Donetsk and Luhansk oblasts. Thus, today in Ukraine there are 1438 territorial communities, of which – 628 rural territorial communities (Table 3). The table is based on data from the site «Decentralization

provides opportunities» [6]. It should be noted that there are settlements in Ukraine where no territorial community has been created. This is the area affected by the 1986 Chernobyl disaster, including the towns of Pripyat and Chernobyl.

Table 3. Number of territorial communities in Ukraine as of February 2021

	Number of territorial communities	Population	Area, km^2
Rural territorial communities	628	4,942,758	1,734,89.0
Settlement territorial communities	429	6,012,228	202,437.0
Urban territorial communities	381	24,206,288	177,626.0

Source: Decentralization, 2021 [6].

As can be seen from Table 3, rural territorial communities in Ukraine are the largest, but there are the least population living in them. On the other hand, urban territorial communities are the smallest, but their population is almost five times larger. Moreover, the area of both rural and urban territorial communities is approximately the same.

It is interesting to analyze the distribution of the territories of Ukraine by the number of rural territorial communities depending on the region.

Table 4 identifies four regions, which include a number of regions of Ukraine: central and northern regions; western regions; eastern regions; southern regions. The table is based on data from the site «Decentralization provides opportunities» [6].

Table 4. Number of rural territorial communities in Ukraine by regions as of February 2021

Oblast	Number of rural territorial communities	Number of village councils amalgamated	Area, km^2	Population, persons
Central and northern regions of Ukraine				
Vinnytsia	24	182	7,124.0	238,355
Zhytomyr	33	219	9,578.0	222,519
Kyiv	23	128	5,658.0	230,694
Kirovograd	21	141	9,587.0	145,967
Poltava	24	118	6,742.0	160,834
Sumy	21	121	7,139.0	127,676
Khmelnytsky	25	155	5,873.0	171,393
Cherkasy	40	258	10,275.0	292,129
Chernihiv	17	122	6,221.0	96,631
Western regions of Ukraine				
Volyn	25	152	7,096.0	190,810
Transcarpathian	35	157	6,173.0	396,572
Ivano-Frankivsk	24	116	3,938.0	203,795
Lviv	18	119	3,251.0	220,036
Rivne	40	137	7,789.0	276,624
Ternopil	21	162	3,470.0	156,550
Chernivtsi	34	140	3,909.0	310,989
Eastern regions of Ukraine				
Dnipropetrovsk	41	149	13,736.0	282,363
Donetsk *	9	46	3,526.0	62,572
Zaporozhye	36	127	10,756.0	219,704
Luhansk *	5	27	2,309.0	30,843
Kharkiv	13	77	5,640.0	105,236
Southern regions of Ukraine				
Mykolayiv	29	141	10,757.0	191,931
Odessa	47	206	14,190.0	438,218
Kherson	23	94	8,752.0	170,317

* Part of the territories of Donetsk and Luhansk regions are occupied and not under the control of the Ukrainian state

Source: Decentralization, 2021 [6].

Traditionally, the eastern and southern regions of Ukraine have been more populated. If we analyze the percentage of the ratio of urban and rural population, the largest population lives in rural areas of western, central and northern regions of Ukraine. Although the south and east of Ukraine are famous for chernozem soils and agricultural lands, a significant part of the population lives in cities [22]. This is due to the fact that the strong industrial potential of the country is concentrated in the eastern regions of Ukraine. And in rural areas it is very difficult to find employment, especially for young people [7]. Therefore, this is one of the reasons for the predominance of urban population over rural one.

Changing the administrative-territorial structure of Ukraine in the context of the decentralization reform requires a revision of traditional approaches in the explication of marketing strategies for rural development.

Unfortunately, the issue of rural areas marketing in Ukraine is on the periphery of modern research [13]. However, the basis for the formation of marketing strategies are significant achievements existing in the discourse of commercial marketing and regional marketing. Accordingly, it is possible to outline the priority areas of marketing for rural areas. First of all, marketing strategies should be aimed at identifying the potential of rural areas within the state, in particular, the implementation of key ideas, goods and services. Also in the marketing of rural areas the direction of promoting ideas, goods, services is important as the rural area is able to generate them nationally and internationally. To this end, the first step should be to identify the competitive advantages of rural areas. Competitive advantages are identified on the basis of assessment of available resources (human, economic, natural, etc.) and the potential for their implementation.

The concept of territory branding, in our opinion, is the most optimal for identifying the competitive advantages of rural areas in order to form effective marketing strategies. Territory branding is one of the promising areas of modern research. This issue is widely covered in the context of marketing areas [18]. Successful brands can in some way contribute to the effective development of rural areas. With optimal branding of the territory, some regions can become additionally attractive for investments, development of various business projects, the formation of tourist infrastructure and more. In modern conditions, the brand is a long-term unique competitive advantage.

The brand of the territory, as noted by S. Anholt, is a reflection of the «essence of the place» [2]. The content of the brand can be covered by the concept of identity (brand identity), as one of the important functions of the brand is the identification of a particular product, service, event, phenomenon and so on. By brand identity, D. Aaker understands a certain idea, the perception of the brand that its developers seek to achieve. According to him, brand identity is a unique set of associations that simultaneously relate to the values of the brand and the promises made to its consumers [1]. It is the brand identity that guides the strategy of its development, highlighting its goals and purposes. Brand identity, according to J.-N. Kapferer, closely correlates with its uniqueness, establishing «the boundaries of its uniqueness and value» [11].

In order to form effective marketing strategies for rural areas in Ukraine, we turn to the analysis of successful decentralization practices. This analysis allows us to identify key problems of rural areas in different regions of Ukraine, which require specific marketing strategies in each case. The authors of the study monitored decentralization practices in rural areas of Ukraine during 2020. The regulatory framework of Ukraine, websites of public authorities on decentralization issues and key electronic media were monitored as well.

2020 was quite difficult for Ukraine (and for the world in general) given the pandemic. Due to quarantine measures, the number of successful decentralization practices (in particular, in the field of tourism, sports, culture) has significantly decreased. Although the field of tourism is one of the most promising for rural development [20].

At the same time, most of the successful decentralization practices in Ukraine in 2020 were recorded in rural areas: 40 out of 60 (see Table 5). The table is based on data from the site «Decentralization provides opportunities» [6].

Table 5. Number of successful decentralization practices in rural areas of Ukraine in 2020

Lines of decentralization practice	Number of successful decentralization practices			
	Western oblasts	Central and northern oblasts	Southern oblasts	Eastern oblasts
Activities of local governments	**2**	**2**	**2**	-
Business development	-	**1**	**2**	-
Education	-	-	**2**	-
Tourism, culture	**1**	-	-	**1**
Infrastructure development	-	**1**	**2**	**1**
Social services	**2**	-	-	**1**
Community safety	-	**2**	-	-
Information communications	**1**	-	**1**	-
Citizen participation	**6**	**1**	**6**	**1**
Medicine	-	**1**	-	**1**
Total, %	**30.0**	**20.0**	**37.5**	**12.5**

Source: Decentralization, 2021 [6].

As can be seen from Table 5, the highest percentage of successful decentralization practices is in rural areas of the southern and western regions of Ukraine. Rural areas in the eastern regions of Ukraine lag far behind in acquiring the benefits of decentralization reform. It is quite significant that there are no successful practices of decentralization under «Activities of local governments» in the eastern regions. Moreover, it is here in rural areas that there has been great resistance to the reform of decentralization of power by both the authorities and the residents in recent years. There are many reasons for such situations. First of all, it is distrust of decentralization reform and unwillingness to take responsibility for managing one's own funds in the community. Strictly speaking, it is a relic inherited from the command-and-control system of the Soviet Union, where man was considered the cog of a system that had no right to his own opinion, to his own initiative.

Negative trends in rural communities are also emerging in the cultural sphere today. There is a mass closure of libraries and various cultural centers (clubs) due to the financial inability of rural communities to maintain them. The same negative trends are observed in the field of education and medicine. Small schools and medical centers are mostly closed in rural areas. The reason is the same: the inability of rural local communities to finance them.

These negative trends offset the achievements of decentralization reform, as they lead to the extinction of rural areas. That is why parents with small children eventually move to the cities. Young people are also leaving rural areas due to lack of jobs. Of course, the authorities should develop effective strategies for rural development, financially supporting the educational, medical and cultural spheres. But the problem now is not only in the financial insolvency of local authorities. The problem is much deeper: it is, in particular, due to the indifference of rural residents and their non-inclusion in the lives of their own communities.

Residents of rural areas are mostly silent when small schools are closed, they do not know where to go when there is no public transport.

Residents of rural areas are also silent on the need to renew the election of the institution of elders (persons who perform management functions in villages). Thus, the Electoral Code of Ukraine provided that in each village people would be able to elect a mayor who will perform managerial functions. However, in July 2020, a few months before the local elections, deputies of the Verkhovna Rada of Ukraine made anti-democratic amendments to the Electoral Code – the village head is now not elected, but appointed [17]. This practice undermines the achievement of decentralization reform, as the authorities in rural areas are now significantly distant from the people.

These trends have a negative impact on the development of rural areas in Ukraine. Distrust of the government, inability to take

responsibility for their own lives lead to the collapse of democracy on the ground. But the basic condition for the prosperity of democracy is the availability of social capital, due to which there is cohesion between people, activity and initiative develop. The high level of social capital indicates the ability of individuals to quickly establish horizontal social ties when needed.

Social capital, according to F. Fukuyama, can be defined as «a set of informal values or norms that are shared by members of the group and that make possible cooperation within this group» [8].

At the same time, the mere adoption of common values or norms by a certain group of people does not contribute to the emergence of social capital, as values can be wrong (for example, values that unite criminal groups). Such destructive values will not promote public cooperation. Norms that can produce social capital should include values such as truthfulness, fulfilment of obligations, cooperation with others. Only on the basis of trust effective cooperation between people is possible.

The lack of trust between people indicates, first of all, a deep problem – the lack of a common strong collective identity in rural areas in Ukraine. Constructive models of collective identity can increase the self-esteem of the population of individual rural areas and promote the emergence of self-governing initiatives. It is in this direction that marketing strategies for rural development should be directed.

The initiators of marketing strategies formation for rural development should be local authorities [3]. Authorities are able to create a comfortable living environment for rural residents only if there is active cooperation between the government and the community. That is, in the line of «government-community» interaction, there should be two-way traffic: the government should explain the benefits of decentralization, and the community should nominate active and initiative people who are able to learn something new, able to take responsibility for others.

One of the functions of territory branding is to establish trusting links between rural residents and the authorities. After all, brands provide certain guarantees not only about the expectations of residents, but also about the predictability of the behavior of government officials.

The brand of rural areas is not formed by itself naturally. Most often it is a product of planned activities. The following provisions are becoming important in the formation of rural branding strategy. First, the main recipients of the rural brand should be clearly identified, i.e. the main target group of the brand's consumers. It is also necessary to identify those entities that are interested in shaping the branding of rural areas and those who are able to influence its development. Second, local authorities should initiate the creation of a rural brand. Third, the formation of a brand of a rural area should actively involve legal entities and individuals who belong to a particular rural area or live in it [24].

In the formation of marketing strategies in rural areas a combination of the following branding elements should be used:

- development of the idea of regional leadership in rural areas given the competitive advantages of the region;
- selection of a certain segment of rural leadership;
- formation of a leadership brand based on the selected segment of rural leadership;
- promotion and development of the leading brand of the rural area; formation of relations of the leading brand of the rural territory with the brands of other regions (in particular, cooperation).

In our opinion, the concept of Smith, Berry & Pulfoid (2001) [21] should be used to form effective marketing strategies for rural development in Ukraine (Table 6). This concept proposes a method of brand design, which should focus on four groups of branding components [21]: clarity, accuracy, balance, competitiveness.

Territorial branding often leads to an increase in the self-esteem of the population of a certain rural area, which, in turn, helps to reduce the conflict potential of local residents.

Also, pride in the place of residence can determine the self-organization of individuals at the local level, contributing to the emergence of various self-governing initiatives. In addition, the formation of the brand of the territory contributes to a significant strengthening of regional identity. After all, provided there is a strong regional identity, various contradictions (for example, religious or national) are able to recede into the background, removing the problematic issues of coexistence of different social groups within one rural area from the agenda.

Table 6. Methods of brand design

Branding components	Basic characteristics
Clarity	- brand values are easy to understand; - key features of the brand are easily recognizable and different from others; - brand values clearly reflect the benefits; - the platform for the brand and its personalization are unique and clearly expressed.
Accuracy	- branding messages are simple; - brand values are significant for specific residents; - brand values are presented in the form of a single clear personalization; - brand values provide a unique positioning compared to other brands.
Balance	- the brand emotional benefits are balanced with the rational ones; - applied communication strategies are coordinated with each other; - re-advertising and other types of communication are agreed at the time of their application; - brand perception is constantly increasing.
Competitiveness	- the brand is clearly positioned; - brand values are unique; - brand values are developed in such a way as to complicate its imitation; - brand design is legally protected.

Source: Smith, Berry & Pulfoid (2001) [21].

It is important to understand that just as successful branding strategies strengthen the collective identity of residents, so do strategies for building a strong collective identity of rural residents strengthen the brand of the territory.

Collective identity is formed by society, it is an acquired phenomenon, not a natural one. In the formation of collective identities, there are three most important parameters that together ensure the stability of collective identity: a) communication, b) experience, c) memory [12]. The parameters «experience» and «memory» are directly related to the branding of the territory, as they «root» the individual in the community of a particular rural area. After all, a common positive experience for residents can be the basis for the sustainability of collective identity in a particular rural area. Similarly, common understanding of memory patterns in a given rural area contributes to a stable collective identity.

The defining criteria of identity are «continuity in time and differentiation from others» [10]. That is, collective identity presupposes long-term positioning of the individual as a representative of a certain community, which shares his basic values, which differ from the values of other communities. Also the understanding of the concept of collective identity proposed by J. Gray is productive for our study. According to the theorist, collective identity is determined by attachments to history, nationality, culture, etc. [9]. Through a set of such connections, an individual identifies himself with a certain community.

In the formation of models of collective identity, according to M. Gibernau, an important role belongs to the dominant stereotypes, which involves the implementation of the process of stereotyping. Stereotyping refers to the selection or hyperbolization of the characteristics of a particular object or phenomenon [10]. That is, in the formation of collective identity those common features of a particular rural community which have a positive potential should be highlighted by implementing them actively.

In general, marketing strategies for rural development should be applied at the level of developing constructive stereotypes. Stereotypes are variable elements, visible markers of collective identity, from which the most relevant for a certain rural area symbols, events, ideas are chosen. Stereotypes are the basis of image, as image formation is often reduced to creating a certain stereotype. It should be noted that the concept of brand is different from the concept of image. If the

concept of the brand is correlated with a certain ideal content, then the concept of image means the perception and evaluation of the brand by recipients. Image characteristics act as peripheral features of the brand, giving it a certain integrity in perception. Image characteristics can change, contributing to a more favorable positioning of the brand in certain conditions. Instead, a radical change in the brand itself (its identity) can lead to the destruction and disappearance of the brand.

It is quite easy to formulate marketing strategies for rural development for already formed communities with a stable constructive collective identity. Most often, communities with a stable collective identity are formed in those rural areas that are famous for either well-known historical events, or unique natural landscapes, or the production of specific goods, and so on. People, feeling involved in certain events or territories, are proud of this involvement and, thus, strengthen the collective identity of the community. In the structure of stable collective identities, one can distinguish the nucleus (a set of powerful unique archetypes) and the periphery (variable stereotypes). It is through the core that stable collective identities receive constant nourishment. That is, in the marketing strategies of a rural area with an established brand, it is enough to focus only on the unique characteristics of the territory (characteristics of the core identity).

It is much more difficult for communities with unstable collective identities to develop marketing strategies. In the structure of unstable collective identities there is no core (unique archetypes), they are not rooted, there is only the periphery of identity (stereotypes, i.e. image characteristics). The formation of marketing strategies in rural areas where communities with unstable collective identities live should start with the image of the territory. That is, first a number of constructive stereotypes for residents should be introduced – markers that are associated with a certain rural area and evoke positive associations. Forming the image of a rural area is only the beginning of the path in creating a brand of the territory.

Thus, in order to position individual rural area own identity, it is necessary to first conduct active work on creating a positive image, which will further contribute to the formation of their brands. The next step should be to "fill" the new content of brands in certain areas, i.e. the formation of brand identity in rural areas. In general, successful branding of territories can act as a determinant of effective economic development of rural areas.

The brand of a certain rural area is associated with a set of values that reflect its uniqueness and unique original characteristics of the region or community, especially if these characteristics have already received public recognition.

In fact, the value of a brand lies not only in its recognition, but also in the positive associations tied with it. That is, one should get rid of the destructive stereotypes associated with rural areas as depressive. Destructive stereotypes need to be replaced by constructive and more productive stereotypes. In branding formation of different rural areas of Ukraine regional characteristics should be taken into account. The implementation of territory branding involves the intensification of educational strategies aimed at positive positioning of the rural area own socio-cultural, historical, economic identity for self-affirmation in the national and global space.

CONCLUSIONS

Changing the administrative-territorial structure of Ukraine in the context of the decentralization reform requires a revision of traditional approaches in the explication of marketing strategies for rural development.

The power decentralization reform in Ukraine was actually started in the country at war. The southern part of Ukraine, the Crimea, is illegally annexed by the neighbouring state of Russia. In 2014, an armed conflict broke out in the eastern territories of Ukraine and hostilities continue to this day. One of the priorities of the power decentralization reform in Ukraine was the formation of effective local self-government on the ground, the creation of comfortable living conditions for residents of the most remote rural areas. After

all, forced internal migrants, who moved en masse to peaceful areas of Ukraine with the start of hostilities, often chose rural areas to live in due to financial difficulties.

In the formation of marketing strategies for the development of rural areas, the concept of branding of territories is important, as the brand of the territory contributes to a significant strengthening of regional identity. Marketing strategies for rural development in the context of decentralization reform in Ukraine can be effective if they are primarily aimed at forming constructive regional collective identities for inclusion of rural residents in new communities. It is argued that the lack of a common strong collective identity in rural areas in Ukraine is one of the reasons for leveling the achievements of the decentralization reform.

Authorities are able to create a comfortable living environment for rural residents only if there is active cooperation between the government and the community. That is, in the line of "government-community" interaction, there should be two-way traffic: the government should explain the benefits of decentralization, and the community should nominate active and initiative people who are able to learn something new, able to take responsibility for others.

It is stated that territorial branding often leads to an increase in self-esteem of the population of a certain rural area, which contributes to reducing the conflict potential of local residents. Under the condition of effective branding of rural areas, some areas may become additionally attractive for investments, development of various business projects, the formation of tourist infrastructure and more. Also, pride in the place of residence can determine the self-organization of individuals at the local level, contributing to the emergence of various self-governing initiatives. In addition, the formation of the brand of the territory contributes to a significant strengthening of regional identity. After all, provided there is a strong regional identity, various contradictions (for example, religious or national) are able to recede into the background, removing the problematic issues of coexistence of different social groups within one rural area from the agenda.

The brand of rural areas is a product of planned activities. The initiators of the formation of marketing strategies for rural development should be local authorities. Legal and physical entities belonging to a certain rural area should be actively involved in the formation of marketing strategies. Successful branding of territories is able to act as a determinant of effective economic development of rural areas.

It is stated that just as successful strategies of branding the territory strengthen the collective identity of the residents, so the strategies of forming a strong collective identity of the inhabitants of rural areas strengthen the brand of the territory.

In general, marketing strategies for rural development should be applied at the level of developing constructive stereotypes - variable elements, visible markers, from which the most relevant for a particular rural area symbols, events, ideas, etc. are selected. Stereotypes are the basis of image. Forming the image of a rural area is only the beginning of the path in creating a brand of the territory. Image characteristics act as peripheral features of the brand, giving it a certain integrity in perception. Image characteristics can change, contributing to a more favorable positioning of the brand of the territory in certain conditions. Instead, a radical change in the brand itself (its identity) can lead to the destruction and disappearance of the brand.

In branding formation of different rural areas of Ukraine, it is necessary to take into account regional features. The branding implementation involves the educational strategies intensification aimed at positive positioning of the rural area own socio-cultural, historical, economic identity for self-affirmation in the national and global space.

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STUDY REGARDING THE BEHAVIOR OF RURAL MOUNTAIN TOURIST IN THE ROMANIAN CARPATHIANS

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Abstract

United Nation World Tourism Organization (UNWTO) defines the tourist as being an overnight stay visitor or a same-day visitor who makes inbound, outbound or domestic tourism. It also defines tourism as being a phenomenon, an economic, social and cultural phenomenon that involves the movement of people to places or countries, somewhere outside their usual environment, the main reason being represented by businesses or personal purposes. Studying the tourist behavior is a fascinating journey around world human behavior. With this study, we wanted to determine whether the personality factors predict or not the tourists behavior. We were able to confirm this theory by classifying almost two hundred people in eight big types of tourists.

Key words**:** *United Nation World Tourism Organization, inbound, outbound, domestic tourism, tourists behavior*

INTRODUCTION

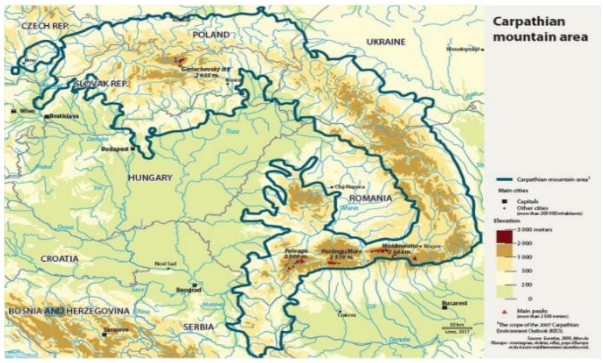
United Nation World Tourism Organization (UNWTO) says that “a visitor (domestic, inbound or outbound) is classified as a tourist (or overnight visitor), if his/her trip includes an overnight stay, or as a same-day visitor (or excursionist)” [11]. It also defines the concept of tourism saying that “tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes” [11]. The tourism demand has seen a solid growth in the last decades due to the economic, social, political and technological changes [10].

Romania has a great variety of cultural historical values. Ethnography, folklore, folk art, historical vestiges and traditions, all of them build a harmonious natural setting combined with a varied and picturesque landscape background. All these things lead us to the concept of the rural tourism. The most common interpretation of this type of tourism, belongs to J.W. Kloeze who stated that rural tourism is a concept that includes all tourism activities which are developed in a rural environment [5]. Vlasenko O.V. affirmed in one of his papers that the rural tourism includes "a complex of agri-tourist services, such as observation and care of pets and plants, riding a horse, organic farm food using agricultural products locally achieved and crafts, acquisition of souvenirs, etc” [12]. Gvarliani T. E. and Borodin A.N. mentioned that rural tourism represents a “group of functional types of tourist activity which can be carried out in the rural areas and includes the activity of the persons who are outside their usual environment, who travel and stay in this area for a holiday and for other purposes” [3].

Appeared and developed on the most varied forms of relief, the Romanian rural settlements have preserved and still preserve, to a large extent, the ancient traditions and customs, the local folklore and ethnographic elements and crafts which can be utilized in touristic products and promoted through a viable strategy of organization and development of rural tourism. Rural tourism includes a wide range of accommodation, events, festivities, sports, other entertainment and leisure activities, all in a typical rural setting.

The Carpathian Mountains (Map 1), belongs to the central mountain system in Europe. The

Carpathians stretch between the Vienna Basin (that separates them from the Alpian chain) and the Timok corridor (that separates them from the Stara Planina, in the Balkan Peninsula) and form an arch with a maximum width of 130 kilometres and length of 1,500 kilometres [13]. This mountain region it is considered to be one of the most significant and richest area in Europe. The Carpathians represents the "home" for almost 30% of the European flora and as well to the Europe's substantial populations of wolves, lynx, and brown bears and for rare bird species. Distinct from the natural diversity that can be seen here, the semi-natural habitats such as meadows and mountain pastures are a great cultural and ecological importance. World Wild Life (WWF) includes in the Carpathian area in the "Global 2020" list all the worldwide eco-regions, for exceptional levels of biodiversity.



Map 1. Carpathian Mountains in Europe
Source: [1].

In Romania, the Carpathian Mountains (Map 2) stretch for more than 900 kilometres, in the shape of an arch that isolates Transylvania with its beauties from the rest of the country. In Romania, the Carpathian chain is split into three big and important groups: Eastern Carpathians, Southern Carpathians and Western Carpathians. Each of these groups has distinct landscapes, being developed on different types of rocks such as karstic, glacial, structural and volcanic.

The rural space in Romania is being called "Carpathian-Danubian-Pontic", because the country has the Carpathians as a component of the relief forms, the Danube river as a hydrographic network, and the opening to the Black Sea, implicitly to the Planetary Ocean, which makes it Pontic.

Map 2. Carpathians Mountain Area in Romania
Source: [6].

The Carpathian chain provides important ecosystem services and goods such as forest products, fresh water, food, etc. which can be capitalized in rural tourism. Actually, the rural tourism in the Carpathians includes in its offer the mountain unbelievable landscapes, the unpolluted environments and picturesque ambiances.

One of the most important services – rural tourism includes "all forms of tourism in the rural area. It includes, at the same time, outdoor tourists activities but also activities that allows tourists to discover the nature, the cultural environment and also the gastronomy"[2]. If we compare with other forms of tourism, the rural tourism stands out for its variety and originality, being based also on the potential of the rural space, on the specific products to the place and on the people. This form of tourism is the result of the modern tourist behaviour, who likes to travel and visit original places that will make him discover all the beauty of the nature, avoiding in the same time all the crowds that are being formed on the dedicated tourism regions.

MATERIALS AND METHODS

The main purpose of our research was to understand if the personality factors predict in a way or another the tourist's behaviour. For this we used as methodology the step by step approach.

Step 1 – we started to make different comparisons using the dynamics (2014 and 2019) to see which was the flow of tourists. To determine the dynamics, it was used the formula: Dynamics = Total Number of Tourists Arrivals in 2014/Total Number of Tourists Arrivals in 2019 x 100.

Step 2 – we applied a questionnaire to a group of almost 212 participants, to identify their accommodation preferences, their accommodation reservation form preferences, and also the preferred timeframe for their travel.

Step 3 – with SPSS data analysis software we were able to generate different information that helped us to understand some behaviours, based on some performed actions.

RESULTS AND DISCUSSIONS

To understand the behaviour of the tourists who choose mountain tourism, it was analyzed the dynamic of the tourists' number fin the Romanian Carpathians between 2014 and 2019 (Fig. 1). This analysis makes us understand that our tourists' preference is rural mountain tourism.

An upward trend can be seen for the rural mountain tourism. A form of tourism which could be chosen by the ones who try to run away from the big crowded cities, from all the closed spaces which could be found there and from all the artificial food that city life offers sometimes – almost always.

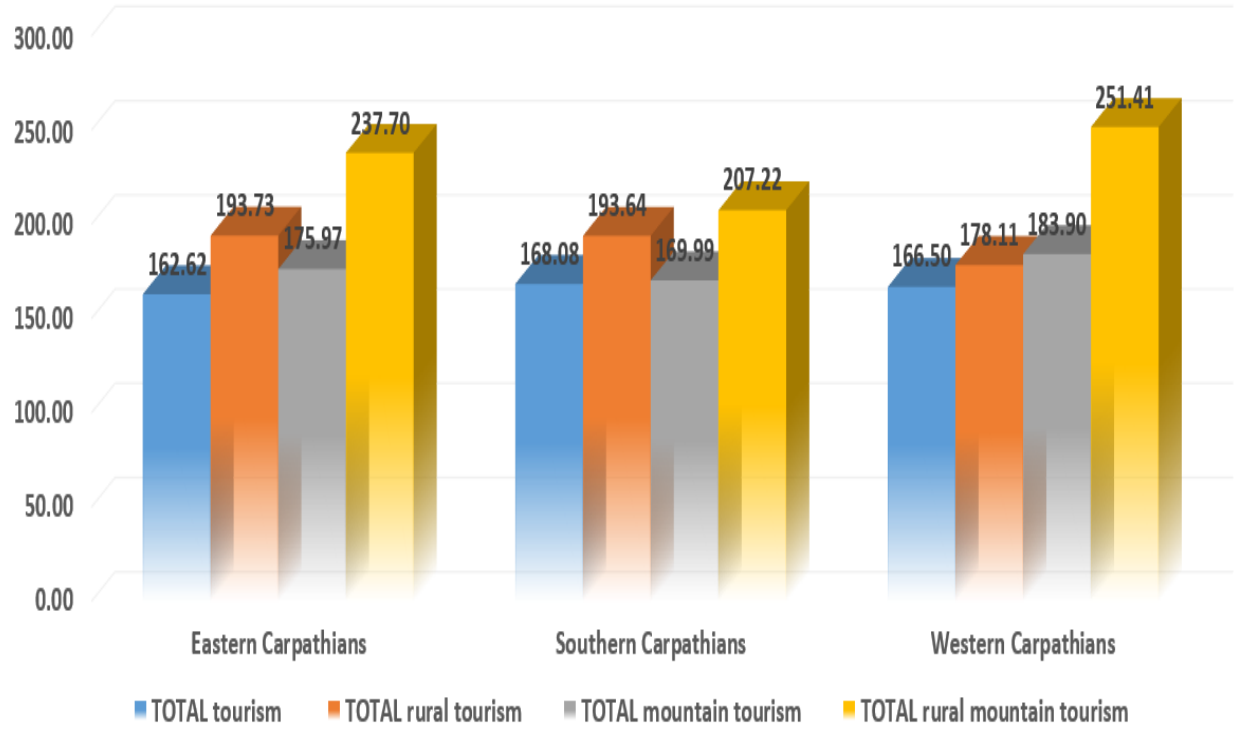


Fig. 1. The dynamic of the accommodation structures number between 2014-2019 in the Romanian Carpathians
Source: Own calculation.

An increase of 137.70% can be seen in the Eastern Carpathians. This part is being well known for all its natural passes-by that made possible the mobility on both sides of the Carpathians since the ancient times. Another increase of 107.22% can be seen in the Southern Carpathians, also called Romanian Alps, where the highest peaks in Romania can be found. The highest increase can be seen in the Western Carpathians, where it reaches out of 151.41%. CNN included the Western Carpathians within the list of the 17 tourist destinations which defines Europe. We could see here different types of tourists, and if we could classify them based on the hierarchy that Robert Lanquar did 25 years ago [7], we could say that the tourists are from the nomad-tourists category. The nomad tourists

seek direct contact with nature and local population, with motivations such as daily escape and adventure, religious and artistic or artisanal travel.

Another important thing which could define the tourists behaviour could be the form of accommodation they choose (Table 1).

Table 1. Preferred accommodation structures by tourists

Preferred Accommodation Structures	No. of Tourists	Percentage
Hotel/Motel	86	40.6
Pensions, Cottages, Villas	110	51.9
Camping	16	7.5
Total	212	100

Source: Own calculation.

It was noticed that many people choose to stay at pensions, cottages and villas, and they also like camping. Plog identified in 1974 two psychological dimensions which differentiate the tourists into psychocentric and allocentric tourists. While psychocentric tourists have concerns that regard their own person, being afraid of the outside world, considering that they cannot control it, allocentric tourists are curious and very concerned of the outside world, independent and looking for new experiences and destinations [9]. This being said, it was noticed that the 40.6% of the tourists who choose hotels or motels, and the 51.9% of the tourists who choose different types of rural accommodations are psyhocentric tourists. They look for standardized tourist products, scheduled and organized trips, preferring accommodations that offer them conditions similar to their home. They like to book their reservation in advance to be sure that everything is planned, and that availability is found. They like common activities accepted by the majority. From the total number of the campers, 7.5% of the tourists could be considered allocentric tourists. The ones who are adventurous preferring to explore to attain their own goals and destinations which are not reachable on the map, people in search of new experiences in new destinations are able to accept also modest conditions.

Nickerson and Ellis, in 1999, combined these two dimensions psyhocentric – allocentric with individual psychological features introverted and extroverted [8]. The analysis presented in Table 2 allows us to understand how many of the total number of tourists can be considered introverted and how many extroverted in this study.

Table 2. Accommodation Reservation Forms used by tourists

Accommodation Reservation Form	No. of Tourists	Percentage
I usually decide when I reach the destination	26	12.3
I prefer camping	11	5.2
Phone reservation	31	14.6
Online reservation	84	39.6
Travel agency reservation	15	28.3
Total	167	100

Source: Own calculation.

Silent, reserved, attentive, relying mainly on their own knowledge, never in a hurry and studious, we may classify our tourists who choose to make their reservations by phone, 14.6%, or online, 39.6%, as being introverted tourists. Great amateurs for fun, not being concerned about their safety, spontaneous, loving to try new experiences, to meet other people, being able to easily create connections, 12.3% of our tourists decide their accommodation while they reach the destination: 5.2% prefer to camp and 28.3% choose to be helped by a travel agency. They could be considered as being “our introverts” tourists.

In 2001, by combing again these two dimensions, psyhocentric – allocentric and extrovert – introvert, Mervyn Jackson, Gerard White and Marie Gronn White identified four types of interdependent personalities (Fig. 2): the explorer, the adventurer, the guided and the groupic.

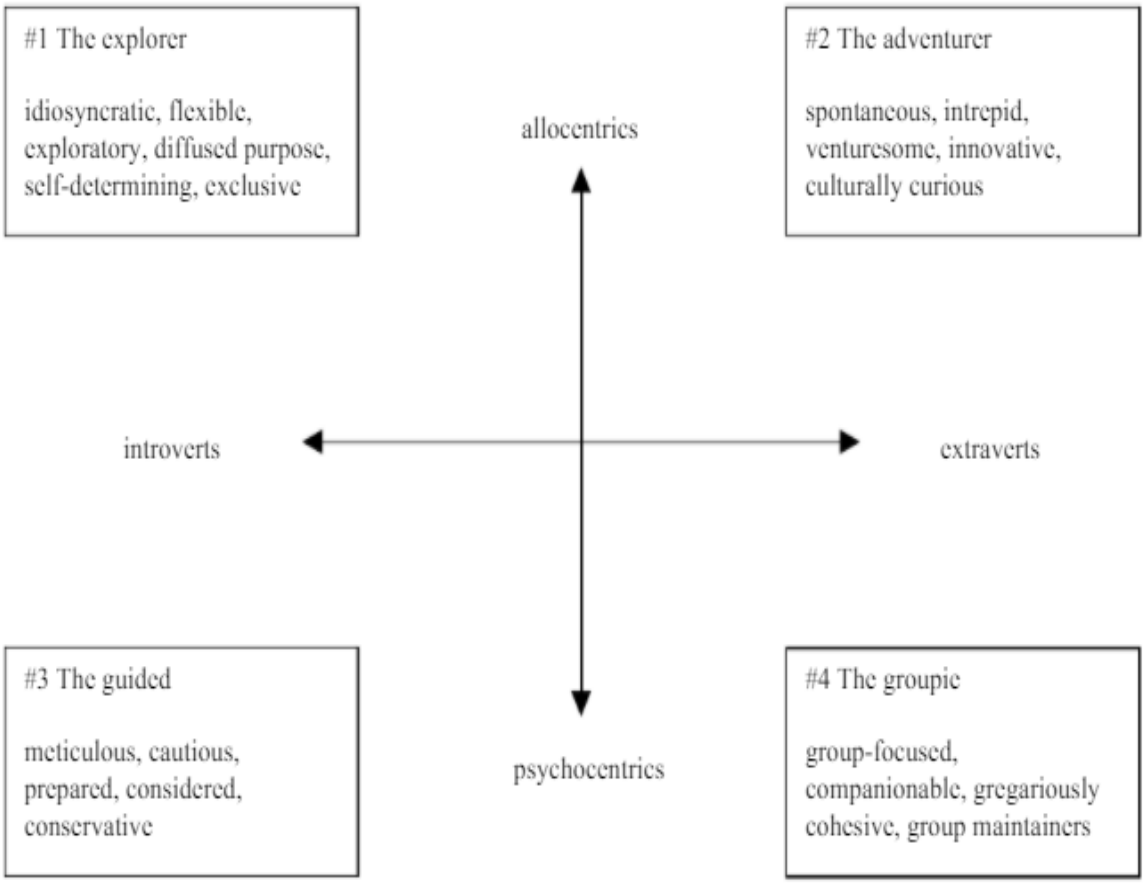


Fig. 2. Name and proposed personality indicators for four interdependent personality type
Source: [4].

We can also classify our tourists based on these criteria if we look at the analysis presented in Table 3, where it is shown the tourists' preferred period for travelling.

Table 3. Preferred Period for travelling

Preferred Period to Travel	No. of Tourists	Percentage
Each time I feel the need to escape my busy life	96	45.3
Usually for holidays	21	9.9
Usually on summertime	80	37.7
Usually on wintertime	15	7.1
Total	212	100

Source: Own calculation.

About 45.3% of the tourists are being part of the adventurer type. Spontaneous, enterprising, innovative, curious, they travel each time to escape of their busy life, with friends maybe, but they are not bothered to meet new people on the road and even if the travel was not planned. They simply need an escape.

About 37.7% of the tourists belongs to the explorer type. They usually travel on the mountain side in the summertime, when most of the people are in search of beaches. Idiosyncratic, flexible, they organize themselves their trip, they cannot be controlled, they avoid crowds, establish their own schedule, chose known hosts, and keep discretion over the destinations.

About 7.1% of the tourists who travel usually in wintertime is considered as being a part of the guided type tourists. Meticulous, cautious, prepared, conservative, they often chose their usual favourite places, destinations, wanting to forget the current problems of the daily life, searching for new relationships.

CONCLUSIONS

Based on this analysis, there were identified several types of tourists. It is easy to afform now that tourists' travel is closely related to

their behavior. Allocentrics, psychocentrics, extroverts, introverts, explorers, adventurers, guided or groupies, there is place for everyone in the Romanian Carpathians. Tourists behavior implies all the internal and external factors concerned with what the tourists want, need, their ideas, their experiences, their activities. During the travel planning process, tourists make different decisions such as booking the travel, looking for the different places that they want to see, searching for places where to eat and drink, to socialize and so on. All these decisions define tourists' behaviors. The attitude has a direct impact on the chosen experience on environment, people and destination.

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STUDY REGARDING THE EVOLUTION OF MOUNTAIN TOURISM AND RURAL MOUNTAIN TOURISM IN THE ROMANIAN CARPATHIANS DURING COVID-19 PANDEMIC

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Abstract

The study aimed to analyze the evolution of mountain tourism and rural mountain tourism in Romanian Carpathians during Covid19-Pandemic, to understand the level of damage that was done by this crisis in Romania in the tourism sector. For this we analyzed the comparison of the dynamic of tourists number between 2014-2019 and 2019-2020, and also the dynamic of the accommodation structures. All these researches were done by analyzing and generating reports provided by National Institute of Statistics (NIS). We discovered that even in pandemic times, investors still invested in accommodation structures, and that now more and more tourists choose rural mountain tourism because due to Covid-19 Pandemic they prefer to rent private villas, mountain huts, apartments or holiday homes, trying to maintain the social distance from others, and where they have the possibility to use their own facilities.

Key words**:** *Covid-19, rural mountain tourism, pandemic, Romanian Carpathians Mountains.*

INTRODUCTION

When the entire world celebrated the dawn of the New Year, on the 01st of January, few could have imagined what 2020 prepared for the humanity. 2020 has been defined by the coronavirus pandemic, the worst pandemic that the world ever saw within the last 100 years. Within the last 12 months coronavirus – Covid19 – paralyzed economies, confined people around the world to their homes, devastated entire communities. It has been a year that changed the world not for a single generation but for entire generations. More than 2,86 million people died, more than 133 million contracted the virus. More than 107 million healed [10].

Grandparents were lost, partners bereaved as their loved ones died alone in hospitals, because visits were considered too dangerous. Children became orphans. Contracting coronavirus is very simple: you only have to breathe in the wrong place at the wrong time.

"I went to the gate of hell and came back, I saw with my own eyes that others failed to recover and died, which has had a big impact on me", said Wan Chunhui, a 44-year-old Chinese survivor who spent 17 days in hospital [3].

On the 31st of December 2019, when the Chinese authorities announced 27 cases of "viral pneumonia of unknown origin", the scale of the global disaster was scarcely imaginable. On the 31st of December 2019, when the Chinese authorities announced 27 cases of "viral pneumonia of unknown origin", the scale of the global disaster was scarcely imaginable.

The next day, the Chinese authorities quietly shut down the animal marked from Wuhan that was initially linked to the outbreak (Fig1).

Fig.1 China and Wuhan
Source: [11].

On January 07th, the Chinese officials announced that they identified the new virus, and they called it 2019-nCoV. On January 11th, China announced the first death in China [2]. Within days, 2019-nCoV flared across Asia, Europe and United States. On the 11th of February, the World Health Organization called the new disease Covid-19 [9]. Only four days later, on the 15th of February, the first death outside Asia has been reported by France [1]. Terrified, Europe watched how northern Italy turned into an epicentre of Covid-19 disease. First Italy, shortly after that Spain, France and Great Britain went into lockdown. United States borders, already closed for China, closed for Europe as well. By mid-April almost the entire humanity were living under some form of lockdown. Around the entire world the streets fell early silent. The only sound that could have been heard were the ambulance sirens, a reminder that we are all vulnerable, and that the danger is so close.

26th of February 2020. 26th of February is date when Romania announced its first case of coronavirus. While the first patient of Covid-19 has healed, the number of cases grown from one week to another. If one month later Romania had almost 1,000 cases of Covid-19, two months later 1,000 turned into 10,000 cases. The chaos begun. Businesses were closed, schools and colleges shut, everything that meant live sport cancelled. Inessential shops, clubs, bars and restaurants were closed as well. Those who had the possibility, worked from home. Conference calls, video meetings replaced travels, parties, gatherings. Those who couldn't transfer their jobs into the virtual world were often fired or forced to risk their health and go to work regardless. Because of that, businesses closed or went in bankruptcy. Commercial airlines travel and tourism industry saw their most violent contraction in our history, being some of the areas severely affected globally by the Covid-19 pandemic.

World Travel & Tourism Council (WTCC), who represents the travel and tourism sector globally, shows with one of their studies that "various events that take place in the world negatively influence the tourism market, due to the consequences they have on collective memory. If the return to the initial values takes place after thirteen months in case of terrorist attacks, in case of an epidemic the decrease of tourist circulation is maintained for a period of twenty-one months" [6].

Among various forms of tourism, mountain and rural tourism have been and looked to be over the time of high attraction during holidays, due to their specificity regarding the position in regions where nature shows its splendours, life is more relaxed, peaceful, quiet, the urban citizens could bring their families for enjoying how rural life and traditions are running and tasting local gastronomy [7].

Despite that these destinations could be found in more isolated places sometimes, during the pandemic of covid-19, these forms of tourism have been also affected [8].

In this context, the main purpose of our research is to be able to see the damage done by the Covid-19 pandemic in Romania, especially within the mountain tourism and rural mountain tourism in the Romanian Carpathians.

MATERIALS AND METHODS

The methodology used is this research has a step by step approach:

Step 1 – There were identified the cities and the rural regions situated in the mountain area within the Romanian Carpathians. To do this selection, there were used the information from the "Mountain Law" from 20th of July 2020. Once this selection was achieved, reports with regards to the tourist arrivals were generated from National Institute of Statistics (NIS). In this way, it was established how many tourists travelled to the Carpathians Mountains within the 2020's. Also, the number of accommodation structures that "survived" during the Covid-19 pandemic, and the number of the ones that closed their doors forever in 2020 was also of high interest in this study to understand the situation.

Step 2 – The statistical data collected before were used for making different comparisons. First, it was analysed the dynamics for 2014-

2019 to identify the accommodation structures available in the Romanian Carpathians within the pre-pandemic era. To determine the dynamics the following formula was used:
Dynamics = Total Number of Accommodation Structures in 2019/Total Number of Accommodation Structures in 2014 x 100.
This formula allowed to compare the number of accommodation structure operating before Covid-19 Pandemic and after.

Step 3 – To have a better overview on the pandemic year, and to be able to determine whether important fluctuations took place, it was also analysed the dynamics of the accommodation structures for 2019-2020. The formula applied was the same:
Dynamics = Total Number of Accommodation units in 2020/Total Number of Accommodation units in 2019 x 100.

Step 4 – To understand the flow of the tourists arrivals within the rural mountain regions, it was also studied the dynamics of this indicator. For this we chose the timeframe 2014-2019 and we used the formula given below:
Dynamics = Total Number of Tourists Arrivals in the timeframe 2019/Total Number of Tourists Arrivals in 20114x 100.

Step 5 – To have a better understanding over the pandemic year, to see whether the tourists still travelled or whether they stopped doing this (at least for a while), we checked also the dynamics for 2019 and 2020.
For this purpose, the same formula was used:

Dynamics = Total Number of Tourists Arrivals in the timeframe 2020/Total Number of Tourists Arrivals in 2019 x 100.

RESULTS AND DISCUSSIONS

To have an overview over the tourism industry in Romanian Carpathians during the Covid-19 Pandemic, first, it was analysed the dynamics for the number of accommodation units between the timeframe 2014-2019 (Fig. 2), the pre-pandemic era, when tourism had no restrictions, when life had no restrictions.

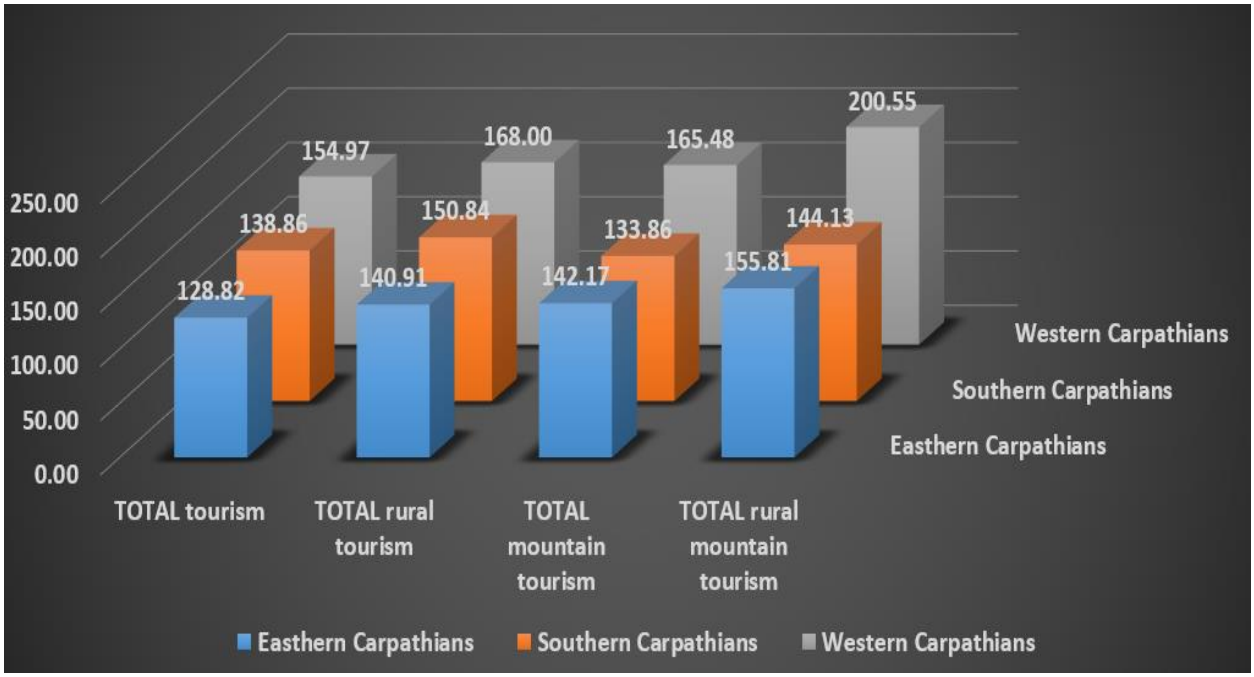

Fig. 2. Growth rate of accommodation units in 2019 versus 2014 for Romania's tourism mountain and rural tourism by the Romanian Carpathians zones (%)
Source: Own calculation.

To see the impact that Covid-19 Pandemic on the rural mountain tourism, it was analysed the dynamics of the number of accommodation units in 2014-2019 to see

how the things went in the pre-Pandemic era. The analysis showed a slightly upward trend between 2014-2019, especially in the Western Carpathians, where the rural mountain tourism had an increase of 100.55% in the year of 2019. We could say that the number of accommodation units has doubled in 2019. They are being followed by the Eastern Carpathians with an increase of the accommodation capacity of 55.81%, and by Southern Carpathians with an increase of its dynamic of 44.13%. Therefore, the accommodation structures sector was in full development in the pre-Pandemic era. Some of the reasons that led to all these investments that almost doubled the number of constructions for the accommodation structures, could be the need for peace and space that can be found only in the rural space. The need for nature and all its beauty.

Investments in constructions of accommodation structures were done in 2020 as well. Even though the Covid-19 hit the whole world in all its industries.

We could assume that this happened because when there is a crisis, people with high risk appetite, who have the opportunity to invest are usually doing this in the most affected areas because there are lower prices, more flexible conditions and profitability in the future, when the crisis will decrease. All these benefits during this time will disappear as the industry recovers. May be these were the main reasons who led to the new constructions that were made in 2020.

Also, the international travel restrictions made the investors to think that the demand of quality accommodation structures will increase. That the definition of a "vacation" of an "escape" of "travel" will be changed. It will be a new one now. Since some of the most important recommendations in the Covid-19 Pandemic is to keep your distance from other people, to avoid all kinds of congestions, to avoid spending time with unknown people, the tourists will search for rural mountain tourism that will offer them the possibility to rent the entire structure, where they will be able to cook for themselves, to disinfect and sanitize everything on their way and each time they feel the need. The rural mountain tourism will offer them the autonomy that they need in this pandemic time. With numbers like 11.4% in the Eastern Carpathians, 10.08% in Western Carpathians and 8.99% in Southern Carpathians, there were noticed slight increases in the investments done in 2020 (Fig.3).

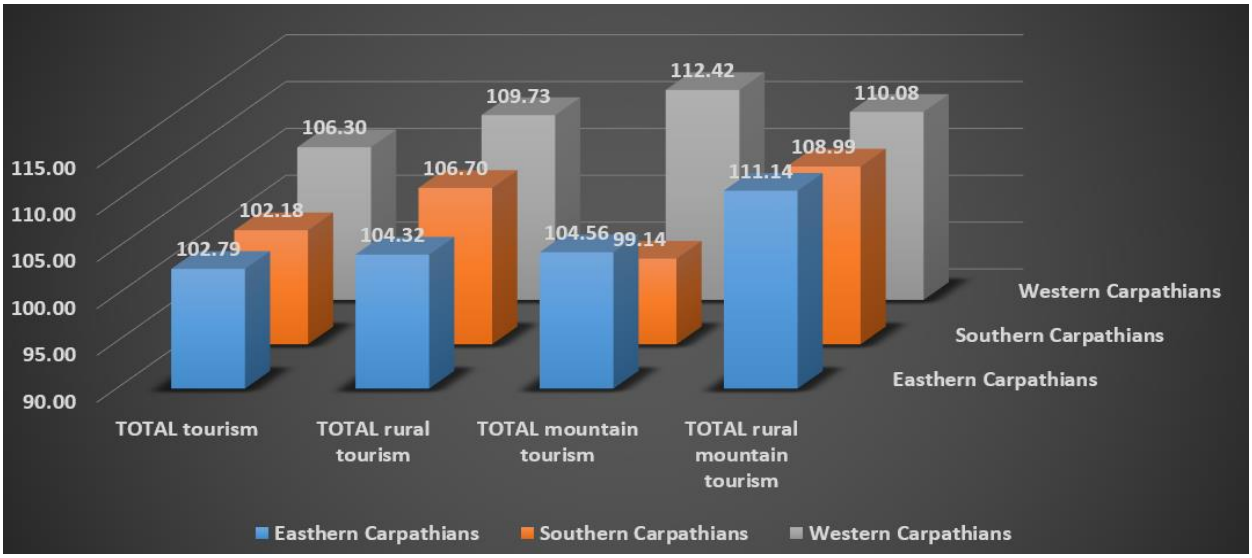

Fig. 3. Growth rate of accommodation units in 2020 versus 2019 for Romania's tourism mountain and rural tourism by the Romanian Carpathians zones (%)
Source: Own calculation.

Rural tourism could represent a good deal for those who, "tired of the pace stressful life of the city and eager to make a change, may be interested in the idea of moving to the country along with his family to work the land and provide hospitality to tourists" [5]. Mostly now, when everything in the world changed and Covid-19 is part of our life.

After we checked the accommodation structures level, and we decided that this wasn't affected by the pandemic, we wanted to see also the number of tourists. For this, we checked the dynamic of the tourists number in pre-Pandemic era (2014-2019) and in the Pandemic times (2019-2020). The analysis presented showed us that the pre-pandemic era made our tourists to travel quite enough. It was identified an upward trend especially for the rural mountain tourism. The highest increase can be seen in the Western Carpathians, 151.41%. Not very far, on the second place in the tourists preferences, there are the Eastern Carpathians with an increase of 137.70%, and then the Southern Carpathians with 107.22% (Fig.4). In this way, it is easy to understand that the behaviour of our tourists, before Covid-19 Pandemic was slightly the same. Wanting to explore nature, to enjoy all the unique sensations that the rural tourism offers them, always in search of uncrowded places, of the flow of our tourists was huge.

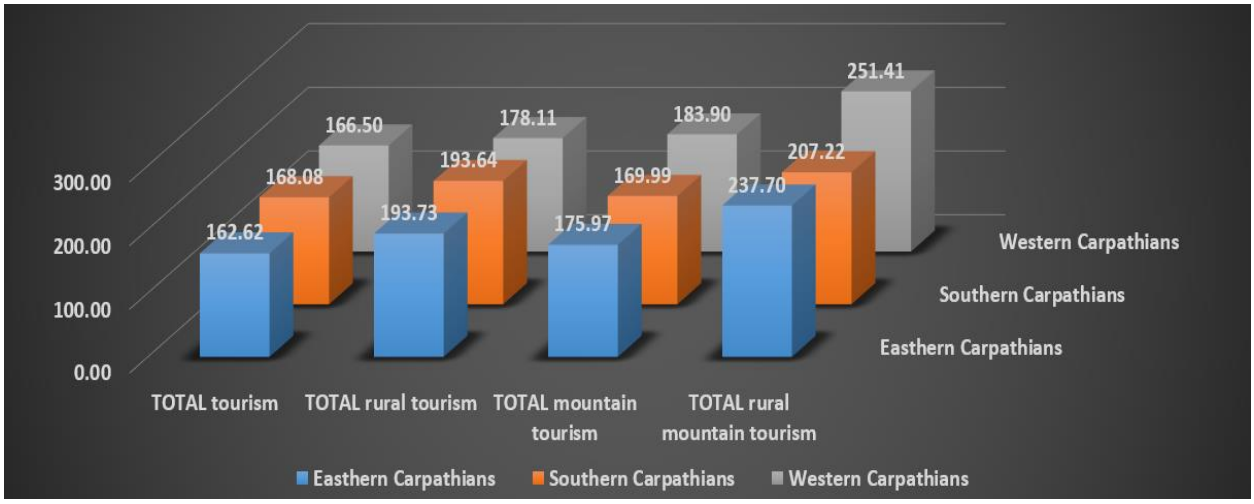

Fig. 4. Growth rate of the number of tourist arrivals in 2019 versus 2014 for Romania's tourism mountain and rural tourism by the Romanian Carpathians zones (%)
Source: Own calculation.

Once the conclusion is clear, that is more and more tourists were in search of rural mountain tourism, a reason to have a look at the 2020 year as well. From this point of view, it was noticed that the Western Carpathians kept its first place in tourists preferences. Western Carpathians represents the only group of mountains from Romanian Carpathians that had an increase in 2020 (Fig.5).

The increase was only 10.08%, but it was an increase. Eastern and Southern Carpathians had severe decreases that could have led to high losses for the economy. With a decrease of 37.97% for the Southern Carpathians and 45.82% for Eastern Carpathians, it is obvious the fear that Covid-19 brought to our tourists.

Why for only these 2 groups of mountains? It is assumed that this is because the Eastern and Southern Carpathians are very accessible to tourists from all over the country. Grace to their geographical position it is very easy for almost everyone from all over the country to reach them out.

Tourists, wanting to avoid congestions of all types, chose to avoid them in 2020, and reach out some other "virgin" places, unknown by everyone. In this particular case, Western Carpathians.

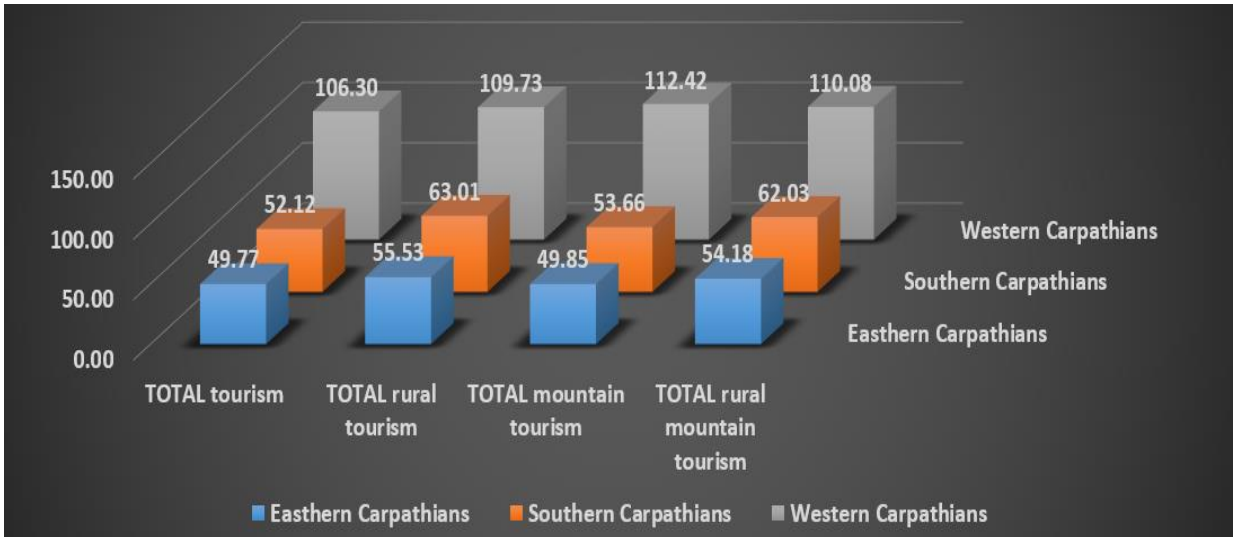

Fig. 5. Growth rate of the number of tourist arrivals in 2020 versus 2019 for Romania's tourism mountain and rural tourism by the Romanian Carpathians zones (%)
Source: Own calculation.

CONCLUSIONS

Covid-19 Pandemic did not discriminate and all the tourism was affected. All travel destinations were deeply affected by unprecedented travel restrictions and felt economic and social bottlenecks. A major and unanimous question is how the pandemic and economic impact will be felt and when the recovery will begin. The forecast indicates at least three years for tourism demand to return to pre-crisis levels, according to a study made by market research firm Euromonitor International. It is possible that certain sectors of tourism industry will never be able to return to the pre-crisis level, especially due to the digital transformation that was already under way, and that it was accelerated by the pandemic. An example is the MICE (meetings, incentives, conferencing, exhibitions) sector where virtual meetings shown that there is no need for travels to attend conferences. Everyone in tourism sector will be able to use this break caused by Covid-19 to review their business concept and travel offers. Tourists will apply for nature destinations – rural mountain tourism – because this form of tourism will allow them to keep their social distance and to access the nature contact and discovery, which they have not been able to benefit from in the recent times. The concept of micro-vacation will probably also be common. Given the dangers associated with long-distance travel, the typical large annual journey will be replaced by smaller ones, closer to home, throughout the year. The travel and tourism industry has been one of the hardest hit by the coronavirus pandemic. It will take a long time to return to something we all recognize as “normal”, but there are plenty of opportunities to be innovative and improve the travel experience for all who wish.

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OPTIMIZATION OF WHEAT FERTILIZATION IN RELATION TO CERTAIN QUALITY INDICES

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Abstract

The study evaluated the variation of some wheat quality indices in order to optimize the mineral fertilization with nitrogen and with the Super Fifty foliar biostimulator. Nitrogen (N) was applied in doses between 0 - 200 kg ha^{-1}, in five variants (N0, N50, N100, N150 and N200). Super Fifty foliar biostimulator (SF) was applied on each level of nitrogen fertilization in six concentrations, between 0 - 5 L ha^{-1} (SF0, SF1, SF2, SF3, SF4, SF5). The Alex wheat cultivar was cultivated under conditions of cambic chernozem soil, with medium fertility. The values of the quality indices of wheat grains, gluten (Glt), starch (ST) and Zeleny Index (Zel) were evaluated. Gluten content (Glt) ranged from 20.33 to 32.93 ± 0.78%. The starch (ST) content varied between 65.99 - 69.93 ± 0.21% and the Zeleny Index recorded values between 36.58 - 77.23 ± 2.56 units. Very strong positive correlations were recorded between the Super Fifty foliar biostimulator (SF) and gluten (Glt) on the N50 fertilization level (r = 0.964), on the N100 fertilization level (r = 0.909) and on the N150 fertilization level (r = 0.923). Strong positive correlations were recorded between the Super Fifty foliar biostimulator (SF) and the Zeleny index (Zel) on the N50 fertilization level (r = 0.893), and on the N100 fertilization level (r = 0.888). From the regression analysis were obtained equations that described the variation of quality indices in relation to N and SF, in conditions of statistical safety (R^2 = 0.963, p<0.001, F = 129.793 for Glt; R^2 = 0.918, p <0.001, F = 56.31099 for ST; R^2 = 0.975, p <0.001, F = 202.4062 for Zel). The optimal doses were calculated for N and SF in relation to the quality indices studied.

Key words: *foliar biostimulator, nitrogen, quality indices, optimization, wheat*

INTRODUCTION

The optimization of production and the market of cereal products are important and widely studied from socio-economic, ecological, production quality, food safety and security perspectives [5], [30], [22], [20], [23], [24], [18].
Fertilizer resources are an important factor in supporting grain production [44], [15].
Nitrogen is one of the elements of major interest from the perspective of agricultural sustainability, food security, in relation to agricultural systems, farm types, agricultural ecosystems and the natural environment, etc., so that many studies have addressed this nutrient [38], [29], [10], [19].
The efficiency of nitrogen use in agriculture has been studied in relation to different soil and climatic conditions, types of agricultural systems, N fertilizing resources, crop plants, yields, etc [35], [33], [13], [2].
Different methods and indicators have been used in relation to the efficient use of nitrogen, plant nutrition, production and quality of agricultural production [41], [8], [25], [43]. Imaging analysis on satellite, aerial or terrestrial images is very useful in evaluating wheat crop based on specific indices [6], [31], [3].
At the same time, various biofertilizing and biostimulating growth products, some with foliar application, have been used to plant nutrition management and plant metabolism control in wheat crops [32], [7].
The content of gluten, starch and the Zeleny Index are important indices for the quality of wheat production, in relation to the use for the food industry, especially for bakery [21], [4], [17], [40].
The elements of productivity and quality in wheat vary major and significant in relation to plant nutrition, fertilization, type and method of fertilizer application [27], [28], [9], [11],

[37], [46].
The present study evaluated the variation of gluten, starch and Zeleny Index in wheat grains, under the influence of nitrogen fertilization and foliar biostimulator Super Fifty, and found models of fertilization optimization in relation to the quality indices studied.

MATERIALS AND METHODS

The study aimed to analyze the variation of gluten content, starch and Zeleny Index, as quality indices in wheat, under the influence of nitrogen and a foliar biostimulator and doses optimization by mathematical analysis.
The Alex wheat cultivar was cultivated in the conditions of a cambic chernozem type soil, medium fertility, in Didactic and Experimental Resort Timisoara, BUASVM Timisoara, Romania. Nitrogen was applied as ammonium nitrate in five doses between 0 - 200 kg N a.s. ha^{-1} (active substance), and the following variants resulted: N0, N50, N100, N150, N200.
The Super Fifty (SF) biostimulator was applied foliar, in six concentrations between 0 - 5 L ha^{-1}, on each level of N (SF0, SF1, SF2, SF3, SF4, SF5). The combination of the two products (N and SF) resulted in 30 experimental variants, in three repetitions.
The content of gluten (Glt), starch (ST) and Zeleny Index (Zel) were evaluated. The determination of the quality indices values was made by the non-destructive NIR-FTIR method. The experimental data were analyzed by the ANOVA test. This analysis facilitated the evidenced of the variance in the data set, as well as the general statistical certainty of the data obtained.
Regression analysis was used to evaluate the interdependence between the quality indices values obtained, and the fertilizer resources used.
The regression analysis facilitated the obtaining of some equations that described the variation of the values of the quality indices in relation to N and SF, as a direct, and interaction influence.PCA was used to obtain the distribution of the experimental variants in relation to the quality indices (Glt, ST and Zel) studied. From the PCA analysis, the values of the variant explained by PC1 and PC2 were obtained.
The Cluster Analysis was used to group the variants based on similarity in generating the values of the studied quality indices.
The analysis and data processing was done with PAST software [12], and for the graphical representation of the quality index values according to N and SF, the Wolfram Alpha software (2020) [42] was used.

RESULTS AND DISCUSSIONS

Nitrogen fertilization, in the range of 0 - 200 kg ha^{-1}, in the five levels provided (N0, N50, N100, N150 and N200), and Super Fifty foliar biostimulator fertilization in 6 doses, on each nitrogen level, between 0 - 5 L ha^{-1} (SF0, SF1, SF2, SF3, SF4 and SF5), led to the variation of the quality indices of wheat grains production, Table 1. Gluten content (Glt) ranged from 20.33 to 32.93 ± 0.78%. The starch (ST) content varied between 65.99 - 69.93 ± 0.21% and the Zeleny Index recorded values between 36.58 - 77.23 ± 2.56 units. The ANOVA test (Alpha = 0.001) confirmed the statistical safety of the experimental data and evidenced the presence of the variant in the data set, Table 2.
The level of correlation between the values of the studied quality indices and the foliar biostimulator (SF), and nitrogen (N), respectively, was analyzed.
Very strong positive correlations were recorded between the Super Fifty foliar biostimulator (SF) and gluten (Glt) on the N50 fertilization level (r = 0.964), on the N100 fertilization level (r = 0.909), and on the N150 fertilization level (r = 0.923), respectively.Strong positive correlations were recorded between the Super Fifty foliar biostimulator (SF) and the Zeleny Index (Zel) on the N50 fertilization level (r = 0.893), and on the N100 fertilization level (r = 0.888).
Moderate, positive correlations were recorded between the Super Fifty foliar biostimulator (SF) and starch (ST) on the N50 fertilization level (r = 0.713), and between the SF and the Zeleny Index on the N150 fertilization level (r = 0.795).

Table 1. Wheat grains quality indices values, Alex cultivar, under the influence of nitrogen and Super Fifty foliar biostimulator

Trial	Independent variable (Nitrogen, Super Fifty)		Quality indices		
	N	SF	Glt	ST	Zel
V1	0	0	20.33	68.85	36.59
V2	0	1	20.53	69.43	36.88
V3	0	2	21.20	69.65	38.21
V4	0	3	22.73	69.68	44.24
V5	0	4	23.63	69.52	44.80
V6	0	5	21.53	69.13	38.97
V7	50	0	22.30	68.68	38.30
V8	50	1	22.87	69.05	40.49
V9	50	2	22.97	69.07	42.53
V10	50	3	25.10	69.74	48.06
V11	50	4	25.53	69.93	55.64
V12	50	5	27.30	68.26	50.01
V13	100	0	26.13	66.81	54.42
V14	100	1	27.63	67.27	59.53
V15	100	2	29.23	67.67	64.32
V16	100	3	30.60	68.25	69.56
V17	100	4	30.23	67.12	68.27
V18	100	5	30.43	66.95	67.81
V19	150	0	29.03	66.82	63.68
V20	150	1	30.17	67.51	65.00
V21	150	2	30.53	67.59	66.18
V22	150	3	31.63	67.44	72.36
V23	150	4	31.53	67.21	69.62
V24	150	5	31.60	67.16	69.47
V25	200	0	32.03	66.00	73.13
V26	200	1	32.17	66.69	73.45
V27	200	2	32.30	66.73	73.48
V28	200	3	32.47	66.76	77.23
V29	200	4	32.93	66.72	75.46
V30	200	5	32.27	66.57	73.28
SE			±0.78	±0.21	±2.56

SE – Standard Error
Source: Original data from the experimental field.

Table 2. ANOVA test, Two-factor

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	68633.36	15	4575.557	6.65801	2.25E-09	2.87868
Columns	28619.21	6	4769.868	6.9407	4.39E-06	4.14999
Error	61850.31	90	687.2257			
Total	159102.9	111				

Source: Data calculated based on experimental results.

Also, weaker intensity correlations were recorded between the Super Fifty foliar biostimulator (SF) and the quality indices studied, in some cases (eg. r = 0.698, between SF and Glt, on the N0 level).
Very strong positive correlations were recorded between nitrogen (N) and some studied indices (r = 0.933 between N and Glt; r = 0.926 between N and Zel Ind), and strong negative correlation was registered between N and ST (r = -0.895).
Starting from the recorded correlation levels, regression analysis was used to evaluate the influence of the two factors (N and SF) on the studied quality indices. For the high accuracy of the analysis, 16 decimals were used for the coefficients of the obtained equations (1), (2), and (3).
From the regression analysis, equation (1) was obtained, which described the variation of gluten content (Glt) in relation to N and SF, in statistical safety conditions, according to R^2 = 0.963, p <0.01, F = 129.793.

$$Glt = ax^2 + by^2 + cx + dy + exy + f \quad (1)$$

where:
Glt - gluten content;
x – N doses;
y – Super Fifty (SF) foliar biostimulator;
a, b, c, d, e, f – coefficients of the equation (1);
a= -0.0005739;
b= -0.8988821;
c= 0.2705667;
d= 9.1827594;
e= -0.0281108;
f= 0.

The ANOVA test confirmed the statistical safety for the values of the equation (1) coefficients, as follows: p = 0.0259 for a; p = 0.03369 for b; p <0.001 for c; p <0.001 for d; p <0.001 for e.
The graphical distribution, in 3D form, of the Glt values according to N and SF, is shown in figure 1, and the graphical distribution in the form of isoquants, is shown in Figure 2.
Starting from equation (1), the optimal values for N and SF in relation to the gluten content

(Glt) were determined. The values x_{opt} = 179.28 kg N a.s. ha^{-1}, and y_{opt} = 2.30 L ha^{-1}, respectively, were obtained.

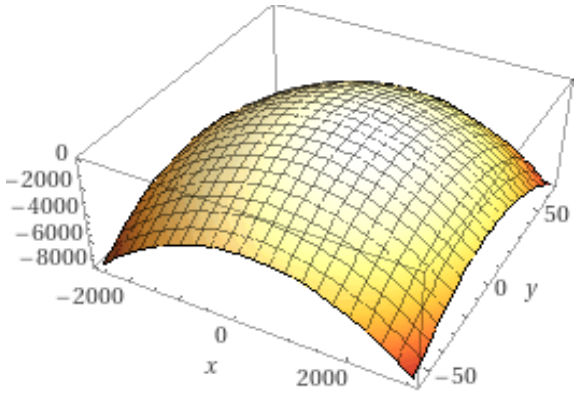

Fig. 1. 3D graphical distribution of Glt index values under the influence of N (x-axis) and SF (y-axis).
Source: Original graph, generated based on experimental data.

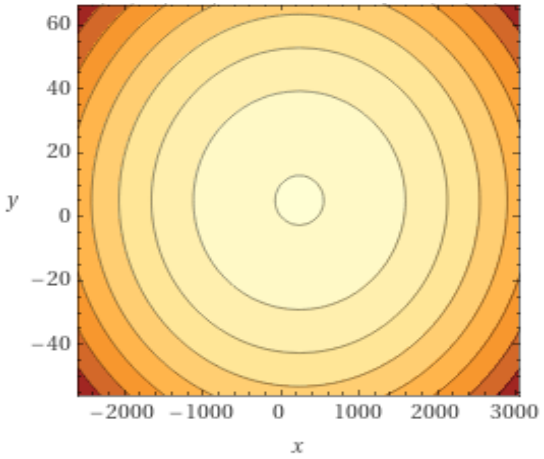

Fig. 2. Graphic distribution in the form of isoquants of Glt index values under the influence of N (x-axis) and SF (y-axis)
Source: Original graph, generated based on experimental data.

The regression analysis facilitated the evaluation of the starch content (ST) variation according to N and SF, as an independent action of the two factors, but also of the interaction. This variation was described by equation (2), in statistical safety conditions, according to R^2 = 0.918, p <0.001, F = 56.31099.

$$ST = ax^2 + by^2 + cx + dy + exy + f \quad (2)$$

where:
ST - starch content;
x – N doses;
y – Super Fifty (SF) foliar biostimulator;
a, b, c, d, e, f – coefficients of the equation (2);
a= -0.0015411;
b= -3.0299650;
c= 0.6365794;
d= 29.2748572;
e= -0.0937512;
f= 0.

The ANOVA test confirmed the statistical safety of the coefficients of equation (2) values, as follows: p = 0.0901 for a; p = 0.04594 for b; p <0.001 for c; p <0.001 for d; p <0.001 for e.
The graphical representation of ST values according to N and SF is shown in Figure 3, in 3D form distribution, and the graphical distribution in the form of isoquants is shown in Figure 4.

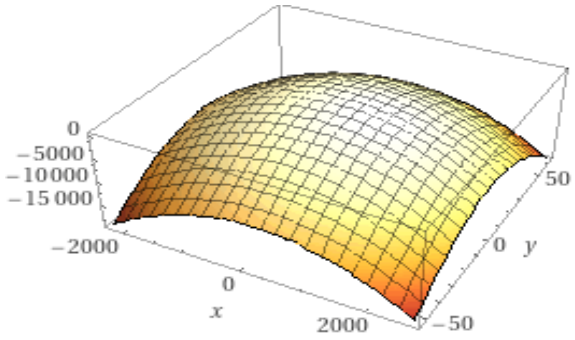

Fig 3. 3D graphical distribution of ST index values in relation to N (x-axis) and SF (y-axis).
Source: Original graph, generated based on experimental data.

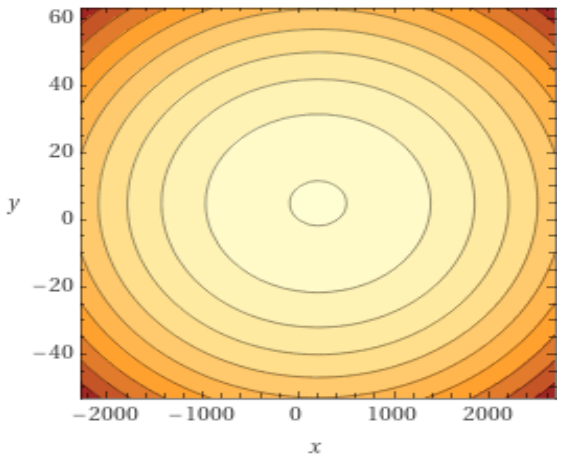

Fig. 4. Graphic distribution in the form of isoquants of ST index values in relation to N (x-axis) and SF (y-axis).
Source: Original graph, generated based on experimental data.

Starting from equation (2), the optimal values for N and SF in relation to the starch content (ST) were determined. The values x_{opt} = 112.56 kg N a.s. ha^{-1}, and y_{opt} = 3,089 L ha^{-1}, were obtained.

The regression analysis evaluated the variation of the Zeleny Index (Zel) values, as a function of N and SF, as an independent action and interaction of these factors. This variation was described by equation (3), in statistical safety conditions, according to R^2 = 0.975, p <0.001, F = 202.4062.

$$Zel = ax^2 + by^2 + cx + dy + exy + f \quad (3)$$

where:
Zel - Zeleny Index;
x – N doses;
y – Super Fifty (SF) foliar biostimulator;
a, b, c, d, e, f – coefficients of the equation (3);
a= -0.0010589;
b= -1.8111150;
c= 0.5621981;
d= 17.7242033;
e= -0.0483577;
f= 0.

According to the ANOVA test, the statistical certainty of the values of the coefficients of equation (3) was confirmed, as follows: p = 0.01828 for a; p = 0.01483 for b; p <0.001 for c; p <0.001 for d; p <0.001 for e.

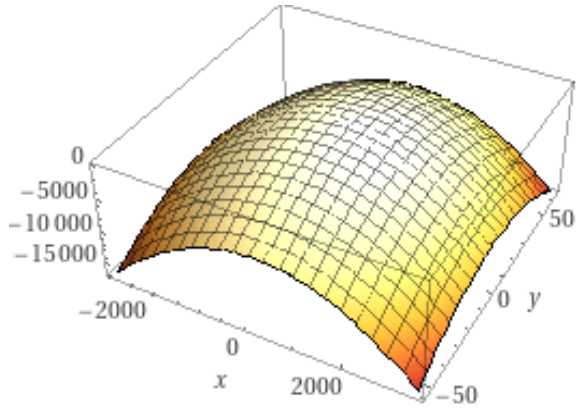

Fig. 5. 3D graphical distribution of Zel index values in relation to N (x-axis) and SF (y-axis)
Source: Original graph, generated based on experimental data.

The graphical distribution of the values of the Zeleny Index (Zel) according to N and SF is shown in Figure 5, in 3D form, and the graphical distribution in the form of isoquants is shown in Figure 6.

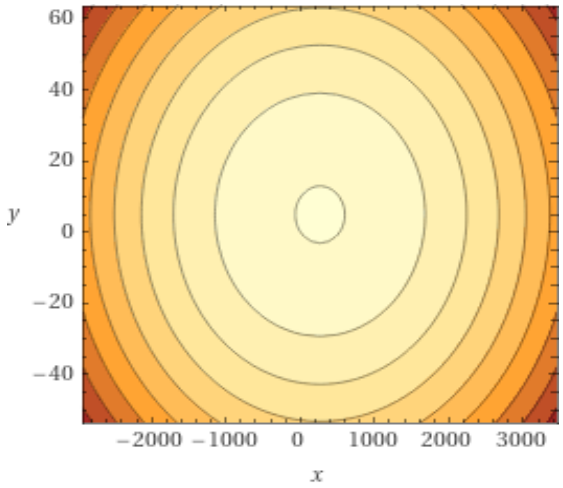

Fig. 6. Graphic distribution in the form of isoquants of Zel index values in relation to N (x-axis) and SF (y-axis)
Source: Original graph, generated based on experimental data.

Starting from equation (3), the optimal values for N and SF in relation to the Zeleny Index (Zel) were determined. Optimal values obtained were: x_{opt} = 221.14 kg N a.s. ha^{-1}, and y_{opt} = 1.941 L ha^{-1}.

Principal Component Analysis facilitated the distribution of the 30 variants according to the values of the studied quality indices. PC1 explained 99.635% of variance, and PC2 explained 0.19327% of variance, figure 7. A high affinity of the V13 - V30 variants with Glt and Zel indices (as biplot) was found, variants that were ensured by applying the Super Fifty biostimulator mainly on the high levels of nitrogen (N100, N150, N200).

The cluster analysis facilitated the grouping of variants based on Euclidean distances, on similarity levels in achieving the values of the studied quality indices (Glt, ST, Zel).

Two distinct clusters were recorded, in which the variants were grouped based on Euclidean distances, in statistical safety conditions, Coph. corr = 0.843, Figure 8.

A C1 cluster included the variants with lower values of the studied quality indices, registered at levels of N0 and N50 and the SF

product. Within this cluster, two subclusters [(C1-1), (C1-2)] were formed, with several subclusters each. From the analysis of Similarity and Distance Indices (SDI), high levels of similarity were recorded for variants (V1-V2), SDI = 0.6786, for variants (V3-V5), SDI = 0.97821, and for variants (V4-V5), SDI = 1.072.

Cluster C2 included variants with high values of the studied quality indices, registered on levels of N100, N150 and N200 and the application of the SF product. Within this cluster, two subclusters [(C2-1 and C2-2)] were formed, with several subclusters each.

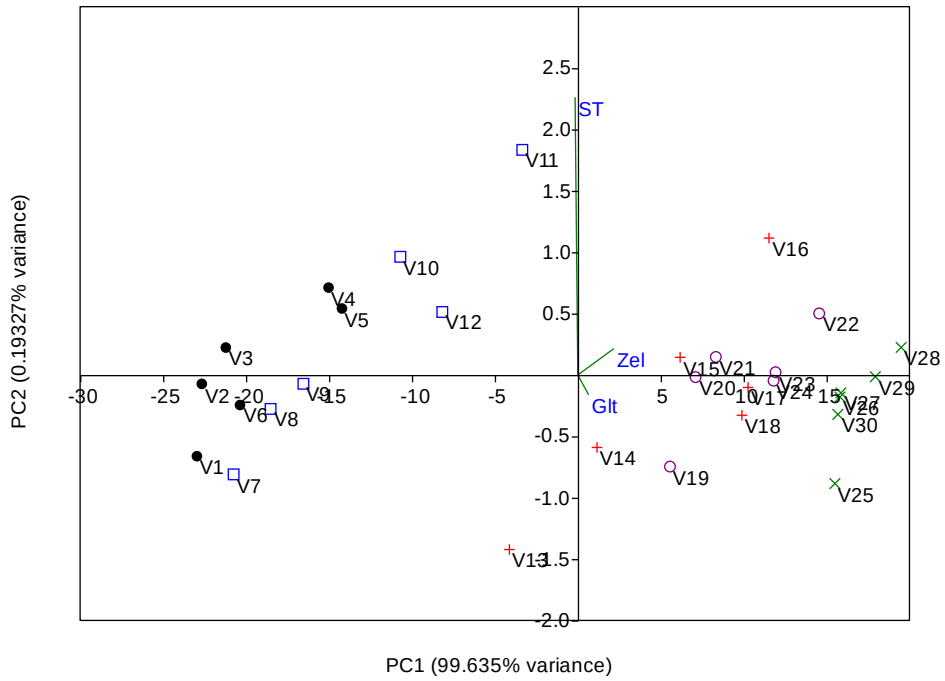

Fig. 7. PCA diagram regarding the distribution of experimental variants in relation to the analyzed quality indices (Glt, ST, Zel as biplot)
Source: Original graph, generated based on experimental data.

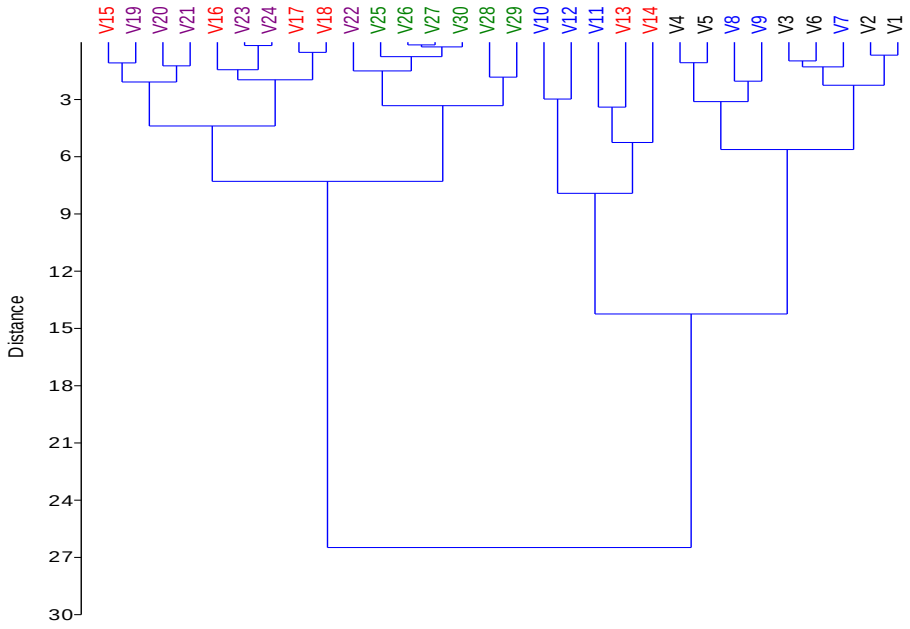

Fig. 8. Cluster grouping of variants based on Euclidean Distances, depending on the values of quality indices, Alex wheat cultivar
Source: Original graph, generated based on experimental data

High levels of similarity were recorded for variants (V26-V27), SDI = 0.13928, for variants (V23-V24), SDI = 0.17292, for variants (V30-V26), SDI = 0.23087, and for variants (V30-V27), SDI = 0.25788, respectively.

The analysis of the values of the quality indices studied, from the aspect of homogeneity, through the coefficient of variation (CV), showed a high degree of variation in the case of the Zeleny Index (CV_{Zel} = 24.1188), a moderate variation in the case of gluten content (CV_{Glt} = 15.5129), and a low degree of variation in starch content (CV_{ST} = 1.7897).

A similar assessment was obtained based on the diversity profile, figure 9, and from the distribution generated for each quality index, a high homogeneity of the data for starch (ST), moderate variation of gluten (Glt), and a high variation of the Zeleny Index (Zel) was found.

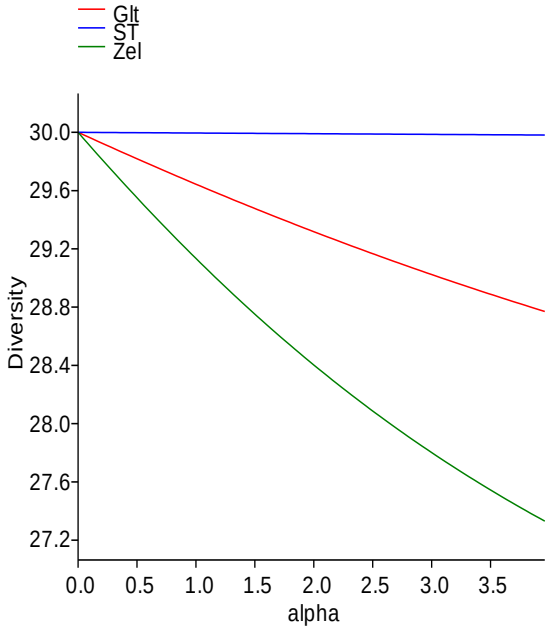

Fig. 9. Diversity profile quality indices in wheat grains, Alex cultivar, under the influence of nitrogen (N) and Super Fifty foliar biostimulator (SF)
Source: Original graph, generated based on experimental data.

From the analysis of the optimal doses for N and SF in relation to the studied quality indices, it can be appreciated that the two fertilizing resources need to be used differently in relation to the quality index which is a priority to be achieved in wheat production, Alex cultivar.

If the priority is the gluten content (Glt), the results obtained, in the conditions of the experiment, recommend that nitrogen (N) be applied at a dose of 179 kg N a.s. ha^{-1}, and the Super Fifty foliar biostimulator in a concentration of 2.30 L ha^{-1}. This combination of the two resources for wheat plants nutrition control, led to optimal values for gluten content (Glt).

In case of if it is desired to optimize the starch (ST) content in wheat grains, in accordance with the results obtained under presented experimental conditions, nitrogen (N) is recommended to be applied at a dose of 112.56 kg N a.s. ha^{-1}, and the foliar biostimulator Super Fifty (SF) to be applied in a concentration of 3.089 L ha^{-1}.

In the conditions in which the aim is to obtain high values for the Zeleny Index, in the wheat grains, according to the obtained results in the experimental conditions described, nitrogen (N) is recommended in higher doses, of 221.14 kg a.s. ha^{-1}, and the Super Fifty (SF) foliar biostimulator in a concentration of 1.94 L ha^{-1}.

The dose of N obtained from the calculations falls outside the experimental range studied (N0 - N200), but expresses the fact that nitrogen supplementation up to the value obtained from the calculation would have led to an increase in the values of the Zeleny Index.

The optimization of wheat production and quality through fertilization has been approached in numerous studies, in different soil and climatic conditions, technology, genotypes and varieties of fertilizer resources, due to the importance of wheat production for food and important sectors of the economy [16].

Zhang et al. (2020) [45] reported results on optimizing the application of nitrogen to wheat crops, in relation to photosynthetic processes, grain production and efficiency of nitrogen and water use in irrigation. Fertilization optimization in agricultural crops has been reported in other studies, and is a permanent concern in agricultural research

and practice [34], [33], [36].
The efficiency of root and foliar fertilization in wheat culture has been studied and evaluated in relation to various nutrients, macro- and microelements, in order to ensure a quantitative and qualitative level of production [26], [1], [39].
At the same time, some studies have evaluated the possibility of reducing the dependence of wheat production on nitrogen fertilizers [14].

CONCLUSIONS

The quality indices, as gluten, starch and Zeleny Index, studied in wheat, Alex cultivar, recorded a specific variation, in close correlation with nitrogen (N0 - N200) and the foliar biostimulator Super Fifty (SF0 - SF5).
Regression analysis facilitated the obtaining of equations that described, in statistical safety conditions, the variation of quality indices, gluten (Glt), starch (ST) and Zeleny Index (Zel), in relation to nitrogen (N) and foliar biostimulator (SF), as influencing factors.
The optimal doses for nitrogen (N) and the Super Fifty foliar biostimulator (SF) were calculated in relation to the studied quality indices. Depending on the quality index with high interest, the optimal fertilization dose can be adopted.
PCA analysis and Cluster Analysis facilitated the grouping of variants in relation to the similarity of the response recorded by the quality indices studied, with the possibility to recommend different variants with similar response.

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APPLICATION OF THE PRINCIPLES OF THE CIRCULAR ECONOMY IN CONVENTIONAL AGRICULTURE. CASE STUDY - PESTICIDE WASTE RECYCLING

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Abstract

Conventional farming systems have been an alternative given that global population growth has been accompanied by an increase in food needs, and areas for production have not been able to keep pace with growth. But the practice of conventional agriculture is the one that, along with other ways of aggressive exploitation of natural resources, economic development, has contributed to environmental degradation and resource depletion. Under these conditions, alternative solutions were sought both to reduce the pressure on the environment, but also to obtain healthier foods that would thus contribute to improving human health. Organic farming, sustainable agriculture, uses principles that have been applied for a long time, but with the advent of the concept of circular economy, as a way to reduce pollution and improve the health of the planet, have been sought solutions for its application in agriculture conventional. In this paper we aim to analyze the current situation of the use of pesticides in agriculture, as an important source of pollution, as well as the possibilities of implementing the principles of circularity in their use, given their high degree of toxicity. The working methodology involved the collection of existing data in national databases, as well as in international ones on the quantities of pesticides sold, the quantities of packaging resulting from their use, but also the possibilities of collection and recycling, as a way of applying recircularity. Based on the processed, analyzed and interpreted data, conclusions were formulated that could be the basis for establishing measures regarding the implementation of efficient circularity systems in agriculture.

Key words**:** *circular economy, conventional agriculture, pesticides, recycling, collection*

INTRODUCTION

The circular economy is a concept that can no longer be considered a novelty, but which is beginning to gain more and more visibility in the context of the pressure that climate change issues have on the political and economic environment, but also on the planet's inhabitants who are increasingly concerned about the effects that uncontrolled consumption, unsustainable practices and irresponsibility have on the environment. The concept of circularity has been discussed since 1976, with over a hundred definitions of the circular economy, but it was developed in 2013 by the Ellen MacArthur Foundation, which sought to develop a new consumption model that deviates from linearity0 and which can use sharing, reuse, repair, renovation and recycling so that the life cycle of the products is as long as possible, and the resulting amount of waste is as small as possible [14]. If the linear economy uses the principle "take-produce-use-throw", the circular economy model wants to transform waste into resources through a more efficient use of them, the effects being to reduce the pressure on the environment and increase sustainability. At the same time, the application of the principles of the circular economy could be measured in terms of increasing the economic efficiency of the activity, increasing the competitiveness of companies, developing innovation, creating new jobs, which will

ultimately reduce the negative impact on environment [10]. Therefore, the circular economy means more than reducing the amount of waste, it means closing the consumption loop.

At the level of the European Union there were initiatives regarding the application of the circular economy model, initiatives that continued in 2020 in order to increase sustainability through the implementation of the European Green Pact, in which there is an Action Plan for the circular economy seeks solutions to ensure investment and financing instruments that ensure the European Union the possibility, by 2050, to be neutral in terms of its impact on the environment [5].

Given that in 2020 only 12% of the materials and products used are reintegrated into the production process, the measures aim to make sustainable products a rule in the European Union market, providing consultants to European citizens who can make sustainable choices, will aim to produce as little waste as possible and will also introduce measures in resource-consuming industries with a high potential for recirculation that are both highly polluting.

Agriculture is thus one of the most important sources of pollution on the planet, it is among the five sectors producing greenhouse gases, along with transport, electricity production, industry, trade and household consumers [3, 7]. The company with the food industry produced in 2020 greenhouse gases which accounted for 21% of the total and a carbon footprint of 6500 million tons [4].

Agriculture is also one of the important sources of plastic waste production. The growth of these uses has increased over the last 70 years, but studies show that by 2050, as the population grows, so will the amount of plastic used, by about 30% [16].

Therefore it is necessary to find solutions that contribute in addition to reducing the quantities of packaging using and a reuse of them. In the case of pesticides, this imposes certain limits due to their continuation with high toxicity, which does not allow a calcium recycling. But measures could be taken to collect the resulting waste and speed up the degradation process.

The circular economy also has its limits which are related primarily to the fact that it requires high investment, and on the other hand related to the relatively low transfer of knowledge between users [2].

MATERIALS AND METHODS

To measure the potential application of the principles of circularity for conventional agriculture, in this paper we aimed to analyze one of the activities with a high impact on the environment, namely the use of pesticides (fungicides, insecticides and herbicides) and how the resulting waste can be integrated in circularity.

Various indicators have been taken into account that allow comparisons to be made between European Union countries and that can provide a clearer picture of the concept analyzed, namely: pesticide sales for the period 2015-2019, the amount of waste resulting, the amount of waste collected, amount of waste recycled.

In order to follow the evolution of the analyzed indicators, we used fixed-base indices, determined as follows:

$IFB = (x_n / x_1) * 100$, [1]

where:

x = variable under study,

n = 1,2,3 ... n, chronological series of years.

RESULTS AND DISCUSSIONS

The analysis of the data regarding the use of pesticides in the agriculture of the countries belonging to the European Union highlights the fact that despite the discussions regarding the sustainable development, their average quantity did not decrease much in the analyzed period.

We find that for countries such as Bulgaria, Cyprus and Finland, the quantities traded increased during the entire analyzed period, the highest increase being registered in Finland, this increase being 12.6 times higher in 2019 compared to 2015.

Continuous decreases in the quantities of pesticides sold were registered in Croatia (-50% in 2019 compared to 2015), in the Czech

Republic (-22%), Denmark (-13%), Italy (-38%), Lithuania (- 22%) and Sweden (-59%). For the other countries, the quantities of fish sold fluctuated in the period 2015-2019. We find that the total amount of pesticides sold in European Union countries in 2019 was about 400,000 tons. Some of these pesticides are used for non-agricultural purposes but the statistics do not show this, there are no data on these values.

Table 1. Quantity of pesticides sold in E.U. countries in the period 2015-2019 (tons, active substance)

Country	2015	2016	2017	2018	2019
Austria	2,130.73	2,006.54	1,991.63	2,668.65	:
Belgium	2,611.18	2,856.22	2,495.88	2,457.91	2,449.42
Bulgaria	619.02	1,048.88	1,287.45	1,798.03	1,578.54
Cyprus	776.93	365.93	817.95	823.46	867.43
Croatia	1,315.18	932.01	727.13	767.23	656.07
Czech Republic	2,109.34	1,785.21	1,853.69	1,755.14	1,650.88
Denmark	504.01	406.71	483.73	438.35	:
Estonia	109.27	104.39	117.03	106.54	104.92
Finland	224.68	3,212.36	3,227.75	3,814.41	2,831.62
France	27,373.71	31,971.20	29,786.23	39,086.67	24,404.95
Germany	12,817.36	12,140.88	13,266.13	11,681.86	10,217.44
Greece	1,926.97	1,803.57	1,685.87	1,728.71	1,755.82
Hungary	3,867.89	3,835.02	4,170.52	3,535.07	2,796.08
Ireland	687.73	596.57	633.47	601.99	:
Italy	39,186.66	36,851.94	32,686.89	31,538.59	24,285.68
Latvia	269.84	261.97	266.54	212.65	:
Lithuania	736.75	741.17	690.12	676.67	575.04
Luxemburg	:	:	:	:	:
Malta	118.65	83.52	101.94	82.51	69.78
Netherlands	4,413.10	4,870.37	4,724.86	4,288.41	:
Poland	7,737.60	7,534.41	6,927.32	7,991.71	6,867.38
Portugal	5,193.43	5,473.57	4,133.62	4,335.17	:
Romania	4,142.49	4,525.81	4,600.28	4,145.91	4,020.81
Slovakia	639.21	640.14	685.33	676.11	652.51
Slovenia	759.24	859.61	794.73	849.03	751.78
Spain	36,423.29	38,905.11	37,982.03	38,067.06	34,073.75
Sweden	398.17	249.03	264.77	222.58	164.28
United Kingdom	6,032.36	5,330.00	5,484.05	4,492.46	6,056.98

Source: own processing [6].

Pesticide consumption depends on climatic conditions and the characteristics of agricultural systems, so this consumption cannot be reported in the same way for all countries analyzed. Moreover, the quantities traded do not imply their consumption in the agriculture of the respective country, so that a part of the quantities cannot be attributed to them.

In Romania, the country where agriculture is an important branch of agriculture, on the one hand due to the labor force employed in this branch of the economy [8], and on the other hand to its contribution to GDP [9], pesticide consumption is a high one. Thus, Romania is among the first six countries of the European Union in terms of pesticide consumption. The data show that the amount used in 2019 decreased by 3% in 2019 compared to 2015 and by 13% compared to 2017, the year in which the highest consumption of pesticides

in the analyzed period was recorded (4,600 tons - active substance).

Ecological agriculture, as a form of agricultural practice and which works on the application of the principles of the circular economy, contributes in turn to the protection of the environment and to the sustainability of the activities carried out. Although Romania has potential for this niche, in 2019 organic farming had only a share of only 5% of total agricultural production [15].

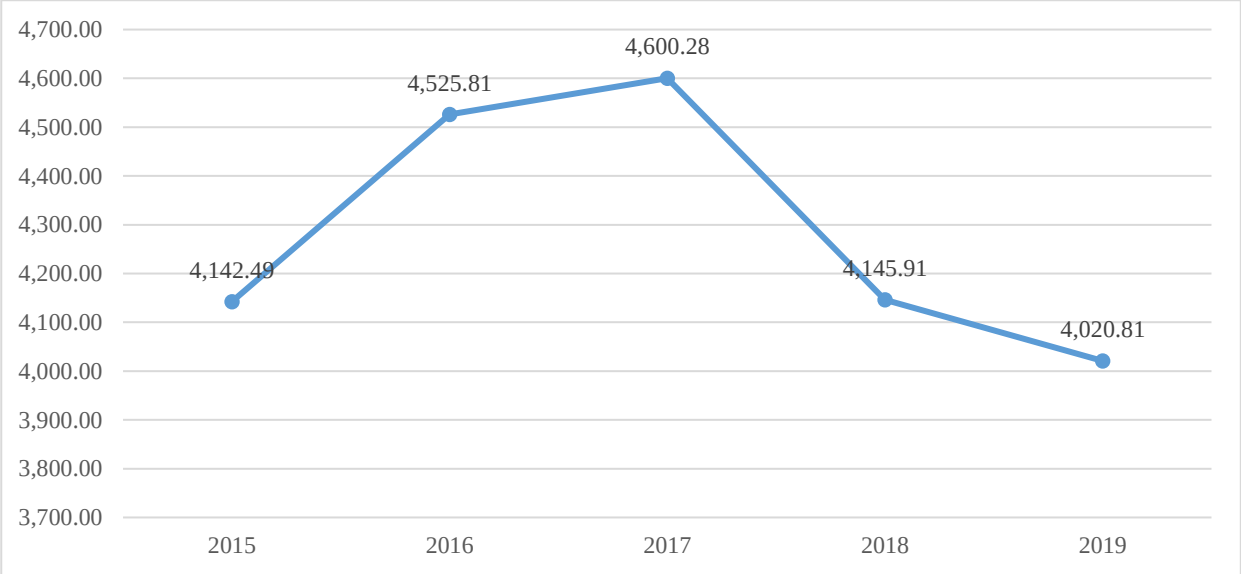

Fig. 1. Quantity of pesticides sold in Romania in the period 2015-2019 (tons, active substance)
Source: own processing [6].

The share of pesticides, by categories, sold in Romania in 2019, in tons shows that 74% of the quantity sold is represented by fungicides, 13% by insecticides, 9% by herbicides and 4% by other categories of plant protection products (Figure 2).

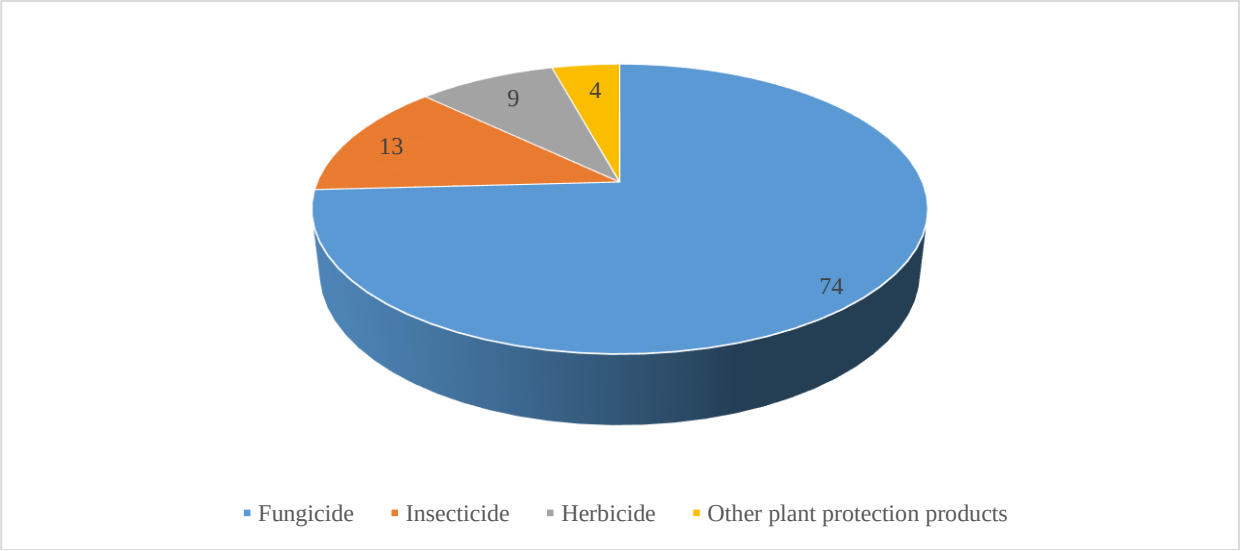

Fig. 2. Distribution of pesticides sold, in tons, in Romania, in 2019 (%)
Source: own processing [11].

The share of liquid pesticides, sold in Romania in 2019, expressed in liters was represented by 58% herbicides, 29% fungicides, 13% insecticides and 3% other phytosanitary protection products. The amount of pesticides, by groups and categories, expressed in active substance, was lower by 18.5% in 2019 compared to 2018.

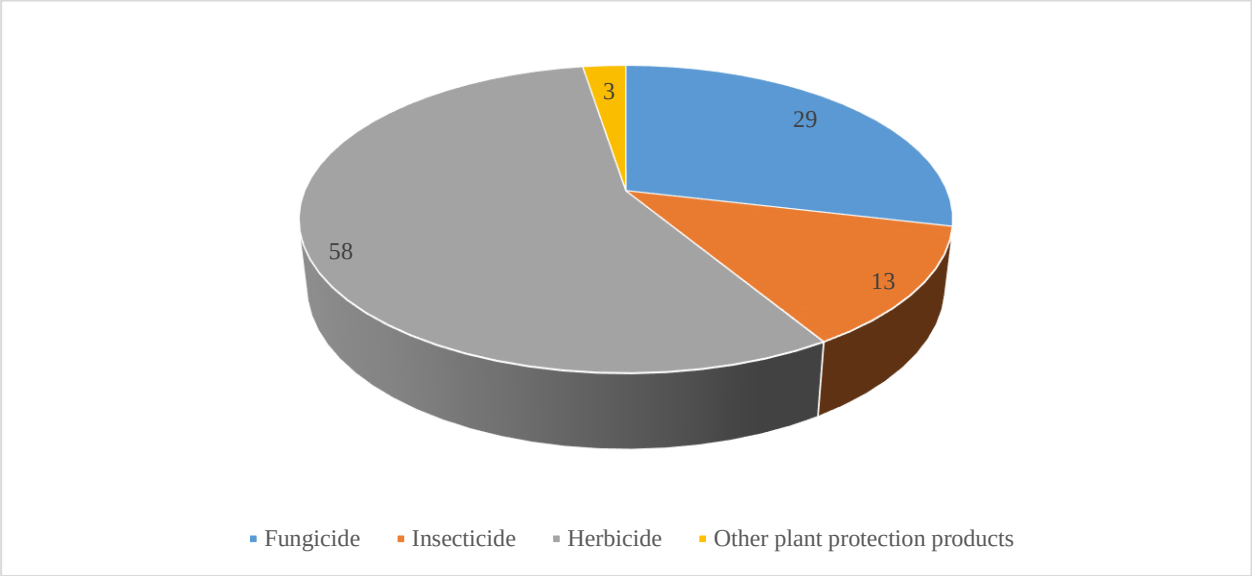

Fig. 3. Distribution of pesticides sold, in liters, in Romania, in 2019 (%)
Source: own processing [11].

Analyzing the structure of pesticides from the point of view of their chemical class, for 2019 the largest share of quantities sold is represented by fungicides based on conazole (9%), organophosphorus herbicides (9%), herbicides based on phenoxy radicals (8 %), dithiocarbamate-based fungicides (8%), chloroacetanilide-based herbicides (6%), inorganic sulfur (4%), copper compounds (4%), phthalamide-based fungicides (4%), fungicides on amide-based (4%), pyridyl-methylamine-based insecticides (3%) and amide-based herbicides (3%).

Given the impact that pesticides have on the environment, the pressure related to their collection and recycling is quite high but it faces many problems. At European level, pesticide producers are the ones who have started procedures for collecting pesticide packaging, but there are many other alternatives related to this waste, such as burying it, burning it, dumping it in landfills, which contributes to a on the other hand to the pollution of the environment, and on the other hand to the increase of the risks related to the human health.

At the international level there are regulations regarding both the recycling of packaging resulting from the use of pesticides and their use. For example, the use of these materials for the manufacture of products used in direct contact with humans is prohibited. The traceability of these products is very important, and the lack of clear procedures contributes even more to the development of the recycling system.

At the level of the European Union, important figures have been advanced regarding the collection and recycling process. Thus, the producers aimed to ensure the collection of a share of 80% of the packaging until 2022 and the recycling of a share of 70% of them.

The quantities collected and recycled of waste resulting from the use of pesticides in the period 2010-2017 show that their amount increased during the analyzed period. Thus in 2010 the amount of waste collected was from 551 tons, and in 2017 the amount was 1050 tons.

The increase in 2017 was 91%, compared to 2010. It is found that starting with 2012, the recycling process of this waste has started, with increases in the quantities processed. In 2013 the increases compared to 2012 were 4.3 times, in 2014 6.5 times, in 2015 6.9 times, in 2016 11.3 times, and in 2017 12.3 times (Figure 4).

The specialized companies ensure the free collection of these packages in case they are decontaminated [12].

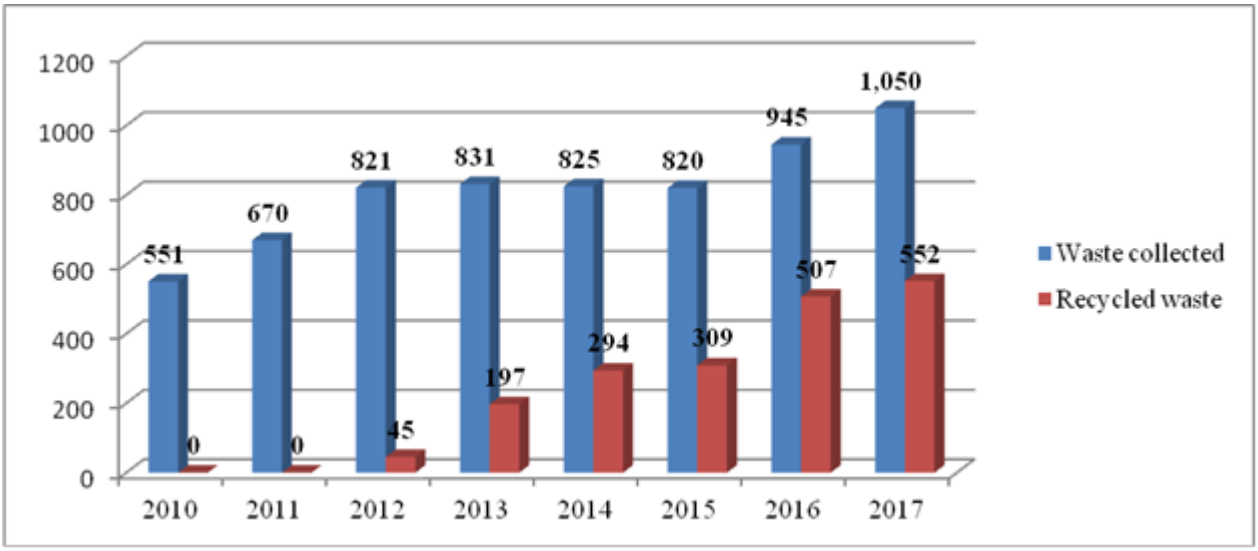

Fig. 4. Evolution of the quantities of pesticide waste collected and recycled (tone)
Source: own processing [13].

Compared to this situation, it is found that there are important uncollected quantities, although their quantity decreased during the analyzed period. Thus, in 2017 compared to 2010, the uncollected quantities decreased by 41%. The smallest quantity left uncollected was registered at the level of 2016, the quantity being 181 tons.

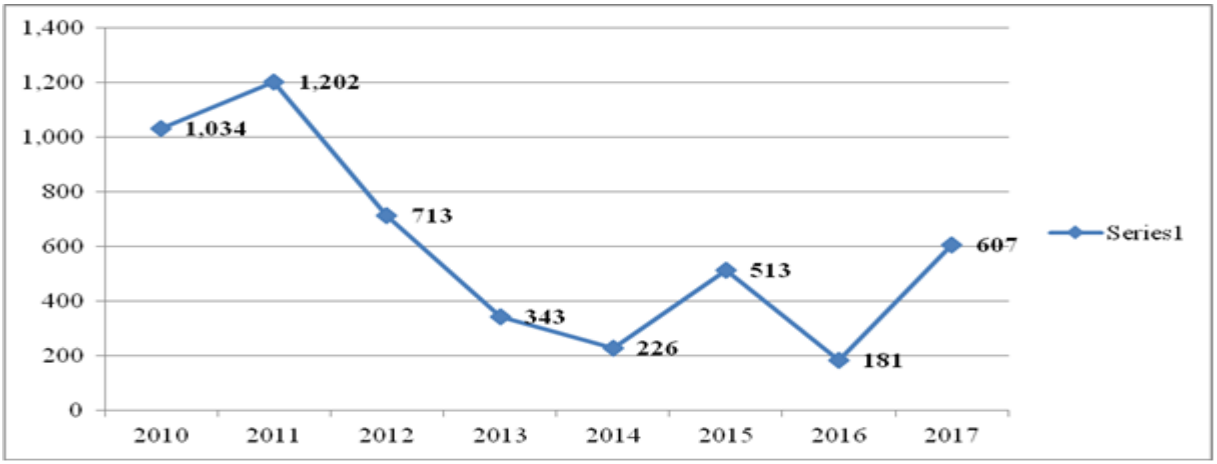

Fig. 5. Evolution of quantities of uncollected pesticide waste in the period 2010-2017 (tons)
Source: own processing [11].

CONCLUSIONS

Recycling is one of the central elements of the circular economy, and its application in agriculture, as well as in the entire consumption circuit could contribute to improving aspects related to environmental protection. In fact, the application of the principles of the circular economy in agriculture is an objective proposed by the policies of the European Union. However, we find that this is not easy to achieve without implementing a traceability of waste resulting from agricultural activities. We have shown in the paper that although the quantities of pesticides can be tracked, the location of their use is more difficult to track due to the fact that they are procured from different sources existing on European territory.

If collection problems could be implemented, there are problems related to the recycling of agricultural waste due to their toxicity. But a well-developed system could have favorable effects not only on environmental sustainability, but also on farm costs, as a result of avoiding some of them.

And yet recycling and reusing waste from pesticide use is not easy. One of the most important issues regarding the recycling of toxic materials, including pesticide waste, is to make the circular loop "toxic" due to the fact that recycled products could be dangerous to human health. The reality showed that such dangerous substances were found in products obtained from recycled materials, the risk being extremely high for health (cancer production, genetic mutations, etc.). This has led to tensions over the use of this category of materials, but when we refer to recycling, this involves not only processing, but also trying to reduce their toxicity, more responsible handling and reuse in complementary areas.

Although the application of the principles of the circular economy has its limits, the proven advantages are economic (such as reducing costs or increasing investment), social (such as increasing household income or increasing employment), but primarily environmental. Therefore, all these support the concept of circular economy, the need to move from the linear model to the circular model being not only useful, but necessary and mandatory if we want future generations to benefit in turn from a clean planet.

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FOOD SECURITY OF THE EUROPEAN UNION AND THE INFLUENCE OF COVID-19

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Abstract

Food security is one of the basic elements of human security that can only be ensured through a sustainable development of society. On the other hand, food security is an important element of global and national security, and is ensured at European level through the common defence and security policies implemented by the Member States. And this food security, which for many countries in the world is already a difficult problem to manage, was affected in 2019 by the COVID-19 pandemic, which caused the whole world to face an unprecedented crisis and which, although it affected the whole world, had an even greater effect on the poor populations that suffered even more, amid an increase in hunger anyway for four consecutive years, that is in the period 2017-2020. In this paper we aimed to analyze the food security situation in European Union countries and how the Covid-19 crisis has affected it. Based on the data provided by international databases, the information was processed, analyzed so that conclusions can be drawn that highlighted the fact that food security is one of the issues of concern to decision makers internationally, but which is ensured for European Union countries this is due to the developed agricultural sector and the productions that manage to ensure the food needs of the European population. The analyzed indicators followed both the agricultural areas and the GDP value, but also the value of the imports and exports of agri-food products at the level of the member countries of the European Union.

Key words**:** *food security, food crisis, Covid-19, poverty*

INTRODUCTION

Globalization is a phenomenon that we are experiencing and which, in addition to its many benefits, has been accompanied by many disadvantages that have been presented in numerous studies over time and which show that many crises such as food or energy are partially the result of policies which in this context of globalization are much less flexible [15], [5].

In the literature, food security has had different approaches, being defined as: a way to ensure access to healthy food for all mankind; way to ensure the necessary food; the right of everyone to eat and eat as healthy as possible; way to ensure social, economic stability and national security [16].

Therefore, the issue of food security and how the world's population will be able to cope with hunger has been addressed over time in numerous papers. Thus in 1968, Paul Ehrlich shows that humanity has lost the ability to provide food for the world's population as a result of population growth. Although the world's population increased by 50% after 1961, the reality showed that agricultural production tripled, and among developing countries production increased fourfold due to the doubling of the population [14]. However, the share of people on the brink of poverty fell from 50% in 1950 to about 9% in 2020 amid the Covid-19 crisis, given that the percentage of extreme poverty in that year was expected to be 7.9%. The target set for 2030 is to reduce poverty to 7% [18].

Lomborg Bjørn points out in one of his articles that poverty and hunger depend less on climate change and more on economic, social or political aspects, because even if environmental change were to be stopped, this would have little influence reducing extreme

poverty. The application of nutrition programs, the use of vaccination programs, disease prevention, extension of education are considered effective measures that can be applied to vulnerable communities around the world [14].

Another cause of the food crisis is the increase in prices, and the reason for their increase is actually determined by several factors, which never act separately, but are interconnected and have the effect of threatening food security. First of all, the increase of the population will require the increase of the productions that will be able to cover the necessary food. Studies show that the world's population will reach from about 7.7 billion today to 10.9 billion people in 2100 [4]. And some measures, such as the decision to use agricultural land for energy crops, as a result of increasing fuel demand, have led to a decrease in areas for agricultural crops, which has continued to increase the prices of agricultural products. At the same time, agricultural production is influenced by climate change, which is the result of global warming. Another factor is the increase in income for a part of the world's population, which makes the need for food increase and with it the need for cultivated areas. It must be acknowledged that the policies applied in the agricultural field, the subsidy system of agricultural products have contributed to price distortions, and regarding food products, government policies influence both supply and demand.

On the other hand, the food crisis is correlated with the energy crisis, and the price of oil in turn influences food security. In terms of supply in the agricultural sector, Western governments have a small margin for action in the face of high consumer demand in the economy, and change can only be achieved through innovation and the application of new technologies that require high investment that poor countries do not have access.

But we are all responsible for this situation, because without thinking about the consequences, we have contributed to depleting resources and ensuring the comfort of the present generation, realizing late the need not to compromise future generations the possibility of ensuring their own needs [6].

Crises can have multiple causes, not only of an economic nature, but also of a medical nature, such as the current Covid-19 crisis, which has certainly influenced food security. This is the reason why in this paper we aimed to analyze in addition to the issue of food security and how it was managed in 2012-2019 and influenced by various factors. Or one of these factors is the Covid-19 pandemic. We also tried to identify solutions that could contribute to improving the current situation, realizing that the causes of food crises and food security instability are multiple, and better management will have favorable effects globally.

Food security, both micro and macro, will have to be considered in relation to certain parameters of food security, given that new categories of powers have emerged on the global policy scene that design both commercial and economic policies that capture certain food markets and which are represented by the food powers, whose importance is undeniable [2].

MATERIALS AND METHODS

In order to measure food security, different indicators have been taken into account that allow comparisons to be made between countries or regions, and which combined can provide an image that is intended to be as clear as possible regarding this concept. One of these is the Global Food Security Index, which tracks the four dimensions of food security, namely: accessibility; availability; quality and safety; natural resources and resilience [3]. At the level of 2019, this index was calculated for 107 countries of the world, starting from the evaluation of 132 countries. For 25 countries the data were not sufficient to determine the rank, being removed from the sample.

Another indicator is the Global Hunger Index (GHI), which was calculated by the International Food Policy Research Institute and uses four indicators: "the percentage of the undernourished population (UNHCR), the percentage of children under 5 years old who

suffer from stunting (low height-for-age), the percentage of children under 5 years old who suffer from wasting (low weight-for-height) (CWA) and the percentage of children who die before the age of five (child mortality) (CM) [12]. Other indices for measuring food security are: the index of health and hunger, the index of hunger and climate vulnerability, the Composite I-distance Indicator", etc., each of them being calculated according to different aggregate indicators, but all following the quantification of food security.

In this paper we aim to analyze the evolution of the Global Food Security Index at the level of EU member states for the period 2012-2019, as well as part of the aggregate indicators. The index can take values between 0-100, 0 being the value assigned to the countries that have the lowest gross values, and 100 for the countries with the highest gross values.

From 2017 in determining the indicator are taken into account elements related to the natural resource adjustment factor and resistivity, the calculation formula being:

$$Score=x*(1-z) + [x*(y/100)*z], \text{ [13]}$$

where:
x - initial score;
y - the score for the fourth component
z - adjustment factor.

The adjustment factor takes the values: 0; 0.5; 1. The default setting of the adjustment factor, according to EIU is 0.25, that is, 25% [17].

The calculation of accessibility to food is made in relation to 6 indicators, namely: food consumption per household, the percentage of the population below the global poverty line; GDP/capita, agricultural import tariffs, the presence of food security programs and farmers' access to financing programs.

Availability is determined on the basis of eight indicators, namely: adequacy of supply, public expenditure on agricultural research and development, agricultural infrastructure, the size of agricultural production volatility, risk to political stability, corruption, food waste and urban absorption capacity.

Measuring food quality and safety uses five indicators, namely: diet diversity; nutrition standards, protein quality, micronutrient availability and food safety.

The evolution of the indicators for the analyzed interval was determined using the Fixed Base Index (IFB):

$$IFB = (x_n / x_1) * 100, \text{ [1]}$$

where:
x = analyzed variable,
n = 1, 2, 3 ... n, the years that are part of the chronological series.

RESULTS AND DISCUSSIONS

The index that reflects global food security shows an improvement in the situation from one year to the next, although food insecurity and hunger still affect a large part of the globe.

Starting from the methodology presented, in this paper we aimed to analyze how the degree of food security has evolved in European countries, given that Europe is one of the regions where the risks of food security are low compared to other areas of the world. These comparisons will be the subject of further study.

At the EU-28 level, and since last year the EU-27, there are 8 countries that are not in the annual rankings of the Global Food Security Index (Table 1). For the other 20 states, the analysis was performed for the period 2012-2019.

We also followed some of the aggregate indicators that influence food security and are the basis for determining this index, given that food security has two strongly interrelated dimensions, one quantitative and one qualitative.

The quantitative dimension refers to the possibility of ensuring sufficient quantities of food to meet the physiological needs of the reference population, and the qualitative dimension refers to the properties of food consumed by the reference population and not to affect or endanger its health. Food insecurity, however, also refers to the categories of people who cannot afford a sufficient amount of quality food that can ensure their health and at the same time active

participation in society. Given the importance of food security, we believe that a collapse of this sector may result in the collapse of the entire security sector worldwide.

Table 1. Evolution of the Global Food Security Index in E.U. countries

Country	2012	2013	2014	2015	2016	2017	2018	2019
Austria	85.6	83.4	85.5	85.1	79.3	85.1	81.4	81.7
Belgium	82.2	82.4	82.0	79.5	77.4	79.5	80.7	80.7
Bulgaria	57.6	55.9	59.6	61.0	60.6	61.0	65.7	66.2
Cyprus	-	-	-	-	-	-	-	-
Croatia	-	-	-	-	-	-	-	-
Czech Republic	73.5	72.2	74.6	74.9	73.9	74.9	72.7	73.1
Denmark	88.1	81.8	83.3	82.6	80.0	82.6	80.4	81.0
Estonia	-	-	-	-	-	-	-	-
Finland	83.1	81.4	79.9	79.8	78.9	79.9	82.9	82.9
France	86.8	83.7	83.4	83.8	82.5	83.8	80.4	80.4
Germany	83.0	81.7	83.7	83.9	82.5	83.9	80.4	81.5
Greece	79.9	70.7	74.3	73.5	71.5	73.5	72.6	73.4
Hungary	70.7	69.0	71.2	71.4	69.3	71.4	72.6	72.7
Ireland	-	81.7	84.0	85.4	84.4	85.4	83.4	84.0
Italy	79.1	74.6	77.6	77.0	75.9	77.0	75.2	75.8
Latvia	-	-	-	-	-	-	-	-
Lithuania	-	-	-	-	-	-	-	-
Luxemburg	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-
Netherlands	86.7	83.2	84.4	85.0	82.6	85.0	81.5	82
Poland	72.5	69.9	72.7	74.3	72.4	74.3	74.9	75.6
Portugal	80.8	76.1	80.3	80.5	80.0	80.5	77.7	77.8
Romania	62.5	65.0	61.3	63.3	65.5	63.3	70.4	70.2
Slovakia	68.8	63.2	69.8	70.7	67.7	70.7	66.7	68.3
Slovenia	-	-	-	-	-	-	-	-
Spain	81.2	77.5	79.8	78.9	77.7	78.9	74.9	75.5
Sweden	80.2	80.8	82.4	82.9	81.3	82.9	82.5	82.7
United Kingdom	79.0	77.3	81.6	81.6	81.9	81.6	79.2	79.1

Source: own processing [12].

The data presented in Table 1 show that at the level of the European Union all countries are in the first half of the ranking for the entire period analyzed, which shows that at the Union level there are no serious problems raised by food security.

The data in Table 2 show how the components participate in determining the global food security index for European Union countries in 2019. Values over 75 points reflect favorable aspects, so we find that there are few countries with a global index below this value. Among these countries are Bulgaria with the lowest score (66.2 points), followed by Slovakia (68.3 points), Romania (70.2 points), Hungary (72.7 points) and Greece (73.4 points).

If among Bulgaria, Hungary and Greece, the decline in the index was influenced first by Availability and then by Quality and safety, in Slovakia and Romania Quality and safety had the greatest influence on the low value of the global food security index. Regarding Romania, it is found that the sufficiency of the offer has a score of 79.3 points. It measures the availability of food whose values are expressed in kcal/head/day, and also the level of customs duties on agricultural imports.

There are also indicators that register moderate values (agricultural infrastructure and the share of food expenditures in the total household expenditures.

Table 2. The global food security index in the E.U. in 2019

Country	Total Score	Accesibility	Availability	Quality and Safety
Austria	81.7	85.4	78.6	81.1
Belgium	80.7	84.4	76.2	83.9
Bulgaria	66.2	79.0	54.2	66.8
Cyprus	-	-	-	-
Croatia	-	-	-	-
Czech Republic	73.1	82.6	66.3	68.1
Denmark	81.0	85.4	74.8	87.2
Estonia	-	-	-	-
Finland	82.9	84.1	78.6	91.8
France	80.4	83.8	74.8	87.1
Germany	81.5	84.9	79.1	79.8
Greece	73.4	77.8	64.9	86.0
Hungary	72.7	80.8	66.1	70.5
Ireland	84.0	90.5	76.8	87.7
Italy	75.8	82.5	68.3	79.7
Latvia	-	-	-	-
Lithuania	-	-	-	-
Luxemburg	-	-	-	-
Malta	-	-	-	-
Netherlands	82.0	85.6	76.2	88.9
Poland	75.6	81.1	69.3	79.5
Portugal	77.8	81.3	70.9	88.0
Romania	70.2	79.3	64.3	64.1
Slovakia	68.3	78.6	62.1	59.4
Slovenia	-	-	-	-
Spain	75.5	82.3	65.9	84.7
Sweden	82.7	85.0	78.1	89.4
United Kingdom	79.1	83.6	74.4	80.9

Source: own processing [12].

On January 1, 2020, the population of the 27 states of the European Union was approximately 447.7 million inhabitants, registering a decrease of almost 13% compared to the previous year (513.5). This was also due to the United Kingdom's exit from the European Union, but also to net migration. These figures will continue to decline due to deaths caused by the Covid-19 pandemic.

Through the GDP/capita expressed in purchasing power (PPS) the living standard of the population is assessed.

The largest shares in the EU are owned by Germany (18%), France (15%), Italy (14%) and Spain (10%). At the opposite pole are countries such as Luxembourg and Malta with 0.1% each, Cyprus (0.2%), Estonia (0.3%) and Latvia (0.4%).

However, it is found that in terms of GDP, Luxembourg is in first place in the E.U. with a value of 261 thousand euros/capita, followed by the Netherlands (130 thousand euros/capita) and Sweden (120 thousand euros/capita), while Bulgaria has a GDP of 51 thousand euros/capita inhabitant, and Romania 66 thousand euro/capita.

Table 3. Key indicators in determining the Global Food Security Index in 2019

Country	Population (million inhabitants)	GDP/capita (Euro Thousand) (PPE)	Export of agro-products (Euro Million)	Import of agro-products (Euro Million)
Austria	8,901	128	13,046	13,121
Belgium	11,549	118	40,961	33,833
Bulgaria	6,951	51	4,838	3,673
Cyprus	0,888	91	417	1,142
Croatia	4,058	64	2,087	3,306
Czech Republic	10,693	92	7,612	9,533
Denmark	5,822	129	16,160	10,622
Estonia	1,328	82	1,174	1,507
Finland	5,525	112	1,996	5,198
France	67,098	104	65,690	52,436
Germany	83,166	123	76,394	91,195
Greece	10,709	67	6,039	6,832
Hungary	9,769	71	9,494	6,365
Ireland	4,963	191	13,604	9,272
Italy	60,244	97	44,757	40,314
Latvia	1,907	69	2,886	2,835
Lithuania	2,794	82	4,934	3,694
Luxemburg	0,626	261	1,200	2,390
Malta	0,514	99	128	575
Netherlands	17,407	130	93,652	63,111
Poland	37,958	71	29,573	19,332
Portugal	10,925	78	6,322	9,308
Romania	19,318	66	7,196	8,379
Slovakia	5,457	71	2,907	4,735
Slovenia	2,095	87	2,156	2,980
Spain	47,330	91	48,985	31,508
Sweden	4,385	120	5,677	11,855

Source: own processing [10].

Analyzing the situation of imports and exports of agricultural products in the European Union, we find that the highest value of imports is recorded in the Netherlands, with over 93 billion Euros, Germany with over 67 billion Euros exports and France with about 66 billion Euros. In terms of exports, the highest value is recorded by Germany with over 91 billion Euros, followed by the Netherlands with 63 billion Euros and Italy with 40 billion Euros exports.

The surplus of the trade balance with agricultural products has high values in countries such as the Netherlands (+30,541 million Euros), Spain (+17,477 million Euros), France (13,254 million Euros).

There are also countries with a moderate surplus such as Belgium (+7.128 million Euros) or Bulgaria (+1.165 million Euros).

But there are also countries such as Germany with a deficit of 14.801 million Euros or Finland with a deficit of 3.302 million Euros. Romania also registers a deficit of the trade balance with agricultural products of 1.183 million Euros.

At European Union level, sufficient food security is due to its agricultural potential. At the same time, however, the countries of the European Union also contribute to ensuring food security in other areas of the world through food exports, both raw and processed foods.

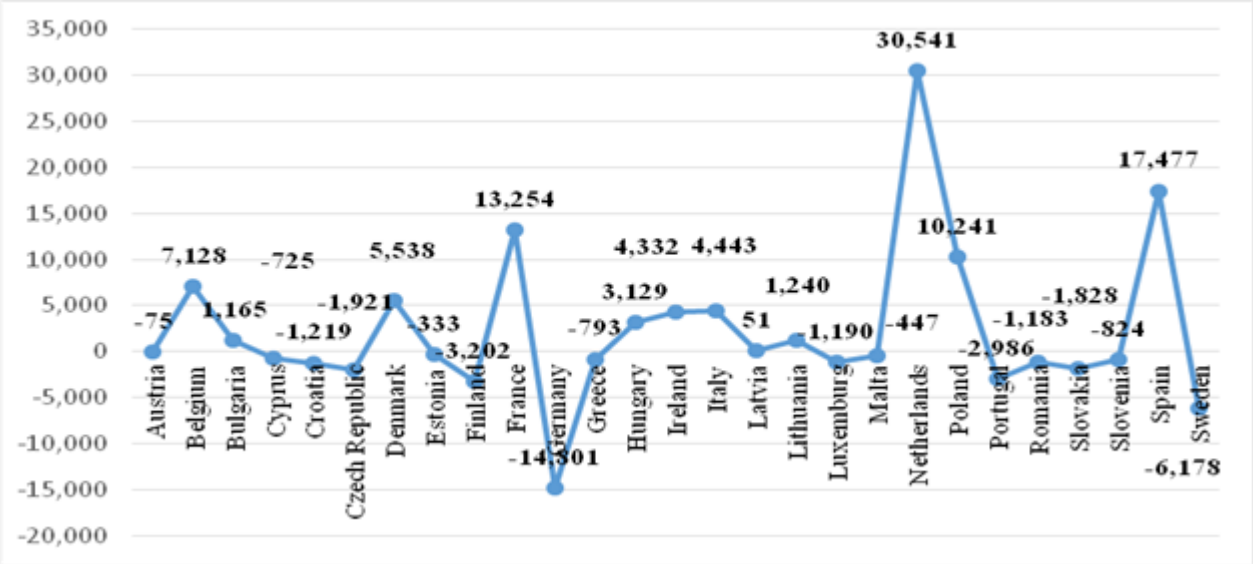

Fig. 1. Trade balance of agricultural products in the European Union countries, in 2019
Source: own processing [7].

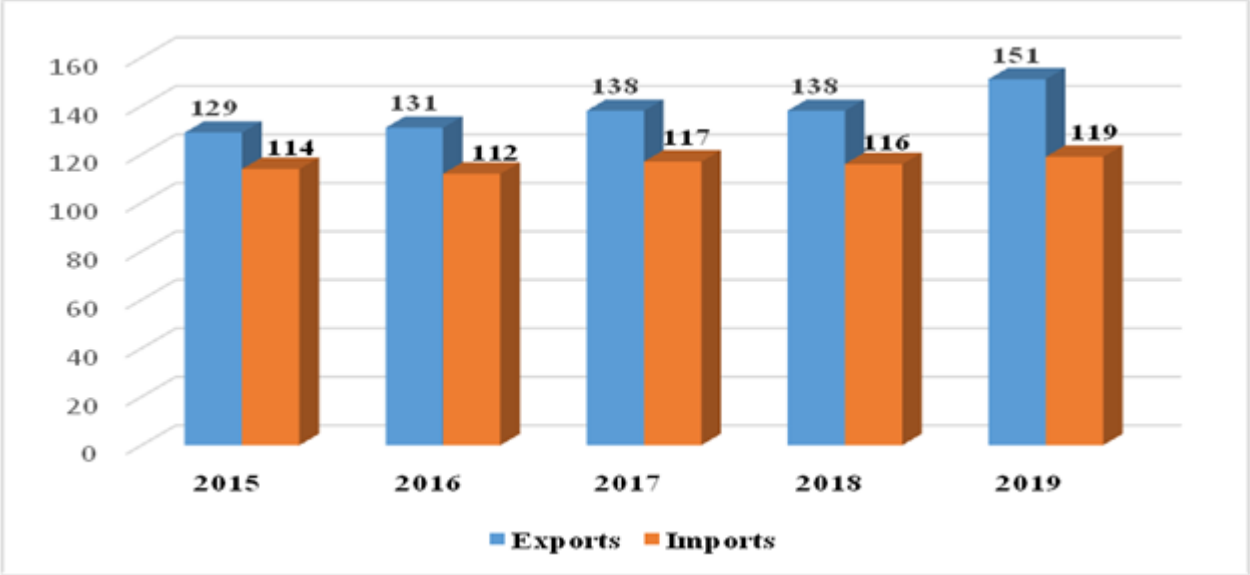

Fig. 2. The situation of exports and imports in the European Union, in the period 2015-2019
Source: own processing [8].

Since 2010, the European Union has become a net exporter and has maintained this position ever since. In 2019, the value of food trade in the Union registered the highest value, namely 270.5 billion Euros, increasing compared to 2018 by 6.4% when it had a value of 254 billion Euros. Increases were recorded both in terms of exports (151 billion Euros) and in terms of imports (119 billion Euros). The evolution of food trade for the last five years is shown in Figure 2, resulting in the European Union being the largest exporter of food in the world, and at the same time occupies the second position in the world in terms of imports. This is due to the effects of the CAP which supports competitiveness and innovation, the fact that farmers are supported and encouraged to export, but also to quality products. Besides the value of the sold production, these activities are generating jobs both for the primary activities and in the processing sectors.

The value of exports of agricultural products increased by 7.6% in 2019 compared to the previous year and by 14.3% compared to 2015. By product categories it is found that the value of "agricultural food and feed products" increased by 2% in 2016 compared

to basic, by 6% in 2017 and by 5% in 2018. In 2019, the increase was almost 14%. The value of "food preparations and beverages" had the largest increase. In 2019, compared to 2015, it was 20%, and compared to 2018 almost 7%.

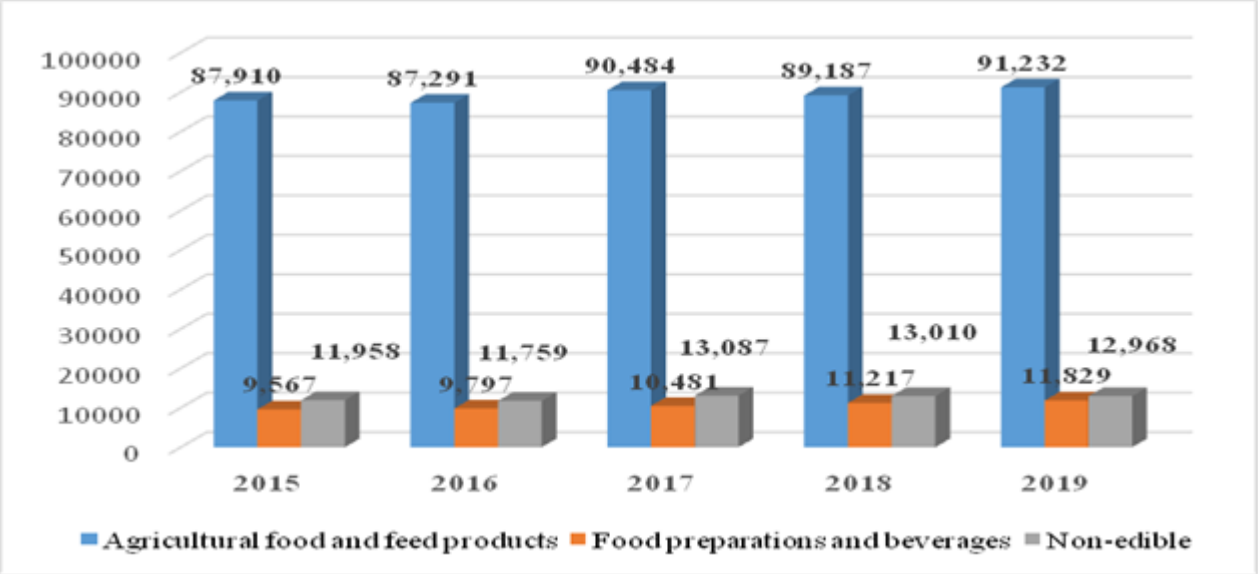

Fig. 4. Evolution of Agri-food exports in the European Union, by product categories
Source: own processing [8].

The value of imports had a lower growth rate than that of exports. Thus, in 2019 the increases compared to 2015 were 4% for agricultural food and feed products, 24% for food preparations and beverages and 8% for non-edible.

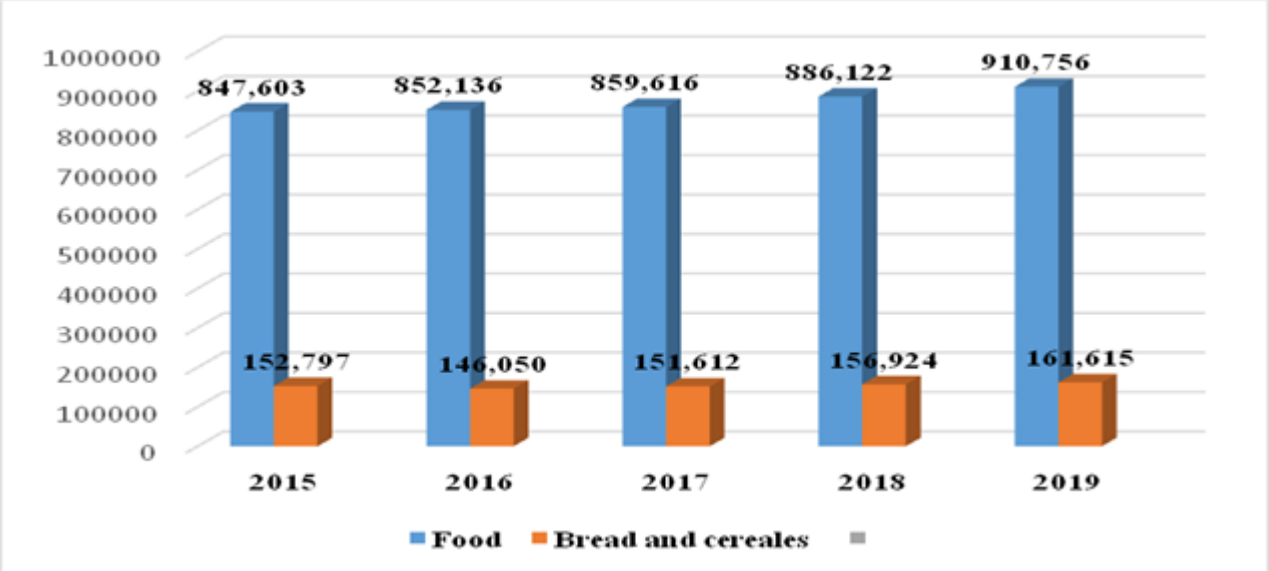

Fig. 5. Evolution of consumer price indices, by aggregate, in the E.U.
Source: own processing [11].

Price level indices, at purchasing power parity (PPP), for food, and bread and cereals highlighted the increase in purchasing power for food products by 7% in 2019 compared to 2015 and by 6% for bread and bakery products. In terms of bread and bakery products, the average price in the U.S. it was twice as high as in Romania, which is the country with the lowest price for bread. In Denmark (151), the country with the highest price for bread and bakery products, the price is three times higher than in Romania (53).

The analysis shows that Europe is not one of the areas whose food security is threatened, given that globally, for 2019, 55 countries have been identified that have faced problems related to food security as a result of chronic problems related to poverty, military conflicts, drought or extreme phenomena [12]. Of the total 690 million inhabitants, however, about 19% had the problem of providing food as a result of the Covid-19 pandemic.

At the level of the European Union, however, measures have been taken to protect disadvantaged groups that have provided assistance, but also food, clothing or essential items for personal use and that supplement social inclusion measures to help people out of poverty.

Measures have also been taken to support agriculture and the food sectors to provide food. These measures consisted of aid for private storage in the dairy sector and in the meat sector; greater flexibility of market support measures; granting temporary E.U. derogations from competition for certain product categories (potatoes, milk, or flowers) [9].

Measures have also been taken to ensure the mobility of seasonal workers to the Member States of the European Union where there have been critical situations related to the agricultural sector or the functioning of the single market which have led to the creation of special green lanes at the border agri-food products. And yet, globally there are concerns about ensuring food security, among its causes being: the global collapse in demand for agri-food products, declining revenues, a significant part of them from remittances, reduced market access for both sellers, as well as of the buyers, etc.

CONCLUSIONS

The issue of food security is a complex one, and its management requires a correlated effort globally. Access to food is limited on the one hand by income disparities, and in terms of food use the problems appear both in the situation of under-production and in the situation of over-production, so ensuring food security requires a unified approach to food systems. A correct correlation of demand and supply given that the challenges related to demand are nutrition and health, and in terms of supply are related to agricultural production.

In conclusion, we consider that the agricultural field represented, but will continue to represent an area of strategic importance and that will be directly related to national security, given that it will be necessary to ensure a basic consumption for its own population.

Under the conditions of ensuring an equitable distribution of food products, both the global food risk and the environmental risks would be reduced. Thus, the controlled exploitation of agricultural land or the reduction of economic migration could be measures that could contribute to ensuring food security.

Although food security is an important issue globally in European Union countries, this risk is low and affects only certain vulnerable social groups.

The countries of the European Union are in the first half of the world ranking in terms of ensuring the Global Food Security Index, this being influenced by the production capacity of the agricultural sector.

Although the food sector has faced some difficulties related to the supply of raw materials, labor or logistics, at the European Union level this sector has remained resistant to the Covid crisis - 19 succeeding in providing food for its citizens.

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AGROECOLOGY: A REAL OPPORTUNITY TO FIGHT AGAINST THE CLIMATE CHALLENGES

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Abstract

Weather changes significantly affect people's lives. Climatic data recorded so far indicates a progressive warming of the weather. Agriculture is one of the most affected branches due to its dependence on the evolution of the weather throughout the entire plants growing season. Agroecology can be one of the correct and concrete answers to the challenge of climate change, as this type of agriculture respects the natural balance of Earth, reducing human impact as much as possible. The current research presents the situation of agroecology in our country, as well as the evolution of organically grown crops areas. Although over the last 10 years, in Romania, the trend has fluctuated slightly with both decreases and increases, starting with 2017 the evolution of organic cultivated areas follow a positive trend. Organic farming follows the same positive trend in European Union and also worldwide. As concerns the types of organic crops grown in Romania in 2019 the largest area is occupied by cereals (32.09%), followed by permanent crops of meadows and hayfields (29.2%), then by industrial crops (19.82%). The smallest ratios of organically cultivated areas are represented by tuberous and root plants, as well as vegetables. Wheat is the most widespread crop, followed by maize, sunflower and barley. Other organic crops in our country, but cultivated on smaller areas, are rye, triticale, oats, rice, soybeans, potatoes and sugar beets. The increase of the surfaces on which the agroecology extends corresponds to the necessity of the humanity to return to the natural state, just how agriculture was from its beginnings, in order to slow down the climatic changes.

Key words**:** *agroecology, climate change, global warming, organic farming, resistant cultivars*

INTRODUCTION

Climate change restricts favourable areas for agriculture, imposes radical changes in farming systems, in crop technologies and animal husbandry, and also in plant and animal genotypes [6]. The effects of climate change are significantly reflected in the air temperature changes and in the rainfall quantity and distribution. Therefore the growth and development of agricultural crops are more and more affected. Among the phenomena abovementioned other evidence of global warming are the melting glaciers and snow, occurrence of extreme meteorological phenomena, raising the level of sea and ocean etc. [9]. Thus, climate change is a major challenge for the agricultural sector, ensuring water resources and crop stability being the main priorities in the actual context [12]. Current climatic conditions as well as future forecasts indicate that all regions of the world will be affected by global warming [12], [16]. The following question arises: does agriculture contribute to global warming or does climate change affect agriculture? It is critical to know the correct order to be able to act correctly. It seems that intensive agriculture is one of the sectors that generate the largest amount of CO_2 and methane, the main greenhouse gas, one of the most important accelerating factors of the global warming. In a communication from the European Commission on an EU strategy to reduce methane emissions, it was reported that 53% of methane emissions comes from agriculture, 26% from waste and 19% from the energy sector. Methane emissions from

agriculture come mainly from animals especially from the ruminant species due to enteric fermentation (80.7%), from manure management (17.4%) and rice cultivation (1.2%) [3].

The Food and Agriculture Organization (FAO) believes that agroecology can be one of the correct and concrete answers to the challenge of climate change, as this type of agriculture respects the natural balance, reducing human impact as much as possible [5]. In a 1982 publication, the author emphasizes the simplest truth 'agriculture has been ecological since its beginnings' [7]. Therefore, humans must return to it.

The main rules of agroecology include environmental protection, maintaining and increasing soil fertility, respect for consumers' health, recycling materials and resources, maintaining biodiversity, obtaining not maximum, but optimal crop yield, apply of appropriate agrotechnical measures etc. [8]. Also, to reduce the impact of weeds and pests, choosing genetically resistant varieties of crops is an essential condition for the organic farming [2]. A great significance for the realization of this desideratum has the plant breeding science; breeding new genotypes is an efficient way to adapt to environmental conditions and, as a result, to climate change [17]. From this point of view, it can be stated that agroecology is dependent on the plant breeding science in the fight against the challenges of climate change.

Considering the above context, the present paper aims to present the situation of organically grown crops in our country, as well as their evolution over the years, given the importance of how this type of agriculture could slow down the effects of climate change.

MATERIALS AND METHODS

Data presented in this research were accessed from databases and reports of Research Institute of Organic Agriculture, Ministry of Agriculture and Rural Development and National Meteorological Agency and for a higher accuracy were statistically represented using the program Microsoft Excel, version 2010.

RESULTS AND DISCUSSIONS

This section presents the evolution of the areas cultivated with organic crops in Romania and also the climate changes that our country is going through, considering the close connection between them.

Climate changes in Romania

According to the National Meteorological Agency [13], Romania's climate is temperate-continental of transition, marked by some oceanic, continental, Scandinavian-Baltic, sub-Mediterranean and Pontic climate influences, depending on the latitude and longitude of the areas. Climatic nuances are also manifested on the altitudinal steps, in the mountain massifs of the Carpathian arc being present the cool mountain climate, with high humidity throughout the year. Geographical position of Romania in Europe can be noted in Map 1.

Map 1. Romania on the map of Europe
Source: [15].

In our country, the average multiannual air temperature has increased in 33 years, since 1981 by 0.5ºC (Figure 1), but still less than the global average of 0.85ºC recorded in the last 100 years [12], [16]. If we report to the coldest and warmest month of the year, January and July, in the last 33 years the temperature has increased more in the coldest month of the year (+1.3ºC) than in the warmest one (+0.8ºC).

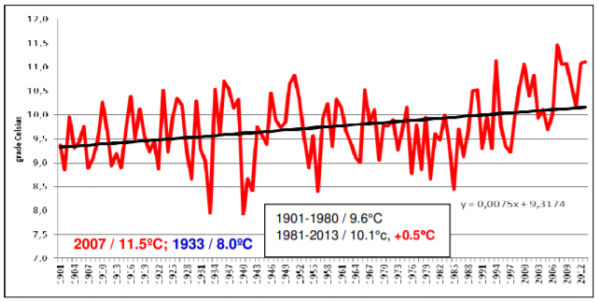

Fig. 1. Average annual air temperature in Romania (1901-2013)
Source: [12], [16].

Regarding the rainfall regime, there was a decrease in annual quantities from 1901 to 1980 (638.2 mm) compared to the period 1981-2013 (627.0 mm) (Figure 2).

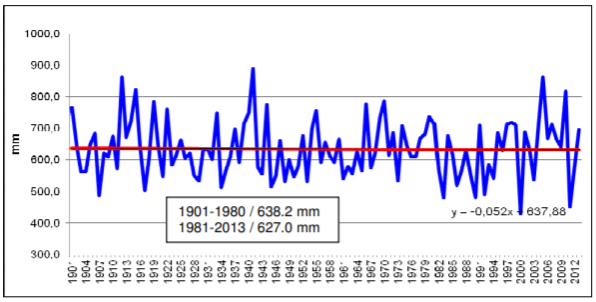

Fig. 2. Average annual rainfall in Romania (1901-2013)
Source: [12], [16].

Analysing the climatic data recorded so far, can be noted the progressive warming of the weather. Along with this warming, there is an increase of extreme phenomena and also in the alternation between severe drought and heavy rainfall [16]. All these effects of global warming are a dangerous source of stress for the plants; therefore the agricultural crops yield can be severely affected, with dramatic losses.

A climate change scenario for Romania up to 2075 was built based on double carbon dioxide atmospheric concentration [1]. According to the script, the mean of annual temperature for the South of Romania is expected to increase between 3.9ºC and 4.4ºC with extreme variations in the monthly rainfall regime between -47% and +81% and in their distribution throughout the entire year; it is considered that the most frequent precipitations will fall in autumn and winter, and the lowest in summer.

Besides field crops, global warming also can have negative influence for the livestock sector, on animal health, animal reproduction or productive performance [11]. Climate change involves the reduction of greenhouse gas emissions and adapting ecological systems. In the current situation of climate change, agroecology seems to be indispensable.

Organic agriculture in Romania, European Union and worldwide

In our country, organic agriculture was officially recognized in 2000 by the government emergency ordinance (GEO) no. 34 from April 17 [8]. Even if over the years, this type of agriculture has occupied more or less areas, in the last time there has been an increase in organically grown surfaces from our country. The evolution of Romanian cultivated areas with organic crops can be analysed in Figure 3. Although over the last 10 years, the trend has fluctuated slightly with both decreases and increases, starting with 2017, the evolution follows a positive trend.

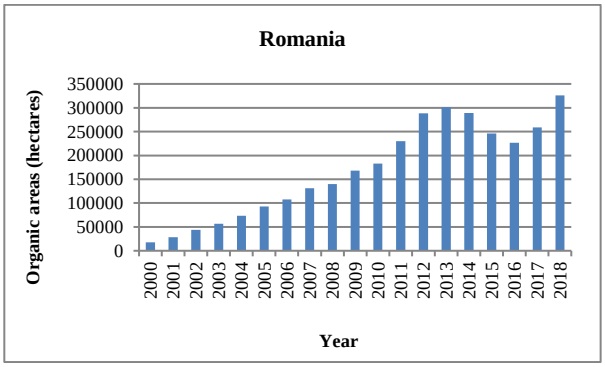

Fig. 3. Evolution of organically cultivated areas in Romania between 2000 and 2018
Source: Own calculation on the basis of data from FiBL Statistics online data base 2005-2018, Research Institute of Organic Agriculture [14].

As concerns the types of organic crops grown in Romania in 2019 (Figure 4), the largest area is occupied by cereals (32.09%), followed by permanent crops of meadows and hayfields (29.2%), then by industrial crops (19.82%). The smallest ratios of organically cultivated areas are represented by tuberous and root plants, as well as vegetables.

The ecologically cultivated species with the largest spread in our country are presented in

Figure 6, where it can be noted the evolution of their areas between 2005 and 2018.

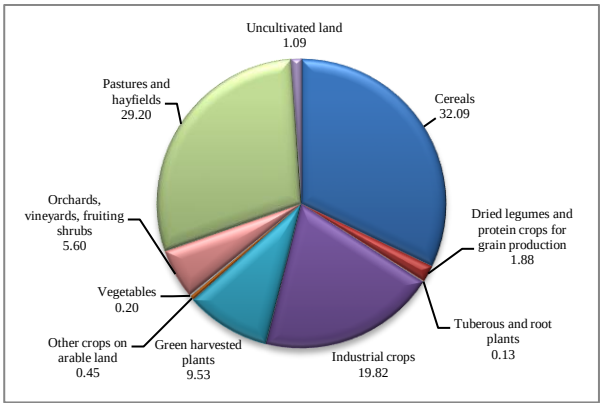

Fig. 4. Percentage distribution of organic crops from the total cultivated area in 2019
Source: Own calculation on the basis of data from MADR report 2010-2019, Dynamics of operators and areas in organic farming [10].

In our country wheat is the most widespread ecological crop, followed by maize, sunflower and barley. Other organic crops but cultivated on smaller areas, are rye, triticale, oats, rice, soybeans, potatoes and sugar beets [14].
During 2005-2018, the highest spreading of the organic areas vas recorded for the maize crop (Table 1).

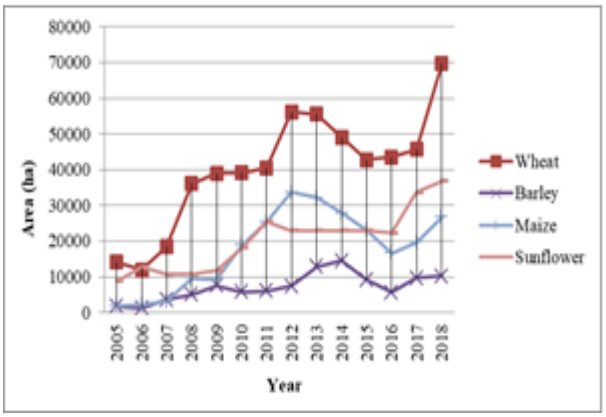

Fig. 5. Organic cultivated areas for the main crops from Romanian agroecological system
Source: Own calculation on the basis of data from FiBL Statistics online data base 2005-2018, Research Institute of Organic Agriculture [14].

Table 1. Progress of ecological crops areas

	Wheat		**Maize**		**Sunflower**		**Barley**	
Year	Hectares	%	Hectares	%	Hectares	%	Hectares	%
2005	*14,095*	*100*	*1,890*	*100*	*8,864*	*100*	*1,750*	*100*
2006	11,965	85	2,217	117	12,717	143	1,278	73
2007	18,417	131	3,178	168	10,704	121	3,673	210
2008	36,137	256	9,523	504	10,701	121	4,982	285
2009	38,979	277	9,364	495	11,714	132	7,610	435
2010	39,160	278	18,869	998	18,161	205	5,840	334
2011	40,529	288	25,386	1,343	25,490	288	5,999	343
2012	56,151	398	33,759	1,786	22,915	259	7,469	427
2013	55486	394	32,199	1,704	22,910	258	12,900	737
2014	49,060	348	27,860	1,474	22,915	259	14,519	830
2015	42,854	304	23,137	1,224	22,910	258	9,215	527
2016	43,495	309	16,643	881	22,372	252	5,689	325
2017	45,687	324	19,671	1,041	33,712	380	9,670	553
2018	69,684	494	26,745	1,415	36,870	416	10,237	585

Source: Own calculation on the basis of data from FiBL Statistics online data base 2005-2018, Research Institute of Organic Agriculture [14].

Compared to the reference year 2005 the cultivated area has grown by fourteen times. We considered 2005 the reference year because the appearance of pre-accession funds for Romania stimulated the cultivation of the organic crops. Among maize, also the area cultivated in ecological regime with barley grew almost 6 times, the area cultivated with wheat almost five times, and the area cultivated with sunflower more than 4 times.

In a study developed by some researchers of the National Institute of Meteorology and Hydrology and of the Institute of Geography that aimed inter alia the evolution of wheat and maize crops from our country in the context of the global warming approached scenarios, maize crops from the South of Romania looks like will be the most affected by climate changes compared to wheat [1].

Due to predictions and considering the huge importance of corn for the daily life of humans, but also for animals, special attention must be paid to this crop by creating resistant hybrids to the alternation of climatic factors, and also with a good capacity to adapt to less favourable environmental conditions, suitable for organic cultivation.

When compare the growth trend of organically cultivated areas in our country, with the trend in the European Union (Figure 6A) or even worldwide (Figure 6B), it can be noted the same increase in areas allocated to the organic farming system, which demonstrates its effectiveness if not in stopping, at least in slowing down climate changes.

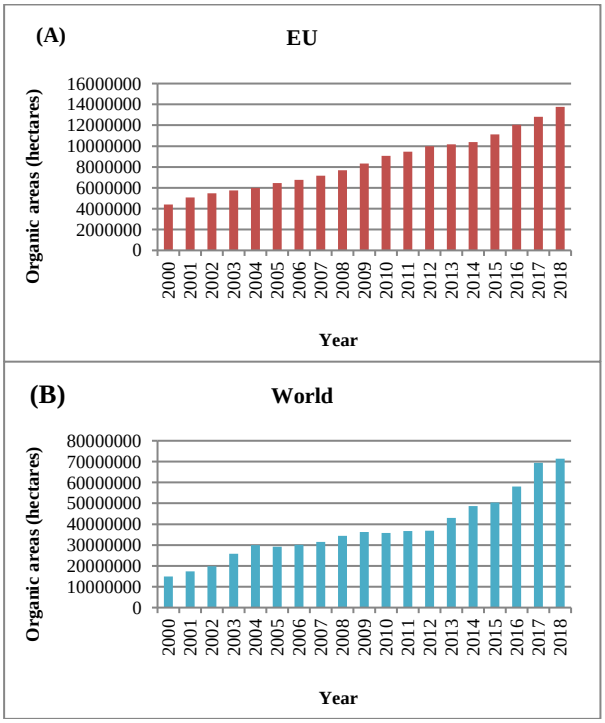

Fig. 6. Evolution of organically cultivated areas between 2000 and 2018 in: (A) European Union; (B) Worldwide

Source: Own calculation on the basis of data from FiBL Statistics online data base 2005-2018, Research Institute of Organic Agriculture [14].

In order to have a real overview of agroecology spread is absolutely necessary to know the percentage of organically cultivated areas out of the total arable areas (Figure 7).

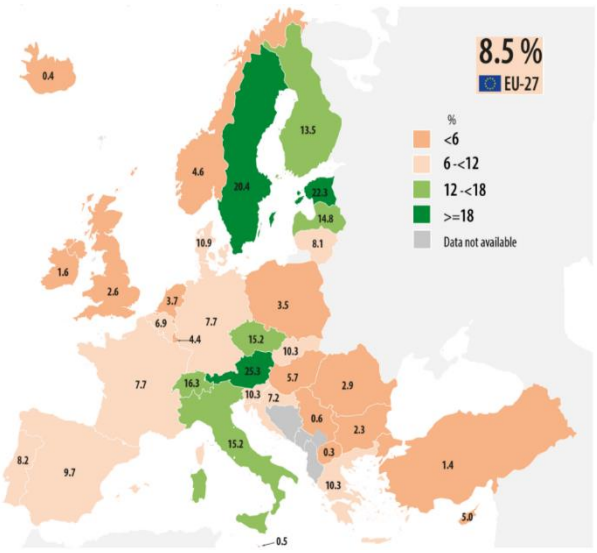

Fig. 7. Agroecology area in European Union (2019) (% of organic area in total utilised agricultural area) Source: [4].

Romania is part of the group of countries with the smallest areas for organic crops (2.9%), but given the upward trend in the evolution of ecological surfaces from the last years, this could improve over time. At the forefront of states that have allocated largest areas for organic crops are Austria (25.3%), Estonia (22.3%) and Sweden (20.4%). Thirteen countries exceed the average of 8.5% organic area from the total EU agricultural land.

According to EUROSTAT the total area of agroecology in the EU continues to increase, and reached to almost 13.8 million hectares of agricultural land in 2019 [4]. The increase of the surfaces on which the agroecology extends corresponds to the necessity of the humanity to return to the natural state, just how agriculture was from its beginnings, in order to slow down the climatic changes.

CONCLUSIONS

In Romania over the analysed years, organic crops have recorded ups and downs but in recent years they have experienced only

upward trends, the organic areas being more and more extensive. Same trend can be noticed in the European Union and worldwide. The largest organic area in our country is occupied by cereals (32.09%), followed by permanent crops of meadows and hayfields (29.2%), then by industrial crops (19.82%). The smallest ratios of organically cultivated areas are represented by tuberous and root plants, as well as vegetables. Wheat is the most widespread ecological crop, followed by maize, sunflower and barley. Other organic crops but cultivated on smaller areas, are rye, triticale, oats, rice, soybeans, potatoes and sugar beets. The highest increase of the organic areas over the years was recorded for the maize crop (1,400%). Even if Romania is part of the group of countries with the smallest areas for organic crops (2.9% from the total agricultural land), given the upward trend in the evolution of ecological surfaces from the last years, this could improve over time. At EU level total area of agroecology reached to almost 13.8 million hectares of agricultural land in 2019 and continues to increase. The extension of organic agriculture on larger and larger areas to the detriment of intensive agriculture is one of the greatest possibilities the humanity has to fight against the climate challenges.

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THE IMPACT OF ECONOMIC FREEDOM ON CORPORATE INSOLVENCIES IN THE EUROPEAN COUNTRIES

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Abstract

Governments constantly try to improve the macroeconomic environment for the business so that the country should attract good investment and it should grow economically. It means the policies of the government directly effects the businesses. Government policies may be designed to provide the economic freedom or it may be strict to bind the firms into different rules and regulations. However, studies have empirically confirmed that economic freedom positively leads towards firm's growth, and ultimately, to firm's stability. Moreover, studies have also found the negative correlation between economic freedom and business activity. Still, insignificant attention has been given to the correlation between economic freedom and the actual insolvency. Thus, this study will try to bridge this gap in two ways. Firstly, it will help theoretically by providing the insights into the relation between economic freedom and firms' insolvency in different economies of Europe including developing and developed economies. Secondly, it will help practically the economic policy makers to determine the influence of economic freedom on number of firms' insolvency

Key words**:** *corporate insolvencies, economic freedom, developing and developed economies, bankruptcy*

INTRODUCTION

In most European countries, the economy has evolved insignificant in recent years. In particular, business has been affected by trade disputes (involving in particular the US and the lack of clarity on Brexit). These aspects made the national economies of Europe much more susceptible to external shocks such as Pandemic Crown [19].

Thus, the issue of bankruptcy becomes a pressing one during the COVID 19 pandemic, when an enormous number of companies, practically all over the globe, were forced to cease their activities.

Corporate insolvencies has a bad impact on shareholders, employees, customers, creditors, and other stakeholders. Therefore, the ability of calculating and assessing the impact of factors on number of bankruptcies of a country is a benefit for all type of external and internal users. Counting on the evaluation and identification of environment factors on levels of corporate insolvencies, EU may take some "corrective action in time in order to work up on the European framework for restructuring and bankruptcy management".

Thus, it is important to determine the causes of the corporate insolvencies increase at the level of the U.E.

Economic Freedom is associated with business activity and the high level of economic freedom has a positive impact on economy of any country. Thus, a country's level of economic freedom show in what direction the number of corporate insolvencies will change.

This study starts with some vague results in the literature regarding the economic freedom and corporate insolvencies. Bjørnskov (2016) demonstrates that countries ranking lower in economic freedom bear slower recovery and

more severe drops from external economic crises [3]. The question comes – do economically free countries operate better with bankruptcy phenomena? Several reasons can justify why economically free countries may register less number of bankruptcies. Firstly, economically free countries have a more substantial intellectual class [16].

Next, these countries are more entrepreneurial and can develop new activities to face with corporate insolvencies [12]. Third, economically free countries positionate high in government integrity [7].

Many governments have invested billions of dollars in the social field in order to help recently laid off employees, keep small entities, and fund research. Economically free countries are likely to lower number of corporate insolvencies and quickly hasten recovery of their economies.

In this context, in this work, we will analyze one of the general environmental factor that influence on number of corporate insolvencies in a transnational analysis perspective. A correlation-regression analysis are to be "performed on a sample of 32 countries during 2013-2019".

The results show that the increase in economic freedom "diminishes the number of corporate insolvencies". Such aspects as innovation, entrepreneurial, or government integrity help the governments to minimize the problems from bankruptcies.

This research enriches the literature by demonstrating that a country's economic freedom influences the number of corporate insolvencies because free countries respond to such economic problems better than unfree countries.

Literature review

Studies in the field of a company's insolvencies are relevant with a design to improve the insolvency proceedings. In developed countries, the researches on determining bankruptcy date back to the early '20s. The first study was launched in the United States. At the beginning, researchers used simple indicators or financial rates in order to distinguish between insolvent and solvent entities. Beaver (1966) was the first economist that used statistical methods in order to predict the bankruptcy risk [2]. In 1968, Altman created one of the best known and the first bankruptcy prediction model, known as the "Z score"[1]. Since then, the number of bankruptcy assessment models has increased. In the 1970s, more than 28 studies on bankruptcy prediction models were published; over 53 studies were published in the 1980s; and in the 1990s more than 70 studies were published [14]. Thus, in 2018, Cândido Peres and Mario Antão "counted 123 different models of bankruptcy risk prediction". The most researched countries in this field, or those with the largest number of published works in bankruptcy prediction, "are the United States (30), the United Kingdom (21) and Spain (16) with approximately 24%, 17% and 13% of the total, respectively" [15]. In the countries of Central and Eastern Europe, because of the geopolitical situation, and the economic system, this subject of research started to be investigated only in the 1990s. At first, in majority of Central and Eastern European countries were utilised models of developed countries to evaluate the bankruptcy risk. Then, were performed more complicated investigations based "on the analysis of general environment factors influence on levels of bankruptcies" [13].

M. Costin and A. Miff (2000), as well as other authors determined that the etymology of the term "bankruptcy" indicates its origin in Latin, from the word "fallo-fallere", translated as to lack, to escape - in the sense that the bankrupt does not fulfill his obligation to pay his creditors, but also having the meaning in Latin to deceive [4].

The term was taken over in Italian under the name of fallere, in the sense of making a mistake, to stop a payment and the name "falimento" (in German - bankruptcy) [9], which translates as bankruptcy, error, mistake and even deception. The insolvent trader was called falito in Italian, a term taken in Romanian under the name of faliment (person who is in bankruptcy; insolvent person; who is in a disastrous situation, who has suffered a total failure), in French it is called failli, in Spanish - fallido, and in English - failure and bankruptcy. However, the terminology has the

same meaning: it designates bankruptcy - a legal institution that regulates the manner of forced execution of the assets of the merchant debtor in a state of cessation of payments. That is, as a rule, the state of affairs of the trader who has ceased payments for his trade debts is called bankruptcy. By the same term, the legal status of the trader against whom a declaratory bankruptcy sentence has been pronounced is designated.

So, some of the terms that are often used in the bankruptcy literature are: *failure, insolvency and bankruptcy*. These terms are sometimes used interchangeably (as in the case of respective article), although formally each of them can be defined in a different way, e.g.

- *failure* can be defined as the inability of a business to continue, especially due to lack of money,
- *insolvency* indicates that the company's net assets have a negative value, and / or failure to perform a required thing (for example, failure to perform a contract, such as payment of someone's debts), and
- *bankruptcy* refers to the official declaration of bankruptcy of a company.

Therefore, dealing with the issue of bankruptcy is not a novelty for economics, but the attention it enjoys from specialists lately is special.

MATERIALS AND METHODS

Variables and data sources

The main goal of our research constitutes in the control of the correlation between the level of economic freedom and the number of corporate insolvencies in a country.

The number of Corporate insolvencies was picked from the Creditreform study (Creditreform study: Corporate insolvencies in Europe, 2017, 2018 and 2019 [5, 6].

Economic freedom can be measured through tree indices which are:

1. Economic Liberty Index (EL),
2. Economic Freedom of the World Index (EFW),
3. Index of Economic Freedom (EF).

We have selected Index of Economic Freedom (EF) given by Adam Smith. It is calculated with the help of 12 quantitative and qualitative indicators that are grouped into four large categories:

1. Rule of Law (Government Integrity, Judicial Effectiveness, Property Rights),
2. Government Size (Tax Burden, Fiscal health, Government Spending),
3. Regulatory Efficiency (Labour Freedom, Monetary Freedom, Business Freedom),
4. Open Markets (Investment Freedom, Financial Freedom, Trade Freedom).

The economic freedom index scales from 0 to 100 - 100 is the highest degree of economic freedom and 0 the least level of economic freedom. “The Index covers 12 freedoms – from property rights to financial freedom – in 184 countries”. This index was used by other researchers in their studies [17] and [3] in order to present the level of economic freedom of a country. The variables and their data sources that are analyzed in the model are summarized in Table 1.

Table 1. Variables and data sources

Variable Name	Description	Source
Corporate insolvencies (CI)	Represent the number of total liquidated business of a country	Creditreform study: Corporate insolvencies in Europe, 2017, 2018 and 2019
Economic freedom variable (EF)	It ranges from 0 to 100 100 is the maximum degree of economic freedom 0 - the least economic freedom	The Heritage Foundation

Source: elaborated by authors.

The research hypothesis of this research is:

• ***H1*** *= A country ranking high in economic freedom is associated with a lower number of bankruptcies;*

Considering the proposed goal and hypothesis, the methods were used: data collecting, data processing, empirical analysis, and panel analysis.

The data of 32 countries:

- 17 countries of Western Europe

- 15 countries of Central and Eastern Europe, over the period 2013-2019.

Methods

In order to determine the correlation between economic freedom and corporate insolvencies, it is necessary to create a model combining the influence of economic freedom on corporate insolvencies. For this effect, the correlation-regression analysis was utilized. This method allows evaluating the influence of risk factors or confounding variables on the resultant variable and the level of correlation between the dependent variable and the independent variables.

Correlation-regression analysis shows the level of the dependent variable changes according to the modifications of one or more independent variables. Due to the fact that each economic phenomenon is influenced by a great number of factors, in majority cases, multifactorial models are utilized. This aspect allows us quantitatively determine the form and intensity of the correlation between the output and the factors of influence (x_1, x_2, …, x_k). Thus, the next factorial equation model will be analyzed:

$$y_i = a_0 + a_1 x_{1i} + a_2 x_{2i} + ... + a_k x_{ki} \quad ,(1)$$

where:

a_0 – the capture point of the regression line and the y-axis;

a_1, a_2, … a_k – the regression coefficients showing the mean change in the endogenous characteristic y caused by the modification of the exogenous characteristic x_k by a unit, with the condition that the influence of the other factors of the mathematical model is taken into consideration and fixed at the average level;

x_1, x_2, … x_k –independent variables.

The coefficient of determination (R) shows the qualitative correlation between endogenous and exogenous characteristics in this model. The closer the value of this coefficient to 1, the tighter the correlation between the characteristics.

This research sample consists of 32 countries (25 developed and 7 developing countries) (M = 32) in the period 2013-2019 (t = 7). The research included 15 countries of Central and Eastern Europe and 17 countries of Western Europe. In the process of multifactorial model elaboration, to determine the influence of factors on the modification of the output indicator, was taken into consideration that *y* reflects "the number of corporate insolvencies of a country (CI)"; and the influence of the causal variable on corporate insolvencies is represented by x_1 - Economic Freedom (EF).

Thus, the correlation between corporate insolvencies and economic freedom can be seen in Figure 1.

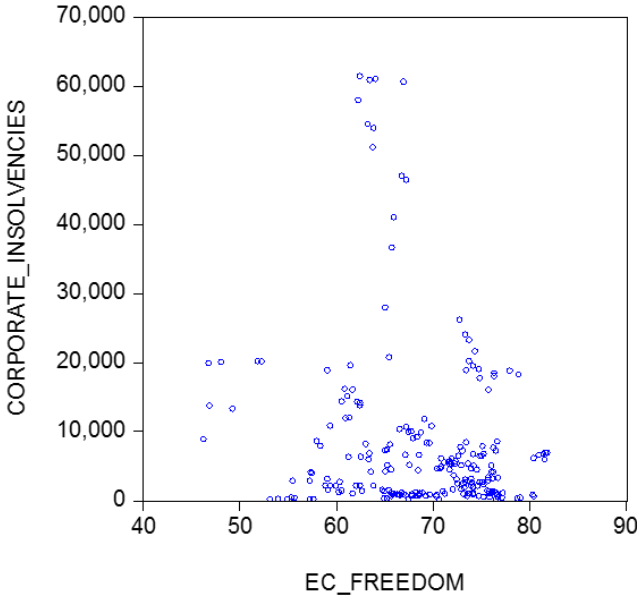

Fig. 1. Correlation between corporate insolvencies and economic freedom
Source: Authors' design.

According to the obtained results, we can see a weak linear relation between the corporate insolvencies and the factor included in the mathematical model, as well as a correct correlation.

Thus, the correlation coefficient shows the presence of a negative relationship, that is, an increase in economic freedom leads to a decrease in the number of corporate insolvencies.

More, the dataset of the present study comprise both cross-sectional and time-series modifications. Thus, the panel data analysis is most suitable. Panel data is ordinarily analyzed with the help by one of its basic models: random effects (RE) or fixed effects (FE). Next, the Hausman test was conducted, in order to determine the feasibility of selecting between models with random (RE) and fixed (FE) effects. The Hausman test

validated the selection of fixed effects model, because the obtained p-value is lower than critical value of 0.05 [3].

A benefit of FE model "include the possibility of unobserved characteristics elimination if they are time-invariant, thus it allows to assess the net effect of the explanatory variables on the result indicator" [18]. Consequently, the FE method is particularly suitable for estimating corporate insolvencies, which depends on time-varying differences in heterogeneity between countries.

More than this, the FE method usage in our analysis will solve the endogeneity problem by the help of FE estimator.

The elimination of both the problem of endogeneity and the source of the omitted variable bias in the FE model can be achieved using the deviation from estimators, or the so-called "within the estimator".

In this context, we may conclude that "FE regression compromises constant average effects of each data category, i.e. country in the case of this study".

Thus, the coefficients in the FE model indicate how different each observation is from the mean; namely, "FE regression reports the average effect within the group". Furthermore, FE regressions are particularly important to use when classifying data, as it can be difficult to control for all category characteristics.

All the calculations, operations described above we performed with EViews software.

RESULTS AND DISCUSSIONS

In Table 2 we can be observe all the results of testing the hypothesis of the research. The results were obtained using the panel regression equation.

Thus, in the table below, performed with the EViews software, we determined the estimated coefficients and probabilities related with them, the value of t-Statistic test and the standard errors.

Taking into consideration that, the coefficients values are notably different from zero, we may conclude that is interdependence between the corporate insolvencies (dependent variable) and the economic freedom (independent variable), as follows:

- increasing with a one percent the index of economic freedom cause a reduction in the average of 0.4 p.p of the bankruptcy indicator.

This insignificant level of CI modification can be explained by the fact that "Economic Freedom is one of the general environment factors", which influence on corporate insolvencies. Mismanagement is the primary cause of corporate insolvencies, but the general environment factors are the factors that do not depend on the company /management, but rather on the efficiency of institutions, which is lower and do not succeed in controlling, and their influence all together is no more than 20%.

Table 2. Testing regression model parameters on panel data

Dependent Variable: LOG(CORPORATE_INSOLVENCIES)
Method: Panel Least Squares
Date: 02/19/21 Time: 18:29
Sample: 2013 2019
Periods included: 7
Cross-sections included: 32
Total panel (unbalanced) observations: 218
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(EF)	-0.368983	0.710374	-0.519421	0.6041
CI	9.720534	3.011383	3.227930	0.0015

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.950919	Mean dependent var	8.162244
Adjusted R-squared	0.942429	S.D. dependent var	1.444640
S.E. of regression	0.346627	Akaike info criterion	0.857476
Sum squared resid	22.22776	Schwarz criterion	1.369808
Log likelihood	-60.46489	Hannan-Quinn criter.	1.064414
F-statistic	112.0079	Durbin-Watson stat	0.874204
Prob(F-statistic)	0.000000		

Source: Author's own calculations.

Adjusted R-squared (0.942) shows "a strong correlation between the dependent variable and the independent variable". So, 94,2% of the modifications in the number of corporate insolvencies are caused by the changes of the independent variable, "the difference being caused by the variation of the residual variable and the errors (e) respectively; the

obtained regression model can be extended to all the analyzed countries" [8], because the Adjusted R-squared is approximately the same as the R-squared coefficient. The value of the F test demonstrates a statistically significant relation (p-value close to 0) and a null random probability between the studied variables.

This result fully conforms to the hypothesis H1. Thus, a country ranking high in economic freedom is associated with a lower number of bankruptcies.

CONCLUSIONS

The objective of this study is to determine the relation between the number of corporate insolvencies and the level of economic freedom in the European Union countries. To reach the purpose, firstly we described what are the factors that may have an impact on bankruptcy phenomenon are. Consequently, we have established one hypothesis, on the base of which a model has been developed. The goal of the model is to show the impact of economic freedom on the number of bankruptcies. Analysis was utilized 32 European countries over the period 2013-2019.

It has been established that for the period 2013-2019, at the level of the countries exists a negative correlation between the corporate insolvencies recorded in each country and Economic Freedom. Interdependence is confirmed by the Adjusted R-squared coefficient, 0.4 p.p. of the modifications in the number of bankruptcies are determined by the modification of the economic freedom indexes. The insignificant level of Corporate Insolvencies modification under Economic Freedom is one of the general environment factors, which influence on corporate insolvencies. Mismanagement is the primary cause of corporate insolvencies, but the general environment factors are the factors that do not depend on the company /management, but rather on the efficiency of institutions, which is lower and do not succeed in controlling. Lower economic freedom may lead to a greater number of bankruptcies. This impact need to be taken into consideration by the EU, which is actively looking to perform the European framework for restructuring and bankruptcy management.

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THE IMPACT OF ELECTRONIC MARKETING ON ECONOMIC DEVELOPMENT - A THEORETICAL APPROACH

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Abstract

The concept of marketing is broad, with a large number of studies conducted on this topic. These studies discuss various marketing tools as well as strategies for directing the business towards success. Today, internet marketing has gained more budgets for marketing efforts, and given its importance in developing the economy, it is imperative to use modern methods for its development. The aim of the research is to study the impact of electronic marketing on developing the economies of countries by studying a comparison between traditional marketing and electronic marketing. The research used the study of economic factors involved in marketing such as cost, speed, and market ... etc. and compared them in both electronic and traditional marketing. The research concluded that there is a positive effect on the use of electronic marketing and the development of the economy. The research found clear differences in adopting electronic marketing to raise the marketing efficiency of all commodities and develop an economy.

Key words**:** *electronic marketing, traditional marketing, reducing costs, economic development*

INTRODUCTION

Information technology has penetrated almost all areas. The advancement of technology has made it possible for merchants to identify specific requirements for products and services through specific markets using "narrow distribution channels" (rather than radio transmission) and online messages using electronic means such as access to lists, discussions in groups, advertising through exciting spots, advertising through an online press or online conferences, etc.

Marketing can customize, in the sense, that it reminds customers' preferences what kind of flavor, fragrance, texture; in what quantities; whether it is a gift or for personal use; and by what method of decision-making he formed his consumption habits. E-marketing helps the merchant in determining the segmentation strategy before marketing the product or service through online marketing.

All these qualities are influenced by electronic marketing, on-line execution of deliveries to customers, and satisfaction due to electronic marketing resources, respectively directing business.

The importance of research comes from the role that electronic marketing plays.

In achieving marketing goals, by using the Internet in all marketing matters.

In order to raise the efficiency of the marketing work and to open up more global markets between them.

Brief history of the internet

The Advent of the Internet

Perhaps one of the most prominent developments we have seen recently is the control of the Internet in many areas of business and life, as it has become difficult to find a field that the computer has not reached particularly or the internet in general, and for this reason, today's discussion revolves around the digital economy and society and about commerce, administration, e-government, etc.

Many observers consider the rise of the Internet until 1969, when the Pentagon conducted a series of experiments with universities and research centers known as

ARPANET, to connect large computers with major computers and apply special rules. To share information and protect yourself from fear of exposure. For external attacks, but the real evolution of the Internet began in 1985 when the National Science Foundation connected the United States with 6 centers Mega computing with a high-speed communication system that allows the transmission of digital data through this network using a simple system that later became known by mail (e-mail). The second stage of development began in 1989 when a scientist named Tim Berners-Lee developed (a set of rules or protocols that can control large office files, such as text, images, sounds, or video, stored in the computers that make up the internet, which today has become known as (www) and is an abbreviation of the word (World Wide Web) and is based on The method is based on the idea of creating ways to access other files stored on the network.

A fast way of exchanging information on a global scale and thus began a new era, which continues to this day, from rapid development and creativity to a fast pace and high life, given that the Internet is a network of networks, Which is a large group of computers that communicate and interact with each other to serve the user in providing useful information in a timely and accessible manner [5].

Several new terms have emerged with the development of the Internet, including what is known as e-business and e-commerce ... etc. And some point out to the term e-business until 1979 when the computer company (IBM) was the first to use this term to distinguish between e-business and e-commerce activities, and according to what stated in the definition (IBM company), the electronic company means an integrated and flexible approach to distribute the value of the distinctive business by connecting systems to the processes by which core business activities are implemented in a simplified and flexible way and by using Internet technology. The activity is conducted according to an objective plan that takes into account a set of basic elements: Pricing the products to be marketed, how to promote them and create new ideas and methods of distributing them [11]. Digital marketing is also defined as an application of a wide range of information technology with a view to Reshaping marketing strategies in order to increase the benefits obtained by the consumer [12].

E-marketing via the internet is one of the important necessities at the present time. It is one of the important means in achieving the required marketing goals [15].

.Consequently, it can be concluded from the above that electronic activity is an integrated combination of processes, systems, and digital activities that allow the organization to manage its internal and external environmental operations efficiently [5].

General considerations regarding electronic marketing

The influence of the Internet on companies and organizations appeared after 1990.

There is a logical fact that there is no electronic marketing without electronic means. Therefore, it is necessary to study the technological aspect represented by the general environment of electronic marketing, and the requirements that must be met for electronic marketing, which are the requirements of the infrastructure, the requirements of the marketing activity and the requirements of the work environment [9].

Electronic marketing is the promotion and sale of products and services using online strategies.

This activity is constantly developing according to the habits of Internet users. Therefore, we need to know the internet users well. Internet marketing covers a smaller field of activities as it includes digital media (web, email, and wireless media), as well as digital data management systems (CRM **and CRM).** Internet marketing involves the use of a company's website along with online promotional technologies such as search engine marketing, interactive advertising, email marketing, and affiliate marketing for another site. In general, marketing passes through production stages represented by multiple characteristics, which are the focus on production and productivity, the focus on industrial activities and the engineering

aspects of products at the expense of the benefits and advantages of goods [8].

The concept of electronic marketing

Define marketing as defining the needs, desires, and interests of target markets to provide the desired level of satisfaction in a way that is more effective and efficient than competitors, where this leads to the preservation or consolidation of everything that would contribute to the well-being of society [7].

As for Kottler and Armstrong, they defined marketing as the process by which companies can create value for customers and build strong relationships with them to get value from them in return. Cutler and Armstrong point out that marketing is a reciprocal process, which is the essence of marketing, which meets the needs and desires of customers, and the necessary service and follow-up are done to ensure that customers are convinced after the purchase, which leads to loyalty. to the company's products and profits [10].

What is e-marketing?

Marketing refers to all marketing activities that have been implemented through the Internet, which manages the interaction between the organization and the consumer in the virtual environment, E-to obtain mutual benefits, and the virtual environment for e-marketing depends mainly on Internet technology, and the e-marketing process does not only focus on product sales operations For the consumer, it also focuses on managing the relationship between the organization and the consumer, on the one hand, and between the elements of the internal and external environment, on the other part [17].

Electronic marketing is also known as the implementation of a wide range of information technologies. Therefore, e-marketing is considered one of the most important

Electronic marketing has some characteristics, including the consumer who initiates the connection, It is the consumer who is looking for information (attraction policy), and is also an effective way to gain the attention of website visitors [2].

The economic impacts of e-marketing

Some studies conducted on information sites concluded that one of the most important applications of communication technology is voice media, text messages and mobile money transfers, as more than 35% of the communications and information technology programs in the programs provide consumers with market information. Through radio, text messages, websites, and information systems are also hotlines. Recent studies of e-marketing networks concluded that e-marketing has achieved a remarkable development in the economic sector that had a positive impact on the economies of countries, as it helped reduce costs, increase supply and demand for products, increase the percentage of sales and speed in supplying various products.

Comparison between digital marketing and traditional marketing

To identify the differences between digital marketing and traditional marketing, there are a set of characteristics that set them apart.

The Internet is a new means of communicating with consumers through traditional means, and these characteristics are summarized in [4]:

1.The consumer initiates the calls.

2.The consumer is the one who seeks information (attraction policy).

3.The new method is an effective way to attract the attention of the website visitors.

4.The company can collect and store information on the responses individuals.

Traditional marketing

Traditional marketing is also known as external marketing and it expresses the traditional methods that the industry has used since the beginning of marketing. It relates to things like newsletters, billboards, business cards, print ads in newspapers or magazines, radio, as well as television ads and can also involve direct contact with clients and networking events. Traditional advertisements can only aim to reach local markets, meaning that research efforts will go far beyond the radio station and newspaper carrier.

Disadvantages of traditional marketing:

(i)Expensive.

(ii)It's difficult to track.

(iii)It is difficult to create meaningful impression statements.
(iv)It may be difficult or costly to change or stop a campaign.

Types of traditional marketing

(1)Text Marketing:

These are striking texts written on the products being marketed, or texts expressing the solidarity of the product with a certain idea, and this leads to an increase in the customer's awareness and awareness of the brand, and texts can also be written about a historical.

(2)Marketing by product packaging design:

Some companies pursue this type of marketing to increase their sales, and it also increases the public awareness of the brand.

(3)TV Marketing:

All advertisements that are seen while watching programs, movies, and series are among the most important types of traditional marketing, and these ads are usually at a very high cost.

MATERIALS AND METHODS

The purpose of this marketing research to know the importance of electronic marketing for products and its impact on increasing sales and using modern means to promote products and to identify the reasons for the success of electronic marketing and what are the most important tools for electronic marketing and services that the marketer needs and in addition:

- Keeping up with technology in marketing methods and moving away from traditional means

-Knowing the impact of electronic marketing on the demand for offered goods

-Knowing the impact of e-marketing on consumer services.

The study is based on the information collected from various important published research results, textbooks, scientific journals.

It is a synthesis logically structured in the own manner of the authors expressing their opinion in a critical approach.

Analysis, synthesis, comparison, logical deduction and other well known methods were used for setting up this study.

RESULTS AND DISCUSSIONS

A comparison was made, and the results show that electronic marketing is better than traditional marketing in many economic factors such as cost, the speed, method to communicate with customers, data collection. It shows the positive impact on developing the economy through electronic marketing, as the cost is lower and the speed of dealing with consumers is organized and the dealings between the producer and the consumer are organized, which facilitated the openness of the market and the speed in supplying products.

Table **1**. A comparison between electronic marketing and traditional marketing

Comparison component	**Electronic Marketing**	**Traditional marketing**
The cost	Low	High
The speed	Unlimited	Limited
Market	Open Globally	Sweetened
Parties to the exchange process	Customer	Market
Method to communicate with customers	Hiring information and communication technology	Difficult (limited in time and place)
Product development	On the efficiency and flexibility	Difficult (incompetent)
Data collection	Very easy	Very Difficult
Follow up for reactions	Very easy	Very Difficult

Source: [13].

The advantages of internet marketing

To find out the truth about the internet, the background and dimensions of the concept must be known in themselves, because a concept like a term "internet" means a computer that talks to a computer that connects them with a regular telephone cable or any other type of cable are located in remote places. Individually, satellites can be used to connect them to obtain international connectivity via the Internet, and even within a single country, they need intermediate links.

The Internet is an important means of communication that has managed to gain a place among the various other means of communication and does not require special amounts of money. It is also characterized by the serious and objective treatment of general problems [14].

The Internet also allows the transfer of photos, videos, or audio data from one user to another. Another feature of the internet is that the simple application can replace phone calls: each travel on the internet so that sounds and images are transmitted free of charge, without remote call bills. Based on these important internet functions.

Here are the main advantages of marketing through online marketing methods.

(1)Save money Copies of online catalogues, brochures and papers do not need to be printed, wrapped, stored, and mailed. When customers receive product information, they shouldn't assign a secretary or assistant to send it. Online versions can be updated in real-time.

(2)Saving time one of the advantages of online promotions is speed. Compared to traditional marketing, it takes a short time to create, launch and track online promotions. Just creating a promotion in a few hours instead of a few weeks doesn't mean it should be created in such a short time. To be a successful promotion, you must be given the time to plan, build and execute. This feature has the advantage that more offers can be created to see which can be more effective. With more online promotions, it's easier to understand what tactics have paid off, allowing adjustments to be made to improve them, to take advantage of this time-saving feature of online promotions. Currently, there are several tools for monitoring results, which allow tracking details such as increased traffic, its source, user behaviour on the site, etc.

(3)Continuously available online marketing One of the best features of an online server is that it is available 24 hours a day, 360 days a year. All these features listed above make online marketing more and more vital for any company and organization in the 21st century [3].

(4)Customers have control over the purchasing process in online promotions, the feeling of control is stronger, because there is the possibility to change the offer in real-time. Also, in real-time, you can find information about partial or final results - about some online promotions. It is important to note that while moderation is possible during the promotion; improper use of this feature is not recommended as it may harm the Offer.

(5)Online marketing can reduce barriers to entry and provide equal access. Internet marketing helps to reduce many market barriers that prevent entrepreneurs from fully participating in the free market system. Pointing to the internet as a virtual space for implementing marketing strategies, equal access allows, by also millions of customers to search for information, a product, or a company.

The phases of electronic marketing

Information and communication technology means "a group of different technologies, tools, means or systems that are used to process content or content that is intended to be delivered through the process of mass or organizational communication, which is accomplished by collecting audio or written information. or images or audio-visual or digital printers or senders (via electronic computers). And storing this data and information, then retrieving it promptly, then publishing these communication materials, messages or audiovisual or digital audio content and transferring them from one place to another and exchanging them, and this technology can be manual, automatic or electronic, or electrical depending on the stage of development. Also known as tools that are used to collect, analyse, classify, store and retrieve information and all these using computer-based technologies [6].

Others have defined it as follows: "The technological aspect of the information system, which includes hardware, databases, software, networks and other devices" [16].

Therefore, the Internet has become the main feature of this era, which witnessed the emergence of the most important phenomenon in it, but it is such a phenomenon that the Internet is one of the foundations of this

global phenomenon, because this network is realized with all parts of the world. to obtain the required information in various fields and multiple purposes. According to the Arthur model: e-marketing includes several stages, as it results from the Arthur mode [1] that e-marketing has four main stages:

(1)Prepare stage of the preparation stages: the seller or manufacturer takes these measures to study the market in terms of determining the needs and desires of consumers who must provide the good or service that can be produced according to the demand of buyers and the demand of the local market or external, to provide the database necessary for this stage, to determine the wishes and needs of local or potential or real consumers, the size of the markets exactly, efficiency of its competitors and gives them an international advantage.

Phase connection: This stage is used as follows:

-Companies have many different means to communicate with the customer in time and promote themselves the company's products through various advertising methods easily and clearly for consumers and tries to convince them and urge them to buy and sell. Businesses use electronic means and make them buy.

-Companies use electronic means in the process of advertising and promotion as the web page and web. The consumer can process the information transmitted by electronic means in the process of advertising and promotion related to the company's products [18] through a form and consists of the following steps:

(a)Stage of attention: several methods are used to attract the attention of the customer/consumer, and the most important of these tools and advertising bars are emailing.

(b)Stage of providing the necessary information: in this stage, the necessary data/information is provided to the customer/consumer, which helps him to build something special about this new product.

(c)Desire phase: in this stage, the emphasis is on the desire of the same customer/consumer. The desire is that the purpose and the presentation process should be an efficient process that favors multimedia technology.

(2)The transaction stage is the stage of acceptance and expenses between the company or seller and consumer, is the offer received for acceptance and after that, the buyer issued the decision to buy electronically using online credit card payment, which guarantees security and confidentiality (confidentiality) as well as (trust), and if this happens, it may be that the purchase accompanies the issuance of a payment order using digital exchange/money in the absence of cash transactions, cash transactions and transactions through what is known as "electronic banking".

Replacement and elimination step: as a summary of the previous steps.

Customer/Consumer, if satisfied with the product offered online [16] is the act of buying.

(3)Sales Stage

After additional support and assistance services, the marketing process does not cease to attract new customers, but to keep those customers in the light of current competition by find a conversation in a virtual community.

Objectives of marketing

Marketing contributes to achieving the goal of growth through expansion by increasing the volume of sales that is achieved by increasing the organization’s share of the market size or entering new markets, which is a strong incentive for growth and expansion.

The primary purpose of marketing is to deliver goods from the producer to the consumer, and these goals are:

(1) Goods consolidation

It is the collection of products or commodities, whether they are food raw materials or manufactured materials, and this is done Assembly in the local market, then in the supermarket, and assembly is one of the main operations, especially in the sale of goods in their natural state as raw materials.

(2) Distribution or disposal of goods

It is the stage in which products are distributed after reaching the central markets, where raw materials find a way to the producers, while consumer foodstuffs are

distributed through wholesalers to reach the final consumer. For the consumer, the methods of distribution and elimination of production differ depending on the current economic system. marketing has several functions represented in a set of services required to collect products from their many scattered places, equating supply and demand and distinguishing between raw or processed products in smaller quantities to reach excellent consumers.

In general, the marketing of products requires the following jobs:

(i)To buy: collect goods from individual producers, and the sale: Display and distribution of merchandise

(ii)Storage is one of the important business in the marketing of the lost, in a continuous manner, and in the absence of storage, it is necessary to accelerate the disposal of goods through sales, especially perishable products. The provision of rapid transportation helped the products to remain in the market for a longer period, which required an increased desire to keep them on demand before they were damaged and the establishment of storage facilities in all conditions. Preserving the natural properties of the stored products without being damaged or destroyed by insects. Storage to verify all this requires a lot of capital, but the economic benefits resulting from it outweigh many costs, and with the availability of storage methods, prices can be stable and otherwise decrease with the growth of the crop and then grow much later. This and this big seasonal change in prices does not matter. Manufacturer and consumer.

(iii)Transportation

Transportation is one of the most important functions of marketing. The faster and more multiplying it, the better its available means and processing to ensure the safety of products during transportation, such as cryotherapy.

(iv)Market area will move around these crops and production areas. It has expanded in the vicinity of consumer centers and this encourages more specialization, as it becomes through the provision of transportation and licenses in the ability of the producer of a certain type of product to obtain other types of other products, and depending on the specialization, there is an experience in growth that increases the technical capacity, which is The amount of crops that have grown and diversified in recent times, has increased the level of real income.

(v)Sorting and matching

Sorting is the process by which products of different types are isolated, such as sorting large, medium and small fruits. Appearance, chemical content, durability, shape, specific density, moisture, ripeness, taste and many other properties, including the similar process.

(vi)Regularity and symmetry, ie different goods produced in different places or purchased from different suppliers, the characteristics of the organization, must be

(vii)An organization based on the qualities desired by the buyer or based on consumer demands or operating factories in processing this type of goods.

(viii) Packaging

Crop mobilization is easy to transport, transport, store and protect from damage and is easy to advertise.

(ix)Collecting marketing information and news: Marketing information and the news is a method by which you can prepare marketing facts and clarifications about selling process.

CONCLUSIONS

There is a continuous and accelerating development in communication and information technologies, and this development has led to the emergence of the new Internet economy, which has led to the emergence of new forms of shopping in economy and the emergence of new shopping habits and have become important for the restoration of their organization.

-E-commerce contributes to increasing profits by reducing many costs such as warehousing, supply, and sales costs.

-E-marketing facilitates contact with customers, wherever and whenever they are practicing, and wherever they are, and communicate with them on one website, thus expanding the customer base.

-E-commerce is an easy way to attract many customers who do not have the time or the

means to go to the market to display their products.

- E-commerce is offered in its various forms to customers without intermediate and direct selling points, which saves a lot of effort, time, and costs by organizing immediate supply contracts that differ from those of traditional marketing.

-E-commerce provides buyers and sellers with a lot of information about the products, such as the size of the expected demand, the characteristics of the product, its prices, the terms of payment, and other information that can be pumped into the website.

-There are many benefits of this technology that can be achieved by the government or the private sector in all public areas, especially in the departments of various institutions, including reducing production costs, increasing the speed of communication, and providing information, which simplifies the procedures and processes of institutions and makes them more clear and efficient over time and uses them better and thus provides better services, for the economy in general.

Based on this study, we were able to draw the following recommendations:

-Providing services that increase product performance and are reflected in productivity, including applied and practical courses, new technologies, and capacity development in the field of electronics.

-Introducing modern technologies and benefiting from global experiences in the field of e-marketing.

-Continue to research to improve the level of Electronic Marketing

-Developing effective government policies, legal and regulatory frameworks for modern approaches, and using modern electronic methods in marketing

-Encouraging employers to use modern technology in marketing by holding educational seminars on an ongoing basis.

-Giving a good impression to the website, it is imperative to form a mental image that suggests confidence about the store and its products and all that it offers by taking care of the website interface. Through it, a holistic view of the site must be given and the customer should be given a reason to return to it again, and it must be characterized by the organization in its content Speed in downloading, quality in its software, sound, formats, and others.

-Joint research with advanced countries in the field of e-marketing and benefiting from their experiences in this field.

-For the application of electronic marketing to work for any institution, the necessary infrastructure must be provided, from the necessary physical information technologies to electronic databases and electronic commercial information and services to the qualified workforce to provide services related to electronic marketing to safe and efficient systems.

-To ensure the success of marketing and the achievement of its intended goal, the marketing officers must exercise control or influence on the departments and interests of the organization to ensure that customer satisfaction is achieved and maintained, as well as taking into account that any bad impression that the customer takes on the institution is not in its interest, in addition to harnessing E-marketing to maintain a constant dialogue at all times to achieve customer satisfaction.

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FORECASTING AS A WAY TO REDUCE THE RISKS OF A CASH FLOW DEFICIT IN AGRICULTURAL ORGANIZATIONS

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Abstract

Cash is the most important resource, since an organization, if there are sufficient funds, can acquire everything that is necessary for carrying out production activities. The research was based on an agricultural organization that is engaged in the production of sugar beets and grain, as well as dairy and beef cattle breeding. Analysis of cash flows by direct, indirect and coefficient method showed that the company under study in the current year belongs to a "normal enterprise", since it received a positive net cash flow from operating and financial activities and a negative one from investment. The calculated ratios of the efficiency of using the organization's funds over the past years have either increased or remained stable. To synchronize flows over time intervals and reduce the risks of a shortage of funds, the authors have developed cash flow forecasts for a year and a half by direct and indirect methods. Both plans showed that cash flow from current activities is positive, that is, the company's activities are profitable and generate income. The organization will be able to pay off the accumulated liabilities. The developed budgets will make it possible to predict the flow of cash flows of the enterprise, to control the synchronization of receipts and expenditures of funds, thereby maintaining their required volume to fulfill payment obligations.

Key words**:** *cash flows, analysis, ratios, forecasting, budgets*

INTRODUCTION

In financial management a special attention has to be paid on the main financial indicators among which cash flow is very important as it is closely related to efficiency of the company. In any sector of activity, but especially in the agricultural companies, the success in their development depends, first of all, on how efficiently its cash flows are organized [1, 5, 7, 10]. Cash flow management is a tool that helps to achieve a high level of enterprise profit [1]. Assessment and forecasting of cash flows allow management to control the synchronization of income and expenditures of funds, thereby maintaining the amount of funds required to fulfill payment obligations. [2]. In addition, this allows a more realistic assessment of the payment capabilities of the enterprise, making such a choice of funding sources and purposes of use that will create an optimal cash flow scheme that can lead to growth of economic value and long-term viability of the enterprise [3]. The purpose of this study is to propose practical recommendations for improving the management of cash flows in an agricultural organization.

MATERIALS AND METHODS

The study was based on a large agricultural enterprise LLC "Vertunovskoye", which specializes on the production of sugar beets and grains with a fairly developed dairy and meat cattle breeding. The main sources of information for the analysis and forecasting of cash flows were the following forms of the company's financial statements: a cash flow statement, a balance sheet, a statement of financial results, as well as synthetic and analytical accounting data on cash accounts.
The calculation and forecasting of cash flows were carried out by two methods - direct and indirect. The direct method takes into account information about the positive and negative flows of the enterprise, generated by the cash method by taking into account the economic turnovers that are associated with cash transactions. The indirect method according to the construction algorithm is the reverse of the direct one. It is carried out using the

recalculation of the obtained financial result by making certain adjustments to the amount of net profit [7]. With the help of the coefficient analysis, the levels of various relative indicators, their deviations from the basic values characterizing cash flows, as well as the efficiency of their use were examined.

RESULTS AND DISCUSSIONS

Cash flow management cannot exist without their primary analysis.

Table 1 shows data on cash flows by type of activity for 2017-2019.

At the end of 2019 there was an increase in cash balances compared to the beginning of the study period (2017) by 993 thousand rubles, which had a positive impact on the liquidity of the organization.

In 2018 the balance decreased by 523 thousand rubles or 52.4%. At the same time, the increase in the organization's funds occurred mainly due to the positive cash flow from current activities.

Table 1. Analysis of cash flows by type of activity of LLC "Vertunovskoe", (thousand rubles)

Indicator	2017	2018	2019	Deviation (+, -) 2019 from		Growth rate, %
				2017	2018	
Cash balance at the beginning of the year	482	1,522	999	517	-523	207.26
Net cash flow from current activities	335,915	555,683	139,490	-196,425	-416,193	41.53
Net cash flow from investing activities	-218,517	-526,209	-197,707	20,810	328,502	90.48
Net cash flow from financing activities	-116,358	-29,997	59,773	176,131	89,770	-51.37
Net increase (decrease) in cash	1,040	-523	1,516	476	2,039	145.77
Cash balance at the end of the year	1,522	999	2,515	993	1,516	165.24

Source: Financial statements of LLC "Vertunovskoe".

At the same time, there is a significant outflow of money for investment activities due to the physical and obsolescence of non-current assets that need to be updated, and financial activities due to the company's growth [13]. In this case, the source of financing for capital and financial investments was not only cash from the sale of manufactured products, but also borrowed funds.

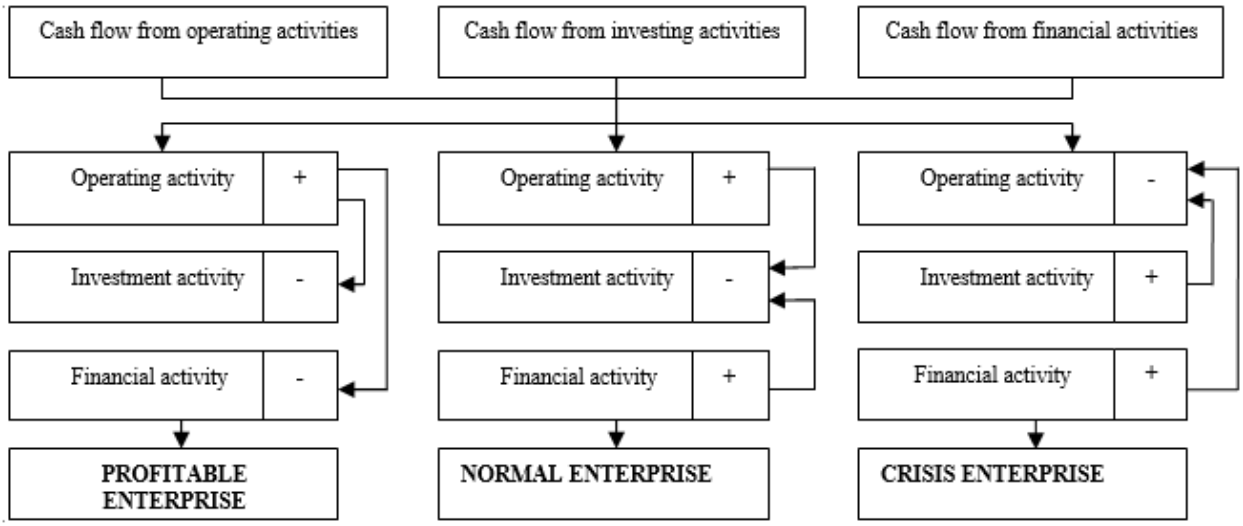

Fig. 1. The structure of cash flows by main activities and their ratio
Source: Nosov et al. (2016) [6].

Thus in 2019 positive net cash flows from current activities in the amount of 139,490 thousand rubles were received which allowed the organization to finance investment activities, the negative cash flow for which amounted to 197,707 thousand rubles. The organization also received positive net cash flows from financing activities in 2019 in the amount of 59,773 thousand rubles.

Having considered the net cash flows for the three types of activities and their ratio, it is possible to determine the financial condition of LLC Vertunovskoye.

According to Figure 1 we could conclude that the surveyed company in 2019 belongs to a "normal" enterprise.

Assessment of the quality of net cash flow was carried out using the coefficient method (Table 2).

Table 2. Indicators characterizing the efficiency of using cash flows of LLC Vertunovskoye

Coefficient name	2017	2018	2019	Deviation (+, -) 2019 from	
				2017	2018
Liquidity ratio CF	1.01	0.99	1.02	0.01	0.03
Coefficient of participation of current activities in the formation of PCF	0.82	0.86	0.64	-0.18	-0.22
Coefficient of participation of investment activities in the formation of NCF	0.54	0.36	0.20	-0.34	-0.16
Current solvency ratio	1.53	1.81	1.18	-0.35	-0.63
Solvency ratio	1.001	1.001	1.002	0.001	0.001
Return on cash flow ratio	0.58	0.25	0.30	-0.28	0.05
Return on cash outflow ratio	0.58	0.24	0.31	-0.27	0.07
DP efficiency ratio	0.001	-0.0004	0.002	0.001	0.0024
Reinvestment ratio CF	8.73	1.99	12.46	3.73	10.47

Source: Financial statements of LLC "Vertunovskoe".

The resulting coefficients presented in Table 2 show the efficiency of using the monetary funds of the studied enterprise - over the course of two years, either the growth of indicators is noticeable, or the stability of their level in general. The cash flow liquidity ratio (CF) changed insignificantly. The coefficient of current activities share in the formation of positive cash flow (PCF) decreased and amounted to 0.64 in 2019. The coefficient of investment activities share in the formation of negative cash flow (NCF) was 0.2 in 2019, which is 0.34 less than in 2017. During the specified period, the values of the coefficients of solvency and efficiency of CF increased. The profitability ratios of the outflow and cash inflow were 0.31 and 0.30 in 2019. At the same time, the coefficient of reinvestment of cash flows increased by 1.5 times compared to 2017.

Thus, we could conclude that the management of cash flows in LLC "Vertunovskoye" is carried out successfully - there are all the main types of cash flow: current, investment and financial activities. Indicators for all types

of activities have a positive trend, the growth rate increases annually, and the absolute growth rate has a positive trend.

However, in the course of the analysis it was revealed that the company does not have enough of the most liquid assets to pay urgent accounts payable. It is necessary to reduce the cash deficit, as the transformation of assets into the most liquid leads to financial losses. In addition, profitability ratios were reduced.

To change the negative situation and increase the level of basic financial indicators, it is necessary to take a number of measures.

We proposed to improve the process of forecasting cash flows for the studied organization [11].

In LLC "Vertunovskoe" budgets of various types are drawn up annually: income and expenses, cash flow, but a significant omission, in our opinion, is the preparation of budgets only once - for a year. It is more effective to draw up budgets on a quarterly basis to collect data on the dynamics of the enterprise and more quickly eliminate emerging problems [9].

Based on the data from the accounting statements of LLC Vertunovskoye, two forecast plans for cash flow for the long term were developed.

The first forecast plan is based on the direct method of constructing the budget of funds, the second - on the indirect method.

Table 3. Forecast of the cash flow budget for 2020-early 2021 (direct method), (thousand rubles)

Indicators	4 qr. 2019	1 qr. 2020	2 qr. 2020	3 qr. 2020	4 qr. 2020	1 qr. 2021	Total
Revenue	270,343	348,466	334,527	362,405	348,466	303,984	1,968,191
Cost price	189,240	243,926	234,169	253,684	243,926	212,789	1,377,734
Material costs	135,172	174,233	167,264	181,203	174,233	151,992	984,096
Labor costs	35,145	45,301	43,489	47,113	45,301	39,518	255,865
Operating expenses	21,627	27,877	26,762	28,992	27,877	24,319	157,455
Administrative expenses	0	0	0	0	0	0	0
Business expenses	0	0	0	0	0	0	0
Other costs associated with production and sale	21,627	27,877	26,762	28,992	27,877	24,319	157,455
Profit (loss) from sales	81,103	104,540	100,358	108,722	104,540	91,195	590,457
Finance income (interest income and share in profit / loss of affiliated companies)	0	0	0	0	0	0	0
Financial expenses	45,958	59,239	56,870	61,609	59,239	51,677	334,592
Interest and other payments on Sberbank loans	27,034	34,847	33,453	36,241	34,847	30,398	196,819
Interest and other payments on loans from other banks	18,924	24,393	23,417	25,368	24,393	21,279	137,773
Other non-operating income / expenses per qr.	48,662	62,724	60,215	65,233	62,724	54,717	354,274
Income tax expense	21,627	27,877	26,762	28,992	27,877	24,319	157,455
Current cash flow - total	62,179	80,147	76,941	83,353	80,147	69,916	452,684
Purchase of non-current assets	-32,069	-63,470	-66,008	-60,931	-63,470	-43,217	-329,165
Proceeds from the sale of assets, loan repayments and similar proceeds	19,369	26,841	25,767	27,914	26,840	29,455	156,186
Investment Cash Flow - Total	-12,700	-36,629	-40,241	-33,017	-36,630	-13,762	-172,979
Income including: obtaining loans and borrowings	56,069	75,512	78,532	77,022	70,982	67,282	425,399
Repayment of obligations	38,289	52,158	51,271	54,244	50,958	52,280	299,202
Requested obligations at Sberbank	2,167	2,952	2,902	3,070	2,884	2,959	16,936
Other liabilities in the future (at Sberbank and other banks)	36,122	49,206	48,369	51,174	48,074	49,321	282,266
Proceeds from equity participation in other organizations	0	0	0	0	0	0	0
Other income from financing activities	17,650	23,209	27,014	22,666	19,783	14,879	125,201
Financial cash flow - total	130	145	247	112	241	123	996
TOTAL CASH FLOW	49,609	43,663	36,947	50,448	43,758	56,277	280,701

Source: Financial statements of LLC "Vertunovskoe".

The company's revenue for 2020 is planned in the amount of 1,233,508 thousand rubles, it is assumed that next year it will increase by 13% and will amount to 1,393,864 thousand rubles. (based on the five-year average annual growth rate).

Agriculture is a material-intensive production, therefore material costs are more than 50%, labor costs - 13%, depreciation of fixed assets - 6% of proceeds. Thus, the total cost is about 70% of the revenue [12].

Also, based on the data of the annual financial statements for the last three years, it was revealed that the company has no selling and administrative expenses, and other expenses amount to 8%. Other non-operating income and expenses represent approximately 18% of revenues and are not expected to increase during the year. The budget provides for the growth of each type of expenses by 1% per month.

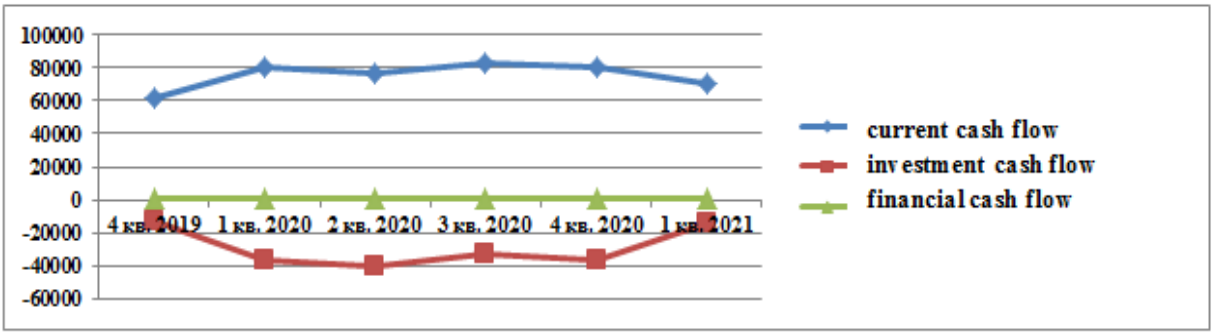

Fig. 2. Forecast of the organization's cash flows using the direct method, thousand rubles
Source: Financial statements of LLC "Vertunovskoe".

Operating cash flow includes finance income from invested amounts and finance costs in the form of interest on loans and borrowings received. The organization is credited with Sberbank of Russia at 16% per annum and in other banks at 16 and 12.5% of the amount received. Interest on loans received is recorded every month at the specified rate.

Investment cash flow includes proceeds from the sale and purchase of assets.

Financial cash flow takes into account loans received from banks. On average, an organization needs 319,042 thousand rubles borrowed funds per year.

The cash flow forecast plan constructed by the direct method is presented in Table 3 and Figure 2.

The scheme reflects the dynamics of the organization's cash flows over a year and a half. The cash flow from the main activity in all periods is positive. Investment cash flow is generated through the sale and purchase of non-current assets, the return and provision of loans and similar receipts and payments. Financial cash flow depends on the amount of borrowed funds. Net cash flow over the period under review is also positive.

According to calculations, the organization's revenue for a year and a half would amount to 1,968,191 thousand rubles, in 2020 the revenue will be at the level of 1,393,864 thousand rubles, which is 272,493 thousand

rubles higher than the revenue of 2019. The cost of production for 2020 would amount to 975,705 thousand rubles, which is more than this indicator in 2019 by 306,722 thousand rubles. Operating expenses for 2020 would amount to 111,509 thousand rubles. The financial expenses of the organization, which include interest on loans and borrowings received, would amount to 236,957 thousand rubles, of which 139,386 thousand rubles make payments on loans from Sberbank and 97,570 thousand rubles on loans from other banks.

Investment cash flow includes proceeds from the sale and purchase of non-current assets, loan repayments and similar receipts (-146,517 thousand rubles in 2020).

In addition to its own funds, the organization requires borrowed funds. During 2020, the company would take short-term loans in the amount of 302,048 thousand ruble.

Thus, the financial cash flow for a year and a half will amount to 996 thousand rubles, and for the year 774 thousand rubles (the low value is due to the return of loans and credits).

The total cash flow in this case reflects the funds that the organization has at its disposal in the specified period and for a year and a half will amount to 280,701 thousand rubles.

The advantage of the direct method is its clarity, the disadvantage is that the calculation does not take into account changes in stocks of finished goods, accounts receivable and payable.

The disadvantage of the direct method can be overcome by using the indirect method. The baseline for using this method is net income. [8].

Net income could be projected in a variety of ways. You can calculate the average increase in net profit for the quarter and change its value based on this indicator, or use the result of calculations of the direct method based on

the amount of revenue and cost of production. [4].

The cash flow forecast plan using the indirect method is presented in Table 4 and Figure 3.

Table 4. Forecast of the cash flow budget for 2020-early 2021 (indirect method), (thousand rubles)

Indicators	4 qr. 2019	1 qr. 2020	2 qr. 2020	3 qr. 2020	4 qr. 2020	1 qr. 2021	Total
Net income (loss)	62,179	80,147	76,941	83,353	80,147	69,916	452,684
Depreciation	16,626	21,431	20,573	22,288	21,431	18,695	121,044
Change in working capital	16,959	-64,131	18,469	-71,709	-41,645	20,439	-122,618
Change [increase (-) or decrease (+)] in receivables compared to the previous period	-17,821	-21,491	-21,312	-19,768	-15,070	9,182	-86,280
Change [increase (-) or decrease (+)] in inventories compared to the previous period	27,824	-39,147	41,513	-46,702	-23,491	13,773	-26,230
Change [increase (+) or decrease (-)] in accounts payable compared to the previous period	6,956	-3,493	-1,732	-5,239	-3,084	-2,516	-9,108
Financial expenses	45,958	59,239	56,870	61,609	59,239	51,677	334,592
Interest and other payments on Sberbank loans	27,034	34,847	33,453	36,241	34,847	30,398	196,819
Interest and other payments on loans from other banks	18,924	24,393	23,417	25,368	24,393	21,279	137,773
Current cash flow - total	95,764	37,447	115,983	33,932	59,933	109,050	448,156
Purchase of non-current assets	-32,069	-63,470	-66,008	-60,931	-63,470	-43,217	-329,165
Proceeds from the sale of assets, loan repayments and similar proceeds	19,369	26,841	25,767	27,914	26,840	29,455	156,186
Investment cash flow -	-12,700	-36,629	-40,241	-33,017	-36,630	-13,762	-172,979
Income including: obtaining loans and borrowings	56,069	75,512	78,532	77,022	70,982	67,282	425,399
Repayment of obligations	38,289	52,158	51,271	54,244	50,958	52,280	229,202
Requested obligations at Sberbank	2,167	2,952	2,902	3,070	2,884	2,959	16,936
Other liabilities in the future (at Sberbank and other banks)	36,122	49,206	48,369	51,174	48,074	49,321	282,266
Other payments from financing activities	17,650	23,209	27,014	22,666	19,783	14,879	125,201
Financial cash flow - total	130	145	247	112	241	123	998
TOTAL CASH FLOW	83,194	963	75,989	1,027	23,544	95,411	280,128

Source: Financial statements of LLC "Vertunovskoe".

The company's net profit for a year and a half would amount to 452,684 thousand rubles. The current cash flow, in addition to net profit, also takes into account depreciation and changes in working capital. Depreciation for a year and a half would be at the level of 121,044 thousand rubles, and the change in working capital - 122,618 thousand rubles. Changes in working capital were calculated based on the amount of financial receipts, that is, funds received on credit were allocated to changes in accounts receivable, stocks of finished goods and to pay off accounts payable.

It is difficult to achieve a complete cash balance, but it is assumed that the net cash flow should be positive.

According to the calculations, an increase in accounts receivable by 86,280 thousand rubles is expected, an increase in inventories by 26,230 thousand rubles and a decrease in accounts payable by 9,108 thousand rubles. The current cash flow for a year and a half would amount to 448,156 thousand rubles.

Cash flows from investing and financing activities do not differ from those calculated in the forecast plan using the direct method. Net cash flow for a year and a half would amount to 280,128 thousand rubles. The obtained value differs slightly from the direct method and this imprecision is acceptable.

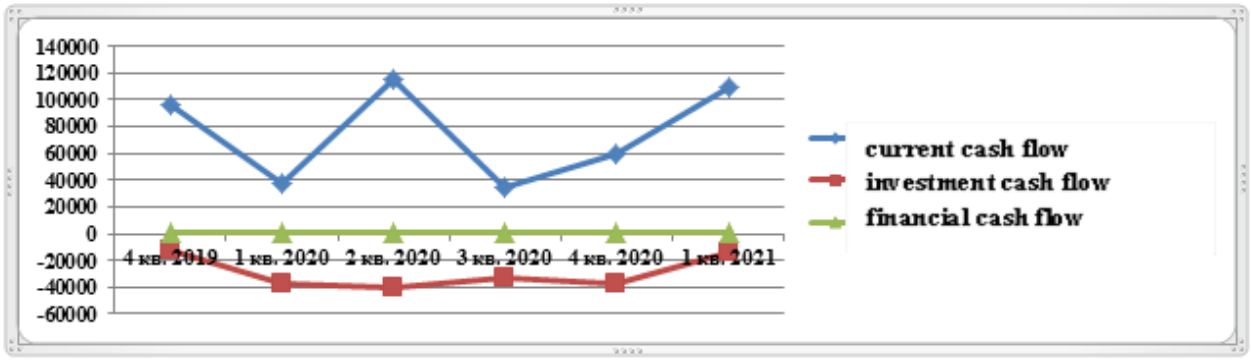

Fig. 3. Dynamics of the organization's cash flows using the indirect method, (thousand rubles)
Source: Financial statements of LLC "Vertunovskoe".

Both plans demonstrate that cash flow from current activities is positive, that is, the company's activities are profitable and generate income. During the analyzed period, the organization is able to pay off the accumulated liabilities.

CONCLUSIONS

The analysis of the state of cash flows of LLC "Vertunovskoe" made it possible to conclude that the company belongs to a "normal enterprise", since here we got a positive net cash flow from operating and financial activities and negative from investment. Cash flows are synchronized in time intervals and the risk of a shortage of funds in LLC "Vertunovskoe" is minimal.

It was revealed that a significant omission in forecasting financial indicators was the budgeting of funds once - for a year. In this regard, two cash flow forecast plans for a long-term period were developed - one and a half years, with a breakdown by quarters using direct and indirect methods. The plan provides information on the proposed loans and the use of funds received, discloses the investment policy of the company.

The developed budgets make it possible to predict the movement of cash flows and the main financial indicators of the enterprise and can be used for both internal and external use.

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CONCEPTUAL APPROACHES TO INFORMATION TRANSFORMATION (DIGITALIZATION) OF AN AGRICULTURAL ENTERPRISE

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Abstract

In this article, we investigate classical and modern approaches to the formation of a scientifically grounded concept of information transformation based on the digitalization of a typical agricultural enterprise. In the context of weakening financial stability and a shortage of resources, the potential for lockdowns and quarantine restrictions, profitable operation of an agricultural enterprise is not possible without comprehensive automation and digitalization. In most cases, the introduction of digital technologies into real agricultural production is spontaneous and often intuitive, the "digital business model" in our view is a complex model of digital technological and management processes of an enterprise that characterizes the production, technological, innovation, financial and marketing strategies of the enterprise. in the process of creating added value of manufactured products, expressed in the form of a digital database and presented in the form of an information flow on a digital medium. We show that digitalization is not effective without full-fledged strategic planning and building a digital business model of an agricultural enterprise. Moreover, the classical approach to modeling may not be applicable, and the author's concept of building an integrated digital business model is preferable.

Key words**:** *agriculture, digitalization, full-fledged model, digital business model, concept*

INTRODUCTION

For a long time, traditional systems of social production have contained a specific set of elements that make up the essence of the process. For agriculture, the objects of production are land, production assets, means of production, farm animals. However, the stage of development of scientific and technological progress dictates new conditions in which information and information (digital) technologies become the key object [5]. Currently, it is impossible to imagine or simulate an economic entity in an information (digital) vacuum and conducting economic activities in a completely isolated and autonomous manner.

This is primarily due to the fact that information (digital) technologies over the past thirty years have become an integral part of all spheres of economic activity and are deeply integrated into each of their elements [1, 3]. And even the land, as the most traditional of the production facilities, gradually transformed into a “digital land.” For the first time, this concept was formed in 1998 and is an expanded concept of “point farming”, which is based on the digitalization of geodetic data and the formation of a full-fledged three-dimensional digital model of a specific territory. Digitization in this context is an important agricultural risk management tool that can help assess the risks associated with climate change, develop an income protection plan for producers, and ensure soil quality [2].

Technological processes in the sectors of the agro-industrial complex have also, in turn, been affected by digital technologies. Agricultural machinery is currently a complex

information technology system that combines colossal production capacities and sophisticated information and digital control modules, which has made it possible to increase labor productivity in agriculture several times over the past 30 years.

Speaking about the processes of informatization and digitalization, it is impossible to ignore the process of managing agro-industrial production. Currently, digital technologies have become mandatory for use and these norms are enshrined in the relevant regulatory legal acts. Digitalization through computerization of management has led to the introduction of dozens of computer programs into the process of economic management, facilitating and accelerating processes such as accounting and reporting, drawing up technological maps, monitoring of control and supervisory bodies, control of technological processes, GIS monitoring, etc.

In connection with the above, it is objective to assume that a modern agro-industrial enterprise is digital. Accordingly, the business model used in the strategic management process at the planning and organization stages will also be digital.

Therefore, the companies and clusters developing business in agriculture will benefit of digitalization and information technologies for strengthening agricultural production and its efficiency either in the classic system or organic agriculture [8, 11].

However, this raises the actual problem of the use of terminology. There is currently no generally accepted meaning of the digital business model. Accordingly, there are discrepancies and difficulties in the process of perception of information and implementation of scientific and technical support of the industry.

MATERIALS AND METHODS

In the course of our research, we studied various approaches to understanding the concept of "digital business model". Samuel Shen, Alan Bassist and Allan Howard [12] in the context of digital agriculture define a digital model as a set of digital databases (climatic, landscape, parametric, soil, etc.) that allow business entities to make better management, production and marketing decisions.

Linder and Cantrell [6], in the context of general business modeling, define the digital business model as a digitized system that defines the logic of an organization to create value and add value.

Venkatraman and Henderson [13], in turn, envision a digital business model as a digital strategy that reflects the architecture of a virtual organization in three main areas: customer interaction, asset configuration, and knowledge utilization.

Osterwalder [9, 10] believes that the digital business model is a conceptual tool that contains a set of digital elements and their interrelationships and allows you to express the business logic of a particular firm. It is a digital mapping of the value that a company offers to one or more customer segments, as well as the technology architecture of the firm and its network of partners to create, market and deliver that value relationship capital to generate profitable and sustainable revenue streams.

Medennikov V.I. [7] in his works defines the business model of the agro-industrial complex as a transformed digital model of databases within a specific digital platform.

Filonenko [4] offers an interpretation of the digital business model in the agro-industrial complex as a model of a digital platform, taking into account the structure of the agro-industrial complex of the region and contributing to the active introduction of advanced information technologies in the activities of small and medium-sized agricultural producers.

As a result, there is an objective uncertainty of perception and approaches to understanding the concept of “digital business model” of an agro-industrial complex enterprise. Domestic approaches are based on business digitalization and further modeling, while in foreign practice the concept of modeling business processes in a digital format is accepted.

The presented review confirms the existence of a significant segment of scientific literature devoted to the development of digital business modeling. Nevertheless, in various sources, there is often an objective uncertainty of perception and approaches to understanding the concept of a “digital business model” of an

agro-industrial complex enterprise. Russian approaches are based on business digitalization and further modeling, while in world practice the concept of modeling business processes in a digital format is accepted.

In preparing the article, the data of the Federal State Statistics Service (Rosstat), scientific works of Russian and world scientists on the topic under study, materials of research institutions were used. The objects of research are typical enterprises, the strategy of which is based on the principles of digital modeling and business digitalization. When studying the theoretical and methodological aspects of digitalization, monographic and logical methods were used. The development of a methodology for identifying methodological foundations was carried out using abstract-logical and computational-constructive methods, the method of paired comparisons.

RESULTS AND DISCUSSIONS

Having summarized and studied in detail the scientific experience, we propose the following definition: a digital business model is a complex model of digital technological and management processes of an enterprise that characterizes the production, technological, innovative, financial and marketing strategies of an enterprise in the process of creating added value for manufactured products, expressed in the form digital database and presented in the form of information flow on a digital medium.

Thus, the above definition removes the problem of terminological discrepancy, generalizes domestic and international experience and allows you to take into account various aspects of scientific, technical and digital progress in the process of enterprise modeling.

Based on the proposed definition, it becomes obvious the need to develop conceptual provisions for the digital modeling process, taking into account the prospects of digital solutions implemented in the process of managing an agro-industrial complex enterprise.

The formation of a digital business model provides for mechanisms for regulating the integration of production, management and digital technologies:

- definition of a long-term goal;
- development of a promising digital production program;
- substantiation of the organizational structure and management structure;
- establishing the form of inter-economic economic relations;
- introduction of an effective planning, accounting and control system;
- determination of the directions of marketing policy.

The methodological foundations for developing the concept of creating a digital business model are:

- the irreversible nature of evolutionary changes in the agrarian economy, since the evolution of productive forces and production relations excludes an absolute repetition of the path traveled;
- convergence associated with the need to converge agricultural production and digital technologies, due to the presence of common objective patterns of development;
- adaptation of agricultural production to the laws of a market economy based on taking into account the specific features of agricultural production, observing the laws and principles of its organization and creating conditions for their implementation;
- an integrated, systematic approach to digital integration with the aim of efficient use of land, labor, production, material and technical, financial, innovative and digital resources;
- gradual and phased development of the integration of participants in agro-industrial production into the digital environment for the full creation of an interconnected economic mechanism of management;
- the unity of the requirements of the laws of the market both at the level of the digital model and at the level of physical production, and at the level of enterprise management;
- maximum coverage of all areas of the enterprise with a digital model, ensuring its well-coordinated work, allowing to assess potential risks, critically assess promising results, and achieve high production indicators.

In practice, the implementation of the above methodological provisions depends on the well-coordinated interaction of the elements of the digital model. The system of internal and external factors influencing the formation of the model is shown in Fig. 1.

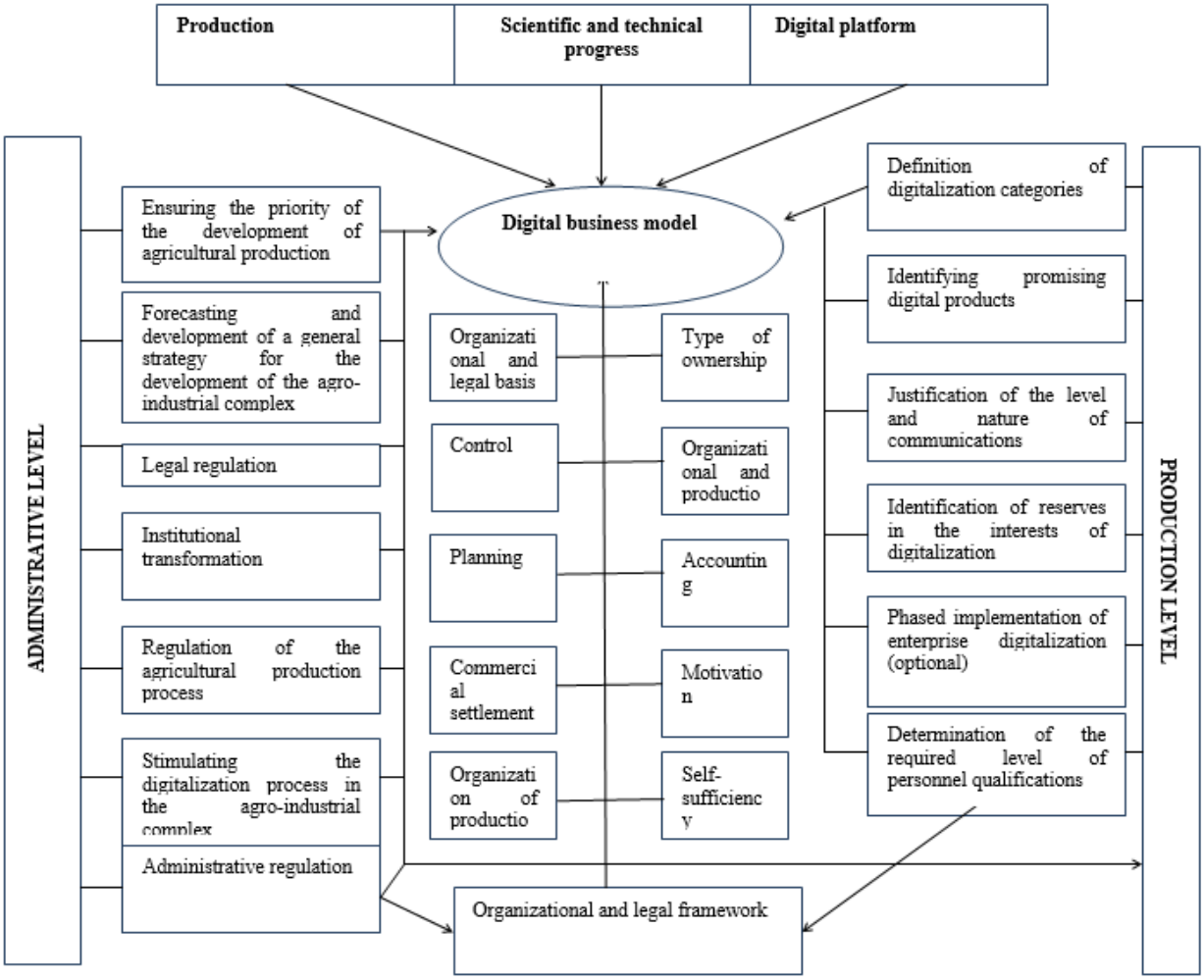

Fig. 1. Conceptual framework for the formation of a digital business model of an agro-industrial complex enterprise
Source: Developed by the authors.

External conditions act as objective factors of the digital business model. They are determined by specific measures implemented at the administrative and production levels. External conditions and the actions they define at the administrative level include:
- ensuring the priority of the development of agricultural production;
- forecasting and development of a general strategy for the development of the agro-industrial complex;
- legal regulation;
- institutional transformations;
- regulation of the process of agricultural production;
- stimulating the process of digitalization of the agro-industrial complex;
-administrative regulation.

At the production level, measures to shape the digital business model are:
- definition of categories of digitalization;
- identification of promising digital products;
- substantiation of the level and nature of communications;
- identification of reserves in the interests of digitalization;
- phased implementation of enterprise digitalization (optional);
- determination of the required level of personnel qualifications.

The formation of a digital business model will depend on the regulation of the level of digitalization within the enterprise, on the mechanism of integration into general economic

digital systems and the tools of the digital platform. In this regard, it is necessary to develop a step-by-step methodology for creating a digital business model of an agro-industrial complex enterprise.

The internal conditions include a set of measures of the microeconomic level, which is carried out directly by the enterprise, or among the founders (if the enterprise has not yet been created). In a crisis, financial deficit and a difficult market environment, well-coordinated interaction of the subjects of modeling and complete interrelationship will be the main and decisive factor in effective modeling.

Conceptual features of digital business modeling of an agro-industrial complex, in our opinion, should be as follows:

- total digitalization of production, land and property;
- the distribution of uniform principles for organizing digital interaction for all business processes;
- the need to constantly assess the effectiveness of the implementation of digital technologies by a set of indicators that characterize the enterprise as a whole;
- organizing the activities of each area of the enterprise on the basis of a general digital business plan;
- coordination and coordination of the work of the industries of the enterprise on the basis of a single digital platform;
- a high degree of independence and responsibility of the management bodies of the enterprise for the final results of activities and the level of proficiency in digital tools;
- creating an optimal level of digitalization for all industries, providing the necessary degree of technological and managerial consistency.

In this regard, it is necessary to develop a general digital model of the agro-industrial complex, taking into account the private models of all its industries. The model of each industry, in turn, should be justified in terms of its structure, composition of participants and level of digitalization.

The analysis of the above factors allowed us to formulate the main conceptual provisions of digital business modeling, which are shown in Fig. 2.

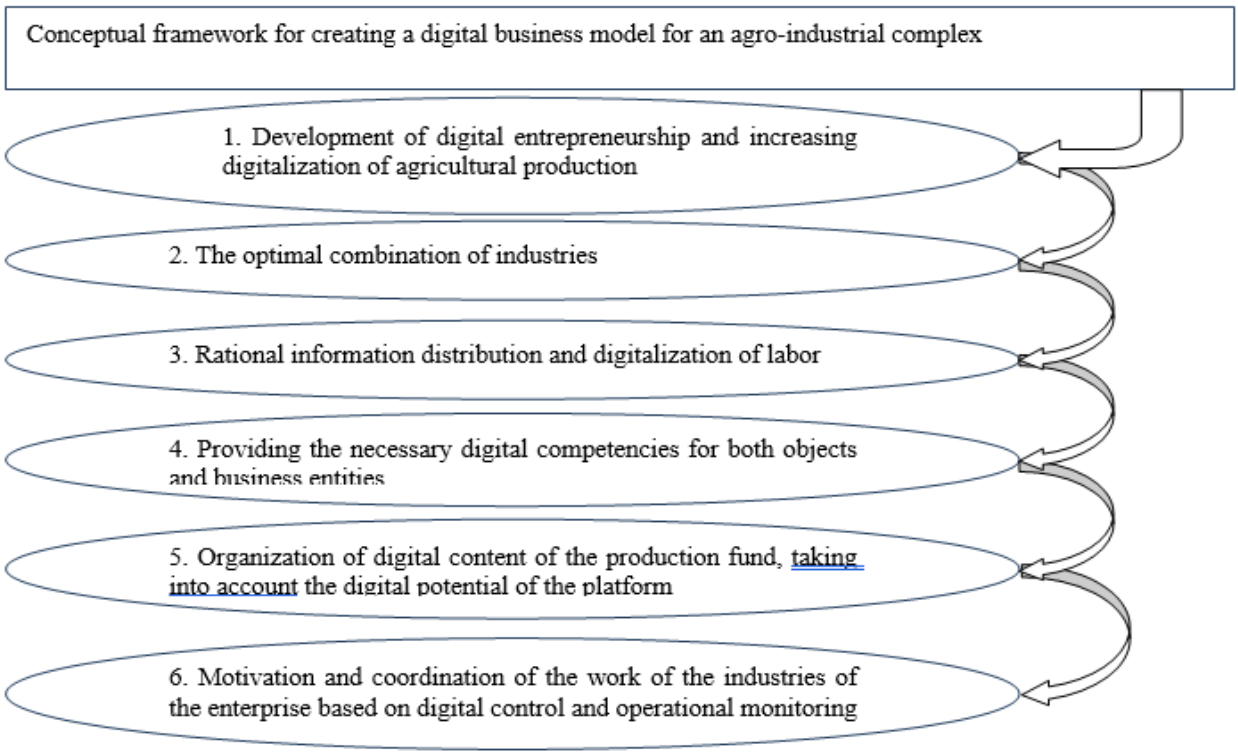

Fig. 2. Conceptual framework for creating a digital business model of an agro-industrial complex enterprise
Source: Developed by the authors.

The presented concept reflects the system of interrelated relations between the industries of the enterprise and within them, based on the level of digitalization of the latter. The concept is a set of organizational and economic principles for creating a digital business model of an agro-industrial complex enterprise, designed to create deep connections and relationships between production, management, service divisions, functional services and administrative control bodies.

The system of elements of the concept, the sequence of implementation of the conceptual provisions and the programmatic issues of their implementation are given in Table 1.

Table 1. The main elements of the concept of creating a digital business model of an agro-industrial complex enterprise

Concept element	Conceptual position	Concept implementation mechanism
1. Development of digital entrepreneurship and increasing digitalization of agricultural production	Creation of conditions in farms and at enterprises of the agro-industrial complex for testing and implementation of advanced digital technologies and developments, production using commercially successful digital technologies	Legal and legislative regulation of digital integration, creation of a legal basis for the implementation of digital regulation of production. Assistance to regional authorities in joining agricultural enterprises to a single information and digital environment
2.The optimal combination of industries	Creation of an optimal production structure that ensures high economic efficiency of activities through the use of digital production technologies. Development of intra-industry specialization, taking into account the requirements of the market and the digital and computing capacities of the enterprise	Determining the size of individual industries based on the digital potential available. The optimal combination and balance of the use of traditional and digital technologies of production and processing, the creation of a diversified digital structure of production in order to obtain the opportunity to compensate the losses of one industry with the profit of others
3.Rational information distribution and digitalization of labor	Formation of digital divisions within the framework of the model from the already created and functioning industries of the enterprise. Optimization of the technological process taking into account digital technologies and the establishment of interconnections between production, management, marketing and regulatory organizations based on a digital platform.	Depending on the specific availability of the digital technology industry, form digital subdivisions of the optimal composition in the model, ensuring the timely and uninterrupted implementation of the main production. Development of regulations on analog-digital interaction of enterprise employees
4. Providing the necessary digital competencies for both objects and business entities	Organization of staffing, taking into account the need for qualified labor in the framework of realizing the potential of digital technologies. Organization of training and retraining of personnel, implementation of modernization of production facilities	Establishment of qualification and competence requirements for employees of the enterprise, establishment of a range of tasks that must be solved without fail using digital technologies. Computerization and informatization of personnel Ensuring free decision-making on digitalization of land, landscape, climate, technological process, accounting, tax, financial and production accounting systems
5. Organization of digital content of the production fund, taking into account the digital potential of the platform	Development of a digital content plan reflected in the digital business model, indicating specific stages, deadlines and responsible persons. Regulating the use of digital technologies, modeling an enterprise with the maximum use of digital tools. Strategic enterprise management in accordance with a digital business model.	Development of an enterprise digitalization plan, ensuring the comparability of income and expenses for the implementation of digital technologies, substantiation of a system of indicators for assessing the effectiveness of digitalization. Development of provisions on production and economic compliance with the digital business model, creation of a roadmap for the implementation of the digitalization process. Development of conditions and registration of digital interaction of the enterprise with the external environment.
6.Motivation and coordination of the work of the industries of the enterprise based on digital control and operational monitoring	Motivation of the work of the industries of the enterprise and the strengthening of the material interest of its participants in the final results of production at the stage of formation of a digital business model	Development of progressive systems of digital interaction between the industries of the enterprise, stimulating the implementation of digital control and monitoring of production, taking into account the exact compliance with digital technologies, methods, norms.

Source: Developed by the authors.

Thus, based on the above concept, it is necessary to develop a digital business model of an agricultural enterprise in order to achieve its effective operation, self-sufficiency, interaction between industries and the interest of all participants in maximizing the potential of the digital technologies used.

The developed concept assumes a comprehensive integrated work of enterprise management in the modeling process, however, speaking about the digitalization of the industry as a whole, it is necessary to study in detail the objective prerequisites for increasing the level of digitalization, as well as consider the advantages and disadvantages of digital business modeling. At present, Russian agriculture is lagging behind in many areas. The level of technical support of the industry, provision of material and technical resources, digitalization of management, selection and genetic work are at a critically low level. The average age of agricultural machinery is on average 20 years or more, the largest hybrid breeding centers have been destroyed, the provision of feed, fertilizers and planting material is generally poorly controlled, which forces agricultural producers to carry out production activities using outdated, simplified extensive technologies.

Table 2. Benefits of digital business modeling for the world's leading economies

Digital business modeling element	**Digitalization of land**	**Digitalization of production**	**Digitalization of management**
USA	Systematization of lands and capitalization of the market for land resources, increasing the value of agricultural. land	Intensification of production, raising the technological level, robotization of production, development of agricultural aviation	Legalization of agricultural production, reducing the number of economic crimes in the industry, improving management efficiency, raising awareness and digital mobility of agricultural management. production
Canada	Systematization of the natural and climatic digital map, reducing risks, improving the quality of risk forecasting	The development of previously unsuitable for agricultural use. activities of land, intensification of production, implementation of concepts of resource-saving production (no-till, mini till)	Raising the level of management potential, reducing management costs, increasing the mobility of management, increasing and legalizing tax revenues.
EU	Creation of a Unified agricultural policy of land turnover and accounting, land cataloging, approval of uniform standards for land categorization	Capitalization of small businesses, development of farming, increasing the economic efficiency of private farming, increasing competition, reducing the cost of the final product	Improving the efficiency of the implementation of agricultural. state programs, legalization and openness of agricultural production, increasing the level of control over the investment turnover, the inflow of investments into the industry.
Brasil	Revealing promising land resources, building a national soil map, improving the efficiency of feed production and pasture cattle breeding	Reducing livestock costs, chipping livestock, digital management of pasture grazing, increasing the productivity of dairy and beef cattle.	Reducing transaction costs and increasing operational efficiency, increasing exports, increasing the volume of contract supplies, increasing the attractiveness of the industry due to an open contract system
China	State control over the turnover of land resources, the return to turnover of "shadow" lands, the totalization of land use	Stabilization of the agricultural market. products, implementation of programs of accelerated import substitution, rejection of manual labor, increasing the efficiency of large and medium agricultural. Entrepreneurship	"Digital transformation" of the industry, government subsidies and investment of digitalization, increasing the level of capital return on investment projects

Source: Summarized by the authors.

Negative market processes also, in turn, do not contribute to the redistribution of financial flows of enterprises for intensification, modernization and digitalization.

Separately, it is worth noting the high distrust of the management segment of agricultural business structures to the domestic scientific potential and the intuitive-proactive type of planning.

These negative trends, together with the high-risk nature of production activities, are ubiquitous in agriculture in most regions of Russia and the ex-USSR countries. However, if we consider the experience of leading enterprises in the leading industry areas, the situation changes radically. In the course of the research, the advantages of digitalization of business processes were studied using the example of the world's leading economies, as well as the leading industrial regions of Russia.

The capitalist nature of the market and the evolutionary processes of the development of social relations led to a significant breakthrough in the agricultural sectors of Europe, Canada, the United States, Brazil and China. The benefits of digital business modeling are detailed in Table 2.

The considered dynamics clearly demonstrates the advantage of using digital business solutions in agriculture, thus leveling the high cost of capital investments due to the potential growth of profits, efficiency and industry mobility. Separately, attention should be paid to increasing the investment attractiveness by increasing the reliability of business planning, the reality of the planned indicators of digital business models and the identification of production risks at the planning stage of the digital business model, which incorporates counter-risk measures and resources into the strategy.

The development of a high-quality and effective digital business model is impossible without a comprehensive analysis of modern digital solutions that maximize the usefulness of system implementation. In the course of our research, we studied advanced scientific and technological developments in the field of digitalization of the agro-industrial complex of Russia and identified the most promising of them. The studies were carried out by analogy with the experience of the leading world economies in three areas: digitalization of land, digitalization of production, digitalization of management.

Digitization of land is a process initiated by the Government of the Russian Federation and aimed at creating and implementing an intelligent system for planning and optimizing agricultural landscapes and land use in agricultural production at different levels of generalization (field, economy, municipality, constituent entity of the Russian Federation, country, foreign territories), operating on the basis of digital, remote, geoinformation technologies and methods of computer modeling. As a result, the following databases have been formed to date:

- database of satellite images of high spatial resolution;
- a database of vector layers of contours of arable land (arable land);
- a database of all agricultural producers of districts: agricultural organizations;
- a database of agricultural producers associated with the vector layer of the contours of arable land (arable land).

Formed expert databases, with the availability of resources and organizational work, allow us to solve the following tasks:

- Keeping a centralized record of arable land, their inventory, monitoring the condition and use, preparing the necessary analytical information;
- conducting regular remote satellite sensing of fields to monitor the state of crops and the actual use of arable land;
- registration of land plots from arable land and land used or provided for agriculture, as part of land of other categories, which is based on information obtained from various sources: cadastral registration, ground observations, remote sensing data of the Earth;
- aggregation and necessary processing of information on production, financial, economic, social and other indicators at various levels: field (site), enterprise or farm, rural municipality, municipal district, region as a constituent entity of the Russian Federation;

- information support for making management decisions related to the development of the agro-industrial complex and rural areas;
- monitoring: the effectiveness of the development of agriculture and rural areas, the implementation of investment projects, the effectiveness of the use of state support at the level of both individual economic entities and territorial entities;
- provision of state information resources on arable land to federal executive authorities, executive authorities of the constituent entities of the Russian Federation, local authorities, agricultural producers, as well as other interested parties.

Formed databases and software provide:
- access of registered users to data through a WEB-browser (via the Internet), without using additional software at the workplace;
- simultaneous connection of cadastre layers, digital space and aerial photographs, maps of soil types and other raster topographic maps. For the vector layers of databases, the following is provided: the function of displaying attributive information on the selected vector object, the function of requesting users to search for vector objects containing information entered by the user;
- integration of the database with vector maps of agricultural land, other areal objects available on the territory of the constituent entities of the Russian Federation;
- full integration of the database with thematic vector maps of agricultural land, other areal objects available on the territory of the constituent entities of the Russian Federation;
- the ability to place any point and area objects on the map: investment sites and projects, specialized objects and enterprises, etc.;
- the ability to connect to open services published by Rosreestr and other federal executive bodies of the Russian Federation.

The formed expert databases are the basis of the Geographic Information System (GIS), which can be an effective tool for managing the use of agricultural land.

The increase in the economic efficiency of agricultural production as a result of the digitalization of land resources made it possible in the USA, Germany, Canada and Brazil to reduce production costs by an average of 150 USD/hectare.

The next area of integrated digital business modeling is the digitalization of production. In this direction, precision farming systems and cattle breeding robotization systems proved to be the most effective.

The robotization of livestock breeding is aimed at automating feed distribution, the introduction of automatic feeding systems, automated systems for cleaning stalls, automation of machine milking, which makes it possible to increase milk yield by an average of 30-38% (Brazil, China, Finland), the use of modern transport control methods allows to reduce costs for fuel by 20% (USA, UK, Israel). The experience of using digital technologies at agricultural enterprises in the Belgorod region has shown that the vector towards automation and digitalization can help reduce costs even in the short term - with the introduction of a system of operational management of production at the meat processing plant for the first month, labor costs decreased by 30%, and general production costs decreased by ten%.

In turn, precision farming technologies significantly increase the economic efficiency of crop production. Experts from the MIT Media Lab Open Agriculture Initiative (OpenAg) assess the effectiveness of the use of innovative technologies in agriculture:

reliable information about the quality of cultivated land and the use of the required amount of fertilizers can increase efficiency by 30%;

the allocation of homogeneous zones within one field can increase productivity by 20%;

The technology of the changeable seeding rate and automatic seeding shutdown allows to increase the yield by 12% compared to using one seeding rate in the field.

According to MIT, the use of automatic section shutdown technology can reduce unproductive seed costs by 1-10%. In the United States, using this technology, farmers save from $ 4 to $ 62/ hectare, depending on the crop. The technology of differentiated fertilization allows you to save from 5 to 40% of fertilizers. "The overall economic effect is from 10% (use of one element) to 50% (full integrated implementation)." So, the saving of seed

material is from $ 6 to $ 16/hectare, differentiated fertilization - $ 36/hectare, local belt fertilization - from $ 40 to $ 70/hectare, and the increase in yield - from 0.5 to 1.5 tons/ hectare. Digitalization of management is a backbone element of digital business modeling. It is aimed at automating management processes, bringing together the results of digital monitoring of production activities, making operational and strategic management decisions aimed at increasing production efficiency and comprehensive implementation of digitalization processes. Digitalization of management in the agro-industrial complex is impossible without taking into account fully integrated internal accounting systems and a single digital back office in the business model. Both dashboarding (a dashboard reflecting the values of the most important business indicators in real time) and the accumulation of a database of production performance indicators should be used. The supply chains in such a production are built online, sales are omnichannel (both off-line and on-line). An example of the implementation of a digital management model is the Novokuban branch of the Federal State Budgetary Scientific Institution "Rosinformagrotech" (Krasnodar Territory), where an experiment was carried out using different information resources, guiding the process of differentiated fertilization: the data of nitrogen sensors and NDVI images give incomplete data, the main effect is obtained when working with maps fertility potentials (layered maps). Economic efficiency (profit growth) based on the results of this project was 0.4-0.8 thousand dollars / hectare, depending on the crops and the set of solutions used.

The study clearly confirms the increase in efficiency from the implementation of complex digital solutions, therefore, when developing an organizational and economic mechanism, it is necessary to take into account the lack of a synergistic effect from digitalization with partial implementation.

As a result, a complex digital business model will look like this Table 3.

Table 3. Three-stage ideal digital business model of agricultural enterprise activity in the region

Digitizing the earth	Digitalization of technologies	Digitalization of management	Key indicators
Stage I			
Installation of GIS markers, satellite determination of field boundaries, installation of digital sensors for soil appraisal	Equipping equipment with GPS, GLONASS equipment (crop production), installation of automatic feed dispensers (animal husbandry)	Equipping all computers of the control apparatus with Internet access, remote monitoring and control of the consumption of agricultural resources. technique	Reducing production costs by 10-25%, increasing the profitability of production, reducing costs by 10-15%, removing the position of a fuel and lubricants accountant from the staff.
Stage II			
Drawing up a detailed soil map of the company's fields, drawing up a climatic map, cataloging lands	Automation and robotization of sowing and harvesting works, equipping machinery, equipment for the precise distribution of fertilizers, planting material (crop production), automation and robotization of machine milking, chipping of livestock (animal husbandry)	Back office optimization and dashboarding, market price monitoring using digital platforms, stock indexing of products, marketing automation	Reducing costs by 10-13%, increasing the level of marketability of products by 30-50%, removing from the staff of auxiliary personnel (milkmaids, cattlemen), sales economists, redistribution of management functions
Stage III			
Robotic monitoring of soil conditions, aerial scanning, automated control of the level of moisture, minerals, digital zoo and phytocontrol	Full robotization of sowing and harvesting operations, robotization of post-processing agricultural raw materials, robotization and digitalization of storage of products (crop production), robotization of feeding and milking, quality control of raw materials, control of vital signs of livestock (livestock)	Adoption of strategic and operational management decisions based on omniak digital analysis, creation of a data bank, accumulation of arrays and the formation of a digital ecosystem of the enterprise.	Reduction of costs by 18-22%, removal from the staff of the position of economist, calculator, foremen of various levels, reduction of transaction costs by 17-23%, increase in profitability of sales by reducing administrative costs by 8-11%

Source: Developed by the authors.

In relation to the conditions of real production, the advantages of implementing a digital business model are most clearly reflected in Fig. 3.

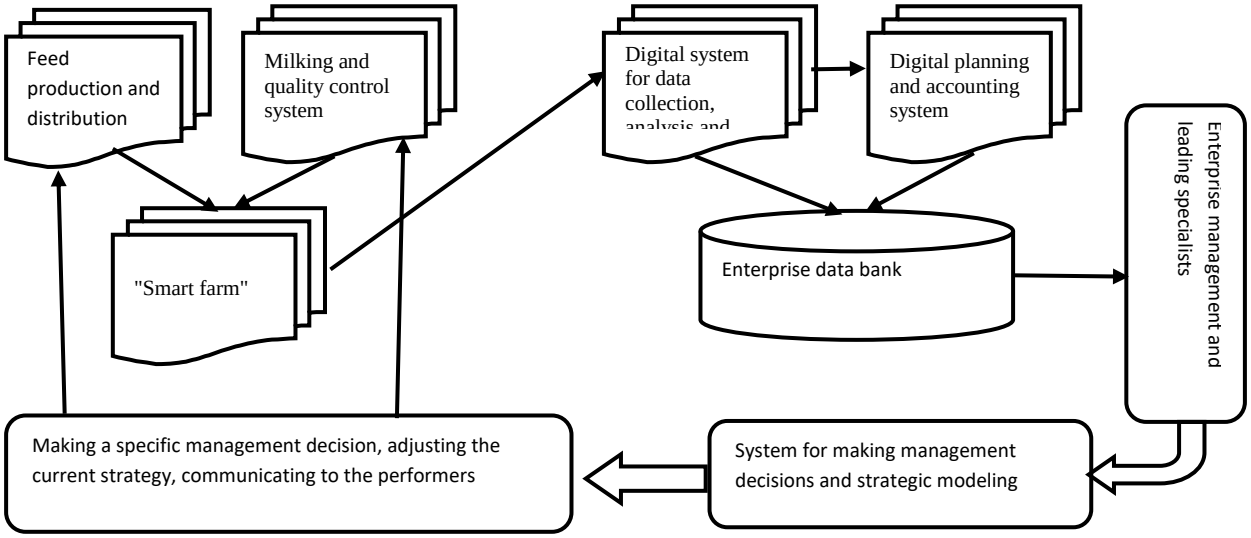

Fig. 4. Process model of the digital ecosystem of the dairy industry of the enterprise
Source: Developed by the authors.

CONCLUSIONS

The presented digital business model is demonstrated by examples of enterprises making the transition to digitalization at stages I-II. Using the example of the dairy industry of enterprises, we forecast an increase in production volumes and the mass of proceeds against the background of fixing the cost price and reducing personnel costs. These factors clearly emphasize the effectiveness of digital business models in terms of removing redundant and redundant personnel from staff, the savings due to which cover the costs of introducing digital technologies and complex system solutions.

Extrapolating the business processes of the enterprise in the Osterwalder-Pignet business model, we can see that before the systematic use of digital technologies, enterprises did not have breakthrough competitive advantages against the background of similar enterprises in the industry. The phased implementation of digitalization mechanisms will allow organizations to automate production, communication and management processes into a single digital multi-system that allows management entities to make more effective management decisions due to complete and comprehensive objective production information accumulated in the enterprise data bank and allowing the implementation and effective use of digital systems. decision making to help the management of the organization. The developed digital business model visualizes a complex digital system of interdependent elements that monitors and controls at all stages of the production and management process of the dairy industry of the enterprise. The resulting production, management, marketing and strategic decisions will benefit from greater objectivity and efficiency compared to the traditional, currently implemented intuitive management methods. As a result, the traditional average enterprise is evolving into a digital forefront business unit.

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DYNAMICS OF FOOD CONSUMPTION IN ROMANIA IN THE PERIOD 2008-2019

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Abstract

The goal of the paper was the analysis of food consumption in Romania in the period 2008-2019 using the data put at the disposal by National Institute of Statistics. The data were processed using descriptive analysis reflected in mean, standard deviation, variation coefficient and also annual growth rate. First, the value of the minimum consumption basket increased accounting for Lei 7,278 in 2020 for ensuring a decent living for a family with two adults and two children. Food consumption in Romania accounts for about 21% in the total expenses for the minim consumption basket. Food consumption was analyzed by category of food products and the results proved a growth of consumption in case of poultry, pork and mutton meat, cheese and butter, fruit, vegetables, jam, honey, ice cream, coffee and tea, and a decline in consumption of bread, beef, milk, beans, potatoes, sugar and chocolate. These trends reflect that the Romanian consumer is aware that his daily diet must be healthier and more balanced than before. For the future, consumption have to be focused on three criteria: health, sustainability and convenience. This means that consumption to be based on fresh, natural, organic, healthy, safe and in-season food offered mainly by local producers and the offer could be completed by imports especially for the extra season food products,

Key words**:** *consumption, food, living standard, dynamics, Romania*

INTRODUCTION

Nutrition plays an important role in promoting and maintaining health. An unhealthy diet can lead to metabolic imbalances and emergence of diseases that have become more common nowadays: obesity, diabetes, cardiovascular disease, cancer, osteoporosis and dental diseases.

Changes in eating habits in the sense of orientation to products rich in protein, fats, carbohydrates, calories, with a low content of fibers, to which is added an increasingly sedentary lifestyle have been caused by the development of industrialization, urbanization and mechanization, changing technologies in food manufacturing, the emergence of fast food and catering, the daily stress of busy working days.

However, consumer has become more conscious that food has to be seen not only as a mean to satisfy the basic needs but also to cover a spiritual satisfaction during and after consumption. More attention is paid to the information available on products, which are carefully studied to be natural, healthy products, with high nutritive value.

Despite that we live in the so called "consumption society", stomach capacity is limited, therefore people cannot consume more food, but could chose higher quality products and consume less. In general consumer have their own criteria to buy a food product: utility, novelty, habits, quality (aspect, freshness, taste, flavour, nutritional value), impact on health (naturalness, low calories food, organic food, food safety etc), country or region of origin, landmark, price, and also other criteria such as to be environment protective [22].

Despite that in the EU it is available a large variety of food and drinks, consumptions and purchases are different from a member state to another taking into account local, regional and national cuisine and cultural identity and also regarding household income spent on food and beverage products.

In the EU, in the final consumption household expenses, food and beverages accounts for

about 21.5%, but in Romania they have a higher weight, 30.9%).

Meat has the largest share of household consumption expenditure, 3.3 % in average in the EU, but 7.8% Romania. Also, Romania is the only country in the EU with the highest share of overweight people, which increased from 50.3% in 2008 to 62.9% in 2017..

The EU promotes healthy, safe, sustainable diets, for avoiding nutritional deficiencies, overweight, reduction of food wastes and ensuring animal welfare. Therefore, this has a deep impact on what farmers have to produce and how they produce, how food is manufactured, packed, labelled, transported, stored and traded around the world and finally, on what we eat and drink [7].

Analysis of consumption is usually reflected by a large range of indicators which could be classified in three groups:

(1)value indicators: consumption fund, total expenses of the population and population consumption expenses,

(2)consumption indicators in natural measure units (volume of total consumption of goods and services; consumption per inhabitant;

(3)food consumption in terms of nutritional factors: calories, proteins, fats, carbohydrates, minerals.

Besides the material, food and non-food goods, the population appeals to a large range of services (education, culture, tourism, banking etc), and these all together characterize the standard of living which is also closely related to the economic development of a country [46].

The minimum threshold below which expenditure cannot be set to ensure a reasonable living standard is called "Minimum monthly consumption basket", which is an important item for establishing the minimum basic salary in the economy.

Taking into account food balances for all the food products we could describe the images of total consumption and also the average consumption per inhabitant in physical units.

In this context, the purpose of the paper was to analyze the dynamics of food consumption in Romania by food category in the period 2008-2019 in order to identify the main trends in order to establish the principal direction in which offer of food products could better satisfy the population needs for a more balanced and healthier diet.

MATERIALS AND METHODS

For setting up this paper a large range of information sources (reports, published articles etc) were carefully studied, paying a special attention to the ones in close relationship with the approached topic and the purpose of interest.

The empirical data were taken from National Institute of Statistics for the period 2008-2019.

Descriptive techniques of knowledge were used for indentifying the problems in consumption for each group of food products in terms of average consumption per inhabitant per year both regarding food of vegetal origin and of animal origin, expressed in physical units.

The main groups of products were the following ones:

- bread, corn, flour, pasta and rice;
-meat meat preparations, and fish;
-milk, cheese, orange cheese, cottage cheese and butter;
- fruit (apples, pears, plums, grapes, bananas, oranges);
-vegetables (tomatoes, peppers, cabbage, cauliflower, beans, potatoes);
-sugar, jam, chocolate, ice cream, bee honey, coffee and tea.

The main methods used to process the data have been:

- average - calculated with the formula:

$$\bar{X}_i = \frac{\sum Xi}{n},$$

-standard deviation was calculated with the formula:

$$\delta = \sqrt{\frac{\sum_{i=1}^{n}(Xi - \bar{X}_i)}{n}},$$

-coefficient of variation was calculated based on the formula:

$$CV_{\%} = \frac{\delta}{\bar{X}_i} x\ 100$$

-average annual growth rate

$$\bar{\Delta} = (\bar{X}_n - \bar{X}_1)/(n - 1)$$

RESULTS AND DISCUSSIONS

Minimum monthly consumption basket- as an expression of decent living

The legal definition of "minimum monthly consumption basket" is given by Emergency Ordinance No. 2017 of November 24, 2000 issued by Romania's Government and consists on the following text: "Minimum monthly consumption basket represents the essential item for establishing the basic minimum salary in the economy, of wage policy and other policies in the social field" [41].

According to Decision No.7/2018 of National Agency for Consumer Protection (ANPC), regarding the approval of the general criteria for establishing a reasonable living standard "The value of the minimum monthly consumption basket is the minimum threshold below which expenditure cannot be set to ensure a reasonable standard of living. This amount represents the amount of money from the debtor's that cannot be stopped for the payment of debts because it is necessary for him to cover the expenses indispensable to ensure the daily living for himself and his family" [16].

In 2020, it was issued Law 174 from August 14, 2020 for modifying and completing Emergency Ordinance of the Government no.217/2000 regarding the approval of the minimum monthly consumption basket.

According to this Law the minimum consumption basket is the basic item for establishing the minimum gross salary at the country level guaranteed in payment and of the wage policy.

The chapters of the minimum monthly consumption basket for a decent living are: (i)Food, (ii)Clothing and footwaer, (iii)House, (iv)Housing equipment, (v)Housing expenses, (vi)Products for house use and personal hygiene, (vii)Communication appliances and transportation, (viii)Education and culture, (ix)Health care, (x) Recreation and vacation, (xi)Family savings fund.

The monthly consumption basket includes a list of basic foods consisting of: milling and bakery products, cereals, fresh and canned vegetables, fresh and canned fruits, meat and meat preparations from all the farm species, fresh and frozen fish, milk and dairy products, eggs, fats and oils, sugar and sweets, soft drinks [42].

The value of the minimum monthly consumption basket is the minimum necessary to ensure respect for the rights, fundamental freedoms and human dignity of the debtor and of the persons to whom he provides or owes them, in accordance with the law, routine maintenance. The value of monthly minimum consumption basket is annually updated by National Institute of Statistics and approved by the Romanian Government [5].

In September 2019, Romanian Government established that for a family consisting of four persons a decent living standard could be assured by "a sum of Lei 6,954, representing the value of the minimum consumption basket" at that time.

In September 2020, Romania's Government approved the updated value of the minimum consumption basket for a decent living for a family with two adults and two children: Lei 7,278, which is by +4.7% higher than in September 2019 (Lei 6,954) and in September 2018 (Lei 6,762) (Table 1).

For a family consisting of two adults and one child, the value of this basket was update at Lei 6,194 and for a family of two adults without children at Lei 4,597.

In case of a family consisting of four persons, the highest increase in the expenses structure was +8.8% at the chapter "house", followed by " Food" where the growth rate was 5.5% in 2020 compared to September 2019 [11].

Barbuta et al (2014) defined "minimum consumption basket", compared the methodology applied in Romania and in other EU countries regarding the setting of minimum salary based on the minimum consumption basket, also they compared the methods for establishing the social policies and pointed out the important of the alignment of Romania to the modern standards used by other EU member states for ensuring a decent living [3].

Between the economic development of a country and the living standard of the population is a close relationship [44, 45].

Table 1. Minimum consumption basket for a decent living for a family (2 adults and 2 children), 2020 vs. 2019 (Lei)

Expenses Chapter	**Sept. 2019**	**Sept. 2020**	**Variation Sept.2020 versus Sept.2019**		**Structure of Minimum consumption basket in 2020 (%)**
			Absolute change (Lei)	Relative change (%)	
1. Food	1,459	1,532	+73	+5.0	21.1%
2.Clothing and footwear	670	686	+16	+2.4	9.4
3.Housing	1,822	1,982	+100	+8.8	27.2
4.Housing equipment	225	229	+4	+1.8	3.1
5.Housing expenses	483	484	+1	+0.2	6.6
6.Household and hygiene products	243	250	+7	+2.7	3.4
7.Services	507	518	+11	+2.3	7.1
8.Education and culture	562	574	+12	+2.1	7.9
9.Health care	111	116	+5	+4.2	1.6
10.Recreation and vacations	240	246	+6	+2.3	3.4
11.Family savings fund	632	662	+30	+4.7	9.2
TOTAL Consumption basket	6,954	7,279	+325	+4.7	100.0

Source: Own calculation based on the data from [11].

It was emphasized that growth rate of GDP per capita (PPC) reflects the best this correlation between economic growth and the raise of the living standard.

Also, the living standard could be expressed in terms of purchasing power which means the number of products and services which could be bought with a monetary unit. Purchasing power is closely related to population's income and also to price level. If prices go up, and the income remains constant, the purchasing power decreases. If the population income is multiplied by inflation rate, purchasing power remains constant. Also, purchasing power depends on the net salary and the index of consumption prices.

In Romania purchasing power and average salary income are much lower than the UE average and the levels reached by most of the EU countries.

Consumption behaviour depends on many factors such as: income level, price, needs, preferences, habits, family size, etc.

Regarding food consumption, despite that Romania has natural premises to ensure an optimal level for nourishing the whole population, the model of food consumption is different compared to the one in other EU countries. The share of food expenses in total expenses is high, a large part of consumption is ensured from the own agricultural production obtained in the rural households, the high consumption of cereals and potatoes which have a low nutritive value and high risk of diabetes [44].

The decent standard of living has two dimensions: a quantitative and a qualitative one, which could differ as importance from a region to another and from a country to another, and that, besides the objective component regarding the biological and social needs, there is also o subjective component translated in terms of humans' perception on a decent living. This subjective component is deeply influenced by life style, being closely linked to income level and social status of each person. The individuals who get a higher income and have a higher social position, have always a higher decent standard [8].

Consumption of food products

Regarding the term "consumption", the National Institute of Statistics defined the following consumption types:

(a)Human consumption or available human consumption which represents the amounts of agro-food products (primary and manufactured) available for human consumption, no matter the supply source (wholesalers, retailers, collective consumption, self consumption); (b)Average annual gross food consumption per inhabitant which represents the amount of products in terms of commercial weight, which still need a few processing for being effectively utilized in human diet.

(c)Average net food consumption per inhabitant which refers to specific products (cereals, honey, fats);
(d)Average daily net food consumption per inhabitant, in grams; (e)Average daily net food consumption per inhabitant, in calories;
(f)Average daily net food consumption per inhabitant, in protein;
(g)Average daily net food consumption per inhabitant, in fats;
(h)Average daily net food consumption per inhabitant, in carbohydrates;
(i)Energy intake of nutrients in the calorie content of the average daily intake of proteins, carbohydrates and fats [17].

Average consumption of food products

Cereals consumption

Cereals play an important role in Romanians' diet being used as bread and other milling and bakery specialities, maize and wheat flour, pasta and rice [39].

- *Average bread consumption* during the analyzed period was 8.48 kg/capita/month and its dynamics reflected a general decreasing trend from 9.22 kg in 2008 to 7.93 kg in 2019, accounting for - 14%. The average annual decline rate was -1.37% and the variation was very small, CV = 4.4% (Table 2).

- *Average consumption of maize flour.* Maize flour is used for preparing polenta, a typical dish mainly in the country side of Romania. Usually, it is associated with cheese and sour cream or other meals like cabbage leaves filled with chopped pork meat, named "sarmale" (in Romanian) which belong to culinary traditions [24].

In average, a Romanian consumed 0.88 kg maize flour per month in the last decade, the general tendency being a decreasing one from 1.02 kg in 2008 to 0.73 kg in 2019, the average decline rate accounting for -3.08%. The variation coefficient, CV = 10.97% reflects a homogeneous distribution of the values across the studied period (Table 2).

-*Wheat flour* is consumed in a small amount than maize flour per month, accounting for 0.81 kg/capita during the studied interval. From 0.78 kg used in 2008, in 2019, a Romanian utilized 0.77 kg, despite that across the period it was reached a peak of 0.87 kg in the year 2015. Therefore, the decline rate is very small, only -0.19% in the whole period, The variation coefficient, CV = 3.39% reflects very small changes from a year to another (Table 2).

- *Pasta* is not a specific food for Romanians and that is why its consumption remained relatively stable at 0.30 kg/month/capita, the variation not being significant from a year to another (Table 2).

Table 2. Evolution of average monthly consumption for bread, maize flour, wheat flour, pasta and rice in Romania in the period 2008-2019 (kg/month/capita)

	Bread	**Maize flour**	**Wheat flour**	**Pasta**	**Rice**
2008	9.22	1.02	0.78	0.30	0.43
2009	8.97	1.01	0.82	0.30	0.43
2010	8.73	0.95	0.82	0.30	0.43
2011	8.57	0.97	0.82	0.30	0.42
2012	8.58	0.91	0.80	0.29	0.42
2013	8.50	0.86	0.82	0.31	0.43
2014	8.33	0.85	0.82	0.31	0.43
2015	8.49	0.86	0.87	0.30	0.44
2016	8.24	0.80	0.80	0.29	0.43
2017	8.20	0.80	0.80	0.30	0.43
2018	8.04	0.77	0.78	0.32	0.43
2019	7.93	0.73	0.77	0.32	0.43
Mean (kg)	8.48	0.88	0.81	0.30	0.43
St. Dev. (kg)	0.37	0.10	0.03	0.01	0.00
Variation Coeffic. (%)	4.40	10.97	3.39	2.75	1.06
Annual growth rate (%)	-1.37	-3.08	-0.19	0.53	0.02

Source: Own calculation based on the data from [18].

-*Rice* is a cereal included in a few dishes in Romanian gastronomy (soup, pilau, rice pudding, and "sarmale" etc) and for this reason its consumption is not so high, in average accounting for 0.43 kg/month/capita (Table 2).

Meat consumption. Meat is a very important component of the daily diet in Romania, and for the consumed amount the country is situated on the top position in the EU. Compared to other member states where poultry meat comes on the 1st position, Romanians consume especially pork, which is traditional in the local gastronomy. On the 2nd position comes poultry meat, followed by beef and veal and mutton, lamb and goat meat [25, 29, 33, 37].

The general trend regarding average monthly meat consumption is an increasing one for almost all sorts of meat, but in a very small proportion from a year to another. In average, the monthly consumption in the period 2008-2019 accounted for 5.29 kg/capita for total meat, 0.49 kg for beef and veal, 2.76 kg pork, 1.81 kg poultry meat, 0.20 kg mutton and lamb, and 1.11 kg meat preparations.

Analysing the average annual consumption, it was noticed a decline for beef from 0.67 kg in 2008 to 0.45 kg in 2019 (- 32.84%) and in case of mutton and lamb meat (-0.37%).

Pork and poultry meat are the most preferred. Consumption increasing by 0.86% average growth rate in the whole interval for pork and in case of poultry meat by 2.99%.

Fish and canned fish consumption accounted for 0.67 kg/month/capita and the general trend is an increasing one, having a mean growth rate of 1.99% annually (Table 3).

Table 3. Evolution of average monthly consumption for meat and fish in Romania in the period 2008-2019 (kg/capia/month)

	Total meat	**Beef and veal**	**Pork**	**Poultry meat**	**Mutton, lamb**	**Meat preparations**	**Fish**
2008	5.50	0.67	2.88	1.68	0.21	1.11	0.60
2009	5.61	0.61	2.86	1.89	0.21	1.11	0.64
2010	4.99	0.48	2.78	1.52	0.19	1.07	0.67
2011	4.67	0.46	2.54	1.46	0.19	1.02	0.64
2012	4.61	0.42	2.47	1.52	0.20	1.04	0.63
2013	4.53	0.43	2.43	1.46	0.20	1.03	0.64
2014	4.82	0.47	2.42	1.68	0.19	1.04	0.64
2015	5.28	0.53	2.61	1.92	0.18	1.12	0.72
2016	5.46	0.51	2.74	2.01	0.19	1.12	0.70
2017	5.70	0.41	3.01	2.08	0.19	1.20	0.73
2018	6.11	0.43	3.19	2.24	0.18	1.24	0.74
2019	6.20	0.45	3.17	2.32	0.20	1.24	0.74
Mean (kg)	5.29	0.49	2.76	1.81	0.20	1.11	0.67
St. Dev. (kg)	0.57	0.08	0.27	0.31	0.01	0.08	0.05
Variation Coeffic. (%)	10.78	16.33	9.94	16.85	4.25	7.07	7.46
Annual growth rate (%)	1.10	-3.51	0.86	2.99	-0.37	0.99	1.99

Source: Own calculation based on the data from [18].

Milk and dairy products consumption.

Milk and dairy products are important in the daily diet bringing an important intake of protein of animal origin and of calcium as well. Milk is a complete food from a nutritional point of view but in small quantities of nutrients. Due to its special flavour, cheese could be served as such or in various dishes or with fruit (apples, grapes etc) [28, 30, 35].

In the analyzed interval, in a month, a Romanian consumed 5.9 kg milk, 1.37 kg cheese and sour cream and 0.06 kg butter.

Regarding cheese consumption, the most preferred sorts are fresh cow cheese, cottage cheese, 0.43 kg/month/capita, then sheep cheese 0.23 kg and orange cheese ("cascaval" in Romanian) 0.11 kg.

While in case of milk, consumption declined by -0.97% per year in average in the studied period, cheese consumption registered an increasing trend, the average annual growth rate being 4.27% for orange cheese, 1.32% for cheese and sour cream, 1% for sheep cheese and 0.42% for cow cheese.

Romanians prefer much more cottage cheese either made from cow or sheep milk or combined. Orange cheese is also preferred, but it is consumed in a smaller amount due to the high price compared to cottage cheese.

Butter is consumed in a small quantity, just 0.06 kg/month, but CV =20.03% reflects a large change from a year to another, the general tendency being an increasing one, with an average growth rate of 5.61% (Table 4).

Table 4. Evolution of average monthly consumption for milk, fresh cheese, cottage cheese, orange cheese and butter in Romania in period 2008-2019 (litre/month for milk; kg/month for cheese and butter)

	Milk	**Cheese and sour cream**	**Cow cheese**	**Sheep cheese**	**Orange cheese**	**Butter**
2008	6.151	1.319	0.427	0.234	0.096	0.045
2009	6.168	1.329	0.425	0.233	0.098	0.052
2010	6.186	1.299	0.408	0.228	0.095	0.054
2011	5.962	1.284	0.416	0.219	0.083	0.053
2012	6.062	1.318	0.423	0.22	0.086	0.054
2013	5.870	1.354	0.439	0.22	0.088	0.057
2014	5.794	1.369	0.439	0.222	0.091	0.06
2015	5.835	1.287	0.447	0.232	0.116	0.068
2016	5.813	1.337	0.442	0.236	0.124	0.076
2017	5.768	1.464	0.45	0.243	0.141	0.078
2018	5.632	1.519	0.456	0.263	0.144	0.078
2019	5.523	1.524	0.447	0.261	0.152	0.082
Mean (litre; kg)	5.90	1.37	0.43	0.23	0.11	0.06
St. Dev. (kg)	0.21	0.09	0.01	0.01	0.02	0.01
Variation Coeffic. (%)	3.62	6.33	3.42	6.38	22.75	20.03
Annual growth rate (%)	-0.97	1.32	0.42	1.00	4.27	5.61

Source: Own calculation based on the data from [18].

Fruit consumption. Fruit plays another important role in human diet bringing us vitamins and fructose. For this reason, fruit consumption is recommended before breakfast, between breakfast and lunch and between lunch and dinner. About 300-400 grams of fruit is recommended to be consumed daily.

During the period 2008-2019, the average monthly consumption of fruit increased from 3.31 kg in 2008 to 4 kg in 2019, meaning +20.8%, as the domestic market is full of a large variety of fruit in all the seasons and for a healthy diet fruit have to be consumed daily.

However, annual consumption in Romania is smaller than in other EU countries.

The most consumed fruit are apples, and also plums, pears, cherries, peaches, apricots, grapes, nuts and also citrus and bananas from the imported fruit [31, 36].

The annual average growth rate in fruit consumption is 1.74% with a smaller variation, CV = 6.83%.

The average monthly consumption increased for all the categories of fruit. Apples and pears account for 1.5 kg/month/capita, the variation from a year to another being very small, CV = 4.4%.

Plums registered an average consumption of 0.13 kg/month with a slight increase in the analyzed period and a moderate variation caused by the deviation in the internal production and market offer, CV = 15.8%.

A Romanian consumed in average 0.26 kg grapes/month in the whole studied period with a slight increasing trend, + 0.93% annual growth rate.

Oranges are the most consumed fruit from import. In average, in a month, a Romanian consumed 0.57 kg oranges and also 0.54 kg bananas during the last decade. An increasing trend was noticed for the both fruit, + 5.06% for bananas and +2.83% growth rate for oranges.

A large variation of the average monthly consumption was noticed in case of bananas, CV =23.84%, reflecting heterogeneous value along the data series compared to CV = 9.98% for oranges, showing an uniformity in the chronological values (Table 5).

Table 5. Evolution of average monthly fruit consumption in Romania in the period 2008-2019 (kg/month/capita)

	Total fruit	Apples and pears	Plums	Grapes	Bananas	Oranges
2008	3.312	1.401	0.123	0.27	0.453	0.473
2009	3.552	1.590	0.097	0.286	0.454	0.505
2010	3.557	1.616	0.132	0.196	0.458	0.555
2011	3.399	1.466	0.104	0.226	0.448	0.561
2012	3.389	1.49	0.13	0.247	0.425	0.511
2013	3.449	1.512	0.131	0.241	0.427	0.519
2014	3.574	1.518	0.131	0.221	0.474	0.576
2015	3.742	1.549	0.152	0.274	0.528	0.595
2016	3.831	1.517	0.163	0.271	0.608	0.619
2017	3.897	1.456	0.108	0.286	0.688	0.61
2018	4.028	1.444	0.157	0.301	0.733	0.643
2019	4.006	1.417	0.127	0.299	0.78	0.643
Mean (kg)	3.64	1.50	0.13	0.26	0.54	0.57
St. Dev. (kg)	0.25	0.07	0.02	0.03	0.13	0.06
Variation Coeffic. (%)	6.83	4.40	15.80	12.86	23.84	9.98
Annual growth rate (%)	1.74	0.10	0.29	0.93	5.06	2.83

Source: Own calculation based on the data from [18].

Vegetable consumption. Vegetables are important in daily diet as a component of various dishes (fresh salads, soups, garnishes, pickles etc) being a source of important minerals and vitamins.

In salads are usually used: lettuce, tomatoes, green peppers, cucumbers, onion, garlic, carrots, celery, mushrooms etc), other vegetables like egg plants, cauliflower, cabbage, potatoes, pumpkins, carrots, celery, peas, beans are used in various dishes.

Canned vegetables are also used mainly during winter season when the offer is relatively limited to the imported one [21, 26, 32].

In average, in a month, a Romanian consumed 7.69 kg fresh and canned vegetables, meaning 92.28 kg/year and 0.248 kg per day.

However, daily consumption of vegetables is smaller compared to 400-500 grams which is recommended for a balanced diet.

Despite that it is a good point that vegetable consumption recorded an increasing trend from 7.3 kg/capita/month in 2008 to 8.06 kg in 2019, meaning by 10.49% more than at the beginning of the studied period.

Tomatoes consumption is in average 1.06 kg/capita/month with a slight increase from 1.098 kg in 2008 to 1.133 kg in 2019, meaning +3.18 % more.

Green peppers consumption has raised from 0.357 kg/month/capita in 2008 to 0.469 kg in 2019, which reflects a growth of +31.37%. The average consumption in the analyzed interval is 0.42 kg green peppers.

Cabbage and cauliflower consumption accounted for 0.79 kg/capita/month in the last decade. The evolution shows a slight increase from 0.767 kg in 2008 to 0.806 kg in 2019, meaning + 5.08%, with an annual growth rate of 0.45%.

Beans consumption is small and accounted in average for 0.35 kg/month. During the studied period, its consumption declined by -0.66% growth rate. This situation is caused by the low internal production of beans and the high price of the imported beans in supermarkets and agro-food markets.

Potatoes are a basic food in Romania, unfortunately domestic production decreased very much due to the drought of last years and the offer was completed by imports to assure the requirements. Also, potatoes price raised and this reduced consumption,

In the analyzed interval, the average monthly potatoes consumption declined from 3.61 kg/capita in 2008 to 2.89 kg in 2019, meaning by -20% less, the average annual decline rate being -2% (Table 6).

Table 6. Evolution of average monthly consumption of vegetables in Romania in the period 2008-2019 (kg/month)

	Total vegetables	**Beans**	**Potatoes**	**Cabbage and cauliflower**	**Tomatoes**	**Green and peppers**
2008	7.305	0.368	3.614	0.767	1.098	0.357
2009	7.627	0.362	3.586	0.791	1.148	0.41
2010	7.382	0.349	3.488	0.744	0.95	0.367
2011	7.597	0.358	3.465	0.779	1.057	0.404
2012	7.575	0.353	3.48	0.74	1.001	0.42
2013	7.617	0.338	3.314	0.798	1.011	0.395
2014	7.726	0.336	3.314	0.83	1.007	0.405
2015	7.654	0.353	3.239	0.791	1.064	0.427
2016	7.726	0.344	3.062	0.807	1.093	0.435
2017	7.983	0.349	3.073	0.857	1.089	0.44
2018	8.077	0.347	3.018	0.823	1.124	0.462
2019	8.066	0.342	2.894	0.806	1.133	0.469
Mean (kg)	7.69	0.35	3.30	0.79	1.06	0.42
St. Dev. (kg)	0.24	0.01	0.24	0.03	0.06	0.03
Variation Coeffic. (%)	3.17	2.73	7.27	4.30	5.74	8.14
Annual growth rate (%)	0.90	-0.66	-2.00	0.45	0.29	2.51

Source: Own calculation based on the data from [18].

Consumption of sugar, sweets, ice cream honey, coffee, tea

Sugar consumption declined in the analyzed period from 0.759 kg/capita/month in 2008 to 0.703 kg in 2019, the average in the whole decade being 0.74 kg and the annual decrease rate accounting for -0/69%. This is a positive evolution in consumption, as sugar must be less consumed for a healthy diet (Table 7).

Jam consumption registered 3.69% annual growth rate in the studied period. If in 2008, a Romanian consumed 0.249 kg jam, in 2019, consumption reached 0.371 kg, being by about 49% higher (Table 7).

Chocolate consumption accounted for 0.22 kg/month/capita in average in the whole analyzed interval, but the general trend was a decreasing one, with an annual decline rate of -1.64%. The cause is not a reduced desire of Romanian for chocolate, but the price growth as cocoa production decrease (Table 7).

Ice cream consumption is very small in Romania, accounting for 0.07 kg/month/year. Despite that it increased in the last decade

from 0.053 kg/month/capita in 2008 to 0.1 kg in 2019, meaning by + 88.67% more, which is a good trend. However, ice cream is less consumed in Romania than in other EU countries (Table 7).

Honey consumption accounted in average for 0.07 kg per month and capita, meaning 0.84 kg per year. In the analyzed period, it increased by 87.75% from 0.049 kg/capita/month in 2008 to 0.092 kg in 2019, which is a positive aspect, taking into account the nutritive value of honey (Table 7).

However, honey consumption is still very small in Romania compared to other EU countries. Romanians must appreciate much more honey qualities, its high nutritional and energetic value and to consume less sugar [23, 27, 34, 40].

Coffee and Tea consumption accounted for 0.21 kg per capita and month in the studied interval having an annual growth rate of + 2.96%. (Table 7).

Table 7. Evolution of average monthly consumption of sugar, sweets, jam, chocolate, ice cream, bee honey, coffee and tea in Romania in the period 2008-2019 (kg/capita/month)

	Sugar	Jam	Chocolate	Ice cream	Bee honey	Coffee/Tea
2008	0.759	0.249	0.24	0.053	0.049	0.185
2009	0.758	0.267	0.242	0.055	0.055	0.189
2010	0.754	0.276	0.231	0.048	0.057	0.191
2011	0.741	0.28	0.219	0.05	0.058	0.187
2012	0.732	0.293	0.217	0.062	0.061	0.187
2013	0.745	0.305	0.224	0.055	0.061	0.197
2014	0.759	0.318	0.237	0.053	0.061	0.208
2015	0.777	0.342	0.191	0.07	0.073	0.217
2016	0.746	0.344	0.188	0.071	0.078	0.22
2017	0.743	0.349	0.196	0.083	0.083	0.235
2018	0.713	0.351	0.197	0.092	0.086	0.241
2019	0.703	0.371	0.2	0.1	0.092	0.255
Mean (kg)	0.74	0.31	0.22	0.07	0.07	0.21
St. Dev. (kg)	0.02	0.04	0.02	0.02	0.01	0.02
Variation Coeffic. (%)	2.76	12.62	9.31	26.39	20.60	11.53
Annual growth rate (%)	-0.69	3.69	-1.64	5.94	5.89	2.96

Source: Own calculation based on the data from [18].

Factors influencing food consumption in Romania

Food consumption is determined by many factors:

-biological and physiological (age, weight, health status, reproduction),

-economic factors (net income, price of food products, inflation rate) [38],

-safety factors (food security, food safety, health, convenience),

-spiritual and emotional factors (the value of the product in consumer's eyes and mind, the feeling of satisfaction, advertising, price discount etc),

-technical means of communication (mobile phones, internet, TV channels etc) [1, 2, 4, 9, 12, 14].

However, the main factors with the deep impact in purchase decision of food products is income and price, which determine the own budget distribution by destination.

Despite that Romanians are more tempted to buy products based on price level, choosing in general cheaper products, which suit much better to their income level, modern consumer started to pay more and more attention to quality, even though price is a little bit higher. Therefore, during the last decades, substantial

changes have been occurred in Romanians' diet and consumption level [19, 20].

In Romania, the low living standard and monthly average income (Lei 2,300 average minimum gross salary; Lei 3,323 average net salary etc) have a deep impact on purchasing power and determine people to buy most of products based on the price level and not based on the their quality. Having a higher price, organic products have a lower chance to be bought by the categories of population with low incomes (young people, pensioners etc). In this way, the potential of organic food consumption is still low [6, 13].

Advertising plays a very important role in increasing consumption because it creates a harmonious combination between product, price, image, package, information available on the package, which could stimulate consumer's decision to purchase and help producers and merchants to increase their sales [15].

Modern consumer is more conscious of his/her own needs, pays more attention to product quality, the correlation between price and quality, and besides the purpose to cover his physiological needs, the new consumer is more and more oriented to satisfactions from a psychological point of view. Modern consumer has access to valuable last minute information put at his disposal by media (TV and Radio channels, internet, mobile phones, leaflets, etc) on the products sold in the market from which could be compared and the final choice to be the product which could satisfy the best consumer's preference, needs, and spiritual culture.

Synthesizing the studied literature on consumer-oriented marketing mix, Hemmerling et al (2015) concluded that the main factors in decision making for purchasing a product are: "consumer value and benefits, cost to the consumer, communication and information needs and convenience and distribution" [10].

CONCLUSIONS

This research pointed out the fact that a decent living standard is ensured by the value and structure of the minimum consumption basket. In 2020, its value increased by 4.7% compared to 2019, and reached Lei 7,278 for a family with two adults and two children.

In the minimum consumption basket, food expenses accounts for 21 %.

In the total consumption expenses, food products have a share of 30% in Romania, representing the highest level in the EU.

From the large range of factors with a deep impact on food consumption, income and price are the most important.

Food consumption in the period 2008-2019 increased in Romania for the following categories of products: meat (poultry, pork, mutton etc), cheese, butter, fruit, vegetables, jam, honey, ice cream, coffee and tea.

At the same time, the consumption declined in case of: bread, beef, milk, beans, potatoes, sugar, and chocolate.

"Health, sustainability and convenience" are the main priorities in the future food consumption [43].

Fresh, natural, healthy, safe and in-season food mainly produced locally and sustainably is much more required and has the tendency to revolutionize consumers' preferences. Having in mind the climate change impact, consumers pay more attention to free waste and environmentally protective food. Flavorful, meatless and eco-friendly dishes as well as ordered food by means of media are more and more among consumer preferences, in order to ensure a healthy diet and saving time.

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THE IMPACT OF THE COMMON AGRICULTURAL POLICY ON THE EUROPEAN AGRICULTURAL SECTOR SUSTAINABILITY BY USING A MACHINE-LEARNING APPROACH

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Abstract

The present research evaluates the sustainability of EU agricultural sector in relation to Common Agricultural Policy by using a custom-developed analytical framework, based on relevant indicators: gross domestic product in rural areas (GDP), gross value added (GVA), GVA for agriculture, direct payments (DP), agricultural factor income (AFI), agriculture employment rate (AER), rural employment rate (RER), degree of rural poverty (DRP), agricultural entrepreneurial income (AEI), agriculture research and development investments (ARD), labour productivity in agriculture (LPA), total factor productivity (TFP), cereal crop yield (CCY), fertilizers use (FU), CO_2 emissions and ammonia emissions (EA). The EA are mostly related to CCY (+0.47%), DP (+0.45%), ARD (+0.49%), AFI (-0.59%) and GDP (-0.52%). The CO_2 emissions are influenced mostly by TFP (+2.82%), RER (+2.49%), DRP (+0.53%) and EA (+0.46%). The FU most significant feature importance weights are CCY (0.79%), CO_2 (0.21%) and TFP (0.19%). The GVA model is related mostly to RER (+1.30%), GVA Agriculture (+0.67%), AER (-0.35%) and FU (+0.31%). The ARD most significant feature importance weights are GVA (0.23), DP (0.16) and GVA agriculture (0.15). The results revealed excellent performance metrics.

Key words**:** *agricultural sector, sustainability, gross value added, analytical framework, Common Agricultural Policy*

INTRODUCTION

Agricultural expenditures represent an important component of the European Union budget. Still, as it could be observed during the last E.U. financial exercises, this tendency seems to be diminishing. The budgetary cost of the Common Agricultural Policy (CAP) in relation to the gross national income (GNI) of the European Union (EU) decreased from 0.54% in year 1990 to 0.34% in year 2020 (European Parliament, 2019). The CAP is the only policy mainly financed from the budget of the EU, and, given the high degree of integration with the other policies of the Union, it has become a catalyst for the development, providing good practice examples in areas coordinated by other policies as Rural Development Policy (RDP). According to the Regulation of the Council of Europe no. 1290/2005 regarding financing under the Common Agricultural Policy, two European funds were set up to finance agriculture: EAGF (European Agricultural Guarantee Fund) for financing agricultural markets and EAFRD (European Agricultural Fund for Rural Development) implemented to finance rural development programs. The EAGF is used to finance expenditure jointly managed by the Member States and the European Commission and centrally managed expenditure by the European Commission, while EAFRD finances the rural development programs implemented in accordance with Regulation (EC) no. 1698/2005 of the European Council, only if the expenses are jointly managed.

The influence of CAP over national economies was analysed in several research papers [18, 24, 33].

Thus, some authors [24] models the impact of policy measures within the CAP on farm production, income and prices. Also, the study of [24] describes how CAP subsidies and

regulations are conducting changes in land use and land-use intensity. Thus, this methodology linked the impacts of economic policy instruments with changes in agricultural production, prices and incomes, having land-use and land-use intensity as the connecting drivers. Other authors [18] identifies the impact of CAP payments on crop diversity of agricultural holdings, in different Slovakian regions. The study [18] used an econometric approach and concluded that the second pillar of the CAP can improve the crop diversity in Slovakia. Also, according to this research [18], the most important factors influencing crop diversity are total crop area, irrigation, geographical location including the soil quality and the legal structure of agricultural holdings, while not important factors are found as managers education, distance of the farm from the city and membership in farmers' associations. In other study [33] is investigated the integration of environmental objectives into the CAP by conducting an economic lab-in-the-field experiment with farmers, in Germany. Thus, the research [33] analysed the impact of different policies on farmers' decisions to adopt sustainable agricultural practices.

The use of machine learning (ML) modelling techniques for improving farm management [16] or performing economic analysis in a more broadly manner [3, 6] has significant potential. Thus, as presented in other papers [13], a type of approach is to assess the influence each explanatory variable on the resulting prediction. Other research [9] targeted to determine the lowest change of an explanatory variable that would cause changes to certain model prediction. [17] had identified the characteristics of an observation that need to be changed for avoiding false predictions. Normally, the model complexity depends on the studied phenomenon. Many phenomena in agricultural economics are inherently non-linear, due to different social, economic or biophysical processes. Thus, some research subjects which confirmed this hypothesis are, as follows: the effect of weather variables on crops yield [27], the groundwater extraction effect on pumping costs [4] or the health effects of pollution [37]. Other study [31] have focused on the estimation of heterogeneity specific aspects, as understanding the distributional effects of an intervention (identifying the variables which reduce consumption in response to food warnings). Other research [32] also emphasizes on the fact that economic theory does not provide clear insights over specific functional form of the estimations, but only information about shape restrictions such as curvature or monotonicity. As such, it is very important to identify models that are able to capture non-linearities, as to avoid misspecification bias. It was emphasized that ML models are extremely flexible and may be helpful in various settings where classical econometric models fail to perform. He identifies three different approaches being particularly relevant to applied economists: ensembles of trees, particularly random forests (RF) and gradient boosting approaches; neural networks; variational inference methods. First two methods are flexible and efficient ML methods that can be applied to a large variety of tasks, while the third one is relevant in a Bayesian context. Several studies [14, 19, 36] revealed that the first two methods are effective prediction tools for scenarios like credit scoring and corporate bankruptcy prediction. Other study [8] develops a Bayesian geo-additive quantile regression model, estimated with gradient boosting.

For the agricultural economics, some studies [21] also used ensemble methods to predict the farmland rental rates. Thus, considering this situation, automatic data-driven parameter selection was applied. The neural networks as being also capable of capturing highly non-linear relationships [14]. An important difference between neural networks and tree-based methods like RF comes from the neural network complexity that is requiring more attributes to be specified, like number of layers and neurons. Also, another important difference comes from the number of samples required to determine a feasible model, which in the case of neural network should be high. A study [14] revealed that with cross-sectional data, in several cases, neural networks were outperformed by tree-based

methods. Still, when enough data is available, neural networks could discover more complex non-linear dynamic relationships. Other study [12] used ensemble trees, respectively RF, to provide accurate prediction models for crop yield for enhancing food policies at the regional and global scales. Thus, in this study [12], RF model for predicting crop yield responses to climate and biophysical variables, at global and regional scales, in wheat, maize, and potato, was evaluated.

Thus, in this context, the present research provides an analytical and predictive framework, based on state-of-the-art ML algorithm, that evaluates the sustainability of EU agricultural sector in relation to CAP.

MATERIALS AND METHODS

Multiple linear regression and model selection

The current research proposed framework was implemented using Python programming language with various specific libraries and the Minitab statistical software. The approaches towards data modelling were performed by using multiple linear regression (MLR) for assessing the relation between one dependent variable and several independent variables, fitting the data set into a linear equation (eq. 1), but also by applying tree-based ensemble learning models, respectively RF algorithms, as the predicted results were very conclusive and, also, the parameter importance was a lot easier to apprehend.

$$Y = \propto_1 X_1 + \propto_2 X_2 + \cdots + \propto_p X_p + \beta + e \quad \text{.....} \quad ..(1)$$

The resulted algorithms were fed only with important features that can explain the dependent variable. The feature selection was used in order to reduce model complexity, improve model accuracy by selecting the right predictors subset and, also, reduce overfitting. Stepwise regression and best subsets were considered in implementing feature selection for the linear modelling. Stepwise technique assures the inclusion of significance level that will be used to accept or not a parameter. After applying 'best subsets' technique, interpreting the key results is required. By default, the model with the highest R^2 for one predictor, two predictors and so on can be chose, where each presented model has several defining predictors 'X' marked.

Selecting the final model requires further examination of residual plots. The histogram of residuals is used to determine if data is skewed or outliers exists. Normal probability plot of residuals verifies the assumption that the residuals are normally distributed. Residuals versus fits is applied to verify the assumption that the residuals have a constant variance and residuals versus order of data is applied to verify the assumption that the residuals are uncorrelated with each other.

Durbin-Watson value tests are applied in order to check if the errors of adjacent observations are correlated. The best model is selected after the interpretation of the statistics related to Best Subsets Regression technique.

Non-linear prediction models and feature importance determination with RF

The RF Regression, used for the current study, represents one of the best tools in the ML repertoire due to its high accuracy and ability to handle a large number of features when few samples are available.

The RF aggregates two concepts, respectively Bagging and Random Selection of Features, generating a set of T regression trees where the training set for each tree is selected based on Bootstrap sampling from the original sample set and the features considered for partitioning at each node is a random subset of the original set of features.

Regression trees are nonlinear regression models having samples partitioned at each node of a binary tree based on the value of one selected input feature. The bootstrap sampling for each regression tree generation and the random selection of features considered for partitioning at each node reduces the correlation between the generated regression trees and, thus, the averaging of their prediction responses is expected to reduce the variance of the error.

Due to the feature selection algorithm and noise robustness, RF provides highly accurate predictions.

According to [26], the RF algorithm has several hyperparameters that have to be set by the user, as follows: number of variables for each split, number of observations drawn randomly for each tree, the splitting rule, minimum number of samples for a node and number of trees. Normally, RF work well with default values specified by different software packages, still, by tuning the hyperparameters it is possible to improve the performance of the random forest. Several reviews were published during the last decade on RF hyperparameter tuning [5]. Also, [26] emphasizes that the RF method is often presented as being insensitive to parameter choice when compared to other competing algorithms. The present study uses RF modelling both for building predictive models and to assess variable importance, especially for the cases where linear regression cannot be applied. Thus, by Python, the parameter importance through a RF approach is determined by 'feature importance' technique provided by scikit-learn's RF, based on gini impurity and by 'permutation importance' approach (as in the present research) in which variable importance is directly measured by observing the effect on model accuracy of randomly shuffling each predictor variable. Therefore, for measuring the performance of a RF model, the current study followed several steps, as follows: define and implement model evaluation function, base model accuracy vs real values, hyperparameter tuning – randomized search-grid search and RF model with fewer features.

Dataset structure

The dataset structure of present research includes a number of 18 relevant indicators [7] as follows : gross domestic product in rural areas (GDP) - (*thousand $*), gross value added (GVA) – [*billion $*], GVA for agriculture – [*billion $*], rural GVA - [*billion $*], direct payments (DP) – [*€/ha*], agricultural factor income (AFI) – [€/annual work unit], agriculture employment rate (AER) – [%], rural employment rate (RER) – [%], degree of rural poverty (DRP) – [%], agricultural entrepreneurial income (AEI) – [€/annual work unit], agriculture research and development investments (ARD) – [mil. €], labor productivity in agriculture (LPA) – [€/annual work unit], total factor productivity (TFP) – [€/annual work unit], cereal crop yield (CCY) – [kg], fertilizers use (FU) – [kg/ha], CO_2 emissions (CO_2) – [thousand tons] and ammonia emissions (EA) - [thousand tons], total factor productivity in agriculture – (TFP) [€/annual work unit].

RESULTS AND DISCUSSIONS

According to other studies [10], in Europe, agriculture accounts for more than 47% of the total territory. In recent decades, European agriculture has experienced a continuous decrease in the number of farms, while the farm size shows a tendency towards larger holdings. According to the authors, a similar tendency was observed also for the share of agriculture in the gross value added (GVA), but with some differences between European regions. In present study, the overall Gross Value-Added parameter can be expressed through a multiple linear regression model with high accuracy (S value 0.20, adjusted R-sq 97.83%, predicted R-sq 97.67%) (see eq 2).

$$Ln(GVA) = -4.37 + 0.09\,Ln(CO_2) + 0.10Ln(rural\ GVA) + 0.31\,Ln(FU) - 0.35Ln(AER) + 0.67Ln\,(GVA\ for\ Agriculture) + 0.17Ln(DP) + 1.30Ln(RER) \quad (2)$$

According to the above model, the overall gross value added is positively influenced by several parameters. According to these, an increase in the rural employment rate, agricultural CO_2 emissions, agricultural gross value added, fertilizer use, or direct payments, would lead to an increase of the gross value-added indicator. The only negative influence comes from the 'Employment in Agriculture' parameter, that could be explained by a significant agricultural employee reconversion to services or industrial fields. This explanation is sustained also in other study [29], where the authors identifies that even if the number of agricultural co-operatives has

been continuously decreasing, they continued to assure a high rate of job opportunities.

The importance of Agricultural Research and Development funding is emphasized in different research studies. For example, in [28], the authors describe the agricultural innovation platforms as promising vehicles to foster a paradigm shift in agricultural research for development. The digital farming, presented in [30], represents also a mandatory direction for the modern agricultural systems. Modern technologies like sensors, robotics, and data analysis helps moving from tedious operations to continuously automated processes. The authors are highlighting task planning algorithms, digitalization, sensors optimization, multi-robots, human-robot collaboration, environment reconstruction from aerial images and ground-based sensors for the creation of virtual farms as facing challenges in the context of digital farming.

The ARD parameter could not be modelled by using a linear approach, still the RF approach showed a good model accuracy (Fig. 1): BM accuracy at 86.01%, RS accuracy at 81.52%, GS accuracy at 82.18% and model validation at 70.18%. The feature selection analysis identified that, according to their weights, the following parameters were the most important for the ARD parameter prediction: 0.23 GVA, 0.16 DP, 0.15 GVA from agriculture, 0.06 CO_2 and 0.03 RER. Based on this numbers, it can be noticed that direct payments, total gross value added and agricultural gross value added are important parameters in ARD prediction.

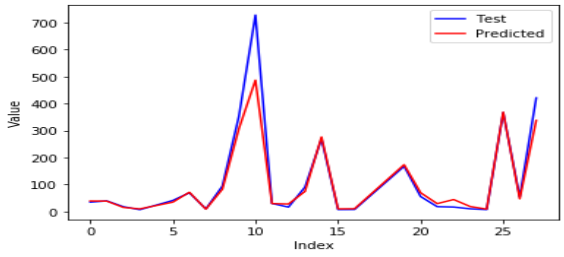

Fig. 1. Real values vs Predicted Values in Random Forest ARD model
Source: Original.

As such it seems, that direct payments overall managed to influence the dynamics of ARD investments. These can be correlated to information revealed by other study [1] which emphasize that ARD is critical in order to ensuring sufficient food for the world in the coming decades.

According to the European statistics, 95% of ammonia emissions come from agriculture. The National Emission Reductions Committee (NEC) criticizes the way the agricultural sector uses ammonia reduction methods and refers specifically to large industrial farms. Investments made in agriculture (through the direct payments / direct investments), along with the results of innovation research activities, can have a direct impact proportional to ammonia emissions (eq. 3), in the sense that the development of agricultural production takes place on a large scale and increases crop yields. On the contrary, the increase of the rural poverty degree, by the lack of jobs, of the presence of investors in the rural / agricultural space, the lack of crops and agricultural production and its effect on environmental, have an effect of reducing the ammonia emissions.

In [35] Velthof et al. (2012), the authors state that the agriculture is the major source of ammonia (NH_3), different methodologies being needed to quantify national NH_3 emissions and to identify the most effective options to mitigate NH_3 emissions. In Europe, according to [2], there has been little progress in controlling agricultural ammonia emissions and their share in European air pollution constantly increased, with values between 85 and 99% in countries with high agricultural activity, such as e.g. Denmark [11].

For the current research, after applying the best subset selection technique, the following linear model was identified for explaining the values of ammonia emissions in agriculture (EA):

$$Ln(EA) = 1.73 + 0.47\,Ln(Crop\ Yield) + 0.45Ln(DP) - 0.59\,Ln(AFI) + 0.24Ln(LPA) + 0.49Ln\,(ARD) - 0.25Ln(DRP) - 0.52Ln(GDP) \quad (3)$$

This model is described by excellent accuracy metrics, having the S value at 0.29, adjusted R-sq at 93.29% and predicted R-sq 92.17%

As it can be observed, the ammonia emissions from agriculture are positively related to cereal crop yield (0.47%), direct payments (0.45%), labor productivity in agriculture (0.24%) and agriculture research and development (0.49%) and negatively influenced by variables like the agricultural factor income per annual work unit in real terms (0.59%), the degree of rural poverty (0.25%) and the gross domestic product per capita in rural areas (0.52%). Direct payments can be used for upgrading fertilizers use technology, improving therefore the research and development activity in this direction and, thus, crop yield and labor productivity in agriculture. However, the increase of labor productivity may decrease the labor demand and accentuate the degree of rural poverty, situating which affects economic growth.

It should be mentioned that in other study [34], the authors are also investigating the relation between crop yield, agricultural factor income and greenhouse ammonia emissions from agriculture, identifying that the agricultural emission mitigation would be possible if a technological path is followed, this allowing also an increase of the farming income.

The CO_2 emissions in the agriculture were included in the current analysis as different studies showed that agricultural activities contribute significantly to the increase of CO_2 in the atmosphere. For example, [25] present as one of the main causes for CO_2 upward trend, the conversion of native ecosystems to agricultural uses. Their study shows that there are also major opportunities for CO_2 and other greenhouse gases mitigation through changes in the use and management of agricultural land. [23] emphasized on the fact that soil act as sources and sinks for greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) and precise quantifications are needed to obtain reliable global budgets that are necessary for land-use management (agriculture, forestry), global change and for climate research.

Similar with the ammonia emissions from the agriculture activities, the CO_2 emissions are influenced by factors like the industrialization of the agricultural sector, agricultural research and development funding schemes, know-how improvements and rural area development. A higher volume of fertilizers could lead to a significant increase of the production volume, respectively production yield, but it will also increase the overall amount of emissions of the sector.

According to the present research dataset, the CO_2 emissions could be linearly modelled, eq. 4 expressing the most important predictors and their influence over CO_2 agricultural emissions.

$$Ln(CO_2) = -21.35 + 0.16\,Ln(DP) + 0.21Ln(ARD) + 2.82\,Ln(TFP) + 0.53Ln(DRP) + 0.46Ln\,(EA) + 2.49Ln(RER) + 0.30Ln(Fertilizer\ Use) \quad (4)$$

The above model has excellent accuracy metrics (S value: 0.33, adjusted R-sq: 90.45%, predicted R-sq: 89.37%).

Regarding the CO_2 emissions from the agriculture parameter, as it can be observed, it is positively influenced by the direct payments (0.16%), the agriculture research and development (0.21%), the total factor productivity in agriculture (2.82%), the degree of rural poverty (0.53%), the ammonia emissions from agriculture (0.46%), the rural employment rate (2.49%), and the fertilizers use in agriculture (0.30%).

As observed from the above coefficients, none of the parameters is negatively influencing the value of CO_2 value. That means an increase of any of the independent parameters will lead to a certain increase of CO_2 emissions.

From the beginnings of agriculture, fertilizers were used extensively by farmers and families to help different crops grow in different soil and weather conditions. Still, the fertilizer use is very expensive and can harm the environment if not used correctly. It is well known, as described by [15], that the excessive use of fertilizer leads to important environmental degradation and to a high

health cost. The technological innovations are expected to improve fertilizers efficiency in crop production, still the socioeconomic constraints should be better understood. [15] emphasizes that the fertilizer use decreased with the increase of farm size and also that the crop yield was higher in large-scale farms. This situation is a consequence of the fact that a very low machinery level in small farms inhibited the application of precise fertilization.

In the current research, the fertilizer use modelling was performed by using a non-linear random forest model, as the linear modelling proved inconclusively, displaying low accuracy metrics.

Thus, the fertilizer use prediction model emphasized high accuracy metrics (Fig. 2), with the base model (BM) accuracy is at 86.71%, random search accuracy (RS) at 88.94%, grid search accuracy (GS) at 89.12% and model validation (MV) accuracy at 82.13%. According to the determined feature importance weights, the most important parameters predicting the fertilizers use are the following: crop yield (0.79), CO_2 (0.21), TFP (0.19), GVA (0.07) and DRP (0.05).

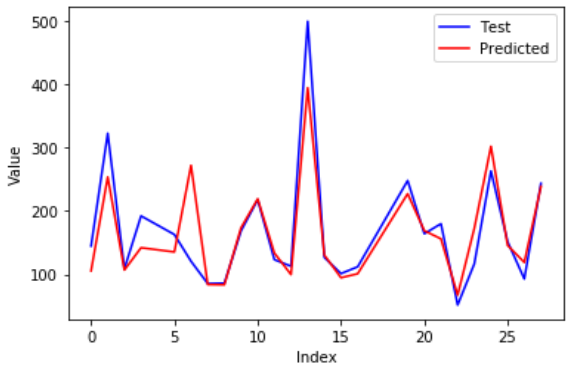

Fig. 2. Real values vs Predicted Values in Random Forest FU model
Source: Original.

As it can be observed, for the prediction of the fertilizers use value, the crop yield parameter displays the highest weight. The pesticides use – crop yield relation was to be expected as several studies are emphasizing on its importance. For example, in other paper [20], the authors emphasize that after the Green Revolution, the global crop production has doubled on the average, but crop yield has stagnated or even declined in some regions. In a context defined by an increased food demand, the use of pesticides and mineral fertilizers has improved crop yields but also contaminated food and the environment. According to their findings: fertilizer and pesticide consumption increased for 35–40 % of the countries; cereal production in 38 % of countries and yields in 47 % of countries either stagnated or decreased from 1961 to 2010; countries showing stagnated or decreased yields are countries with low gross domestic product per capita, mainly situated in Africa, South America, and West Asia – this would explain also the presence of the GVA parameter amongst the most important predictors for fertilizer use parameter. Another example can be found in the work of [22], where the authors are estimating the role of agronomic inputs in cereal yield improvements, their findings clearly suggesting the role for fertilizer, modern seeds and water in boosting yields.

Also, the model presented above confirms the relations previously identified in eq. 3, between fertilizers - crops and labor productivity, as well as CO_2 emissions and the degree of poverty.

CONCLUSIONS

The dataset used in present research is able to generate prediction models, by using both multi-linear and random forest techniques, with excellent performance metrics, for the evaluation of agricultural sector sustainability. The environmental sustainability can be predicted through fertilizers use, CO_2 and ammonia emissions models. However, the economic sustainability is represented by the synergy of both GVA and ARD models. The results can be used for assessing insights over the dataset parameters, in terms of parameter relations and importance.

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HONEY PRODUCTION IN THE EUROPEAN UNION IN THE PERIOD 2008-2019- A STATISTICAL APPROACH

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Abstract

The paper analyzed honey production in the EU-28 in the period 2008-2019 using the data provided by FAOstat. Regression equations and average annual growth rate have pointed out a general increasing trend in honey production both at the EU level and in almost all member states. In 2019, the EU produced 280 thousand tonnes honey, of which 76.44% was carried out by the largest producing countries: Spain, Romania, Hungary, Germany, Greece, Poland, France, Italy, Bulgaria with over 10, 000 tonnes per year. Other countries like Portugal, United Kingdom, Czechia, Croatia, Austria had a moderate production ranging between 5 and 10 tonnes per year, and their share accounted for 12.07%. The remaining of 11.49% was assured by the other 12 countries. The average growth rate of honey production was 3.07 at the EU-28 level, but the highest growth of over 6% was registered in the Baltic countries, Croatia and Italy, and a moderate growth rate varying between 4 and 6% was recorded in the main producing countries and also by Czechia. Spain, France and Bulgaria had growth rates below 2%. In Denmark production stagnated, and in Austria, Ireland and Slovakia declined. Important EU funds are destined for the implementation of the national apiculture programmes 2020-2022 for sustainable beekeeping development, enhancing technical endowment, improving apiculturists' education level, sustaining young apiculturists, increasing the number of beehives and honey production level and quality and for assuring healthy and strong bee colonies. Bees have to continue to support agricultural production by pollination, rural areas development, a clean environment, balanced ecosystems and biodiversity preservation.

Key words**:** *honey, production, EU, member states, trends, problems, support*

INTRODUCTION

Honey is an important food and medicine due to its high nutritional value which per 100 g consists of: carbohydrates (38% fructose, 31% glucose, 8% dissacharides, 2% other sugars) assuring 300kcal energy, proteins 0.5 g, vitamins (Phyllochinon 0.025 mg, Thiamin 0.01 mg, Riboflavin 0.01 - 0.02 mg, Pyridoxin 0.01 - 0.32 mg, Niacin 0.10 - 0.20 mg, Panthothenic acid 0.02 - 0.11 mg), Ascorbic acid 2.2 - 2.5 mg, minerals (Potassium 40 - 3,500 mg, Calcium 3 - 31 mg, Sodium 1.6 - 17 mg, Phosphorus 2 - 15 mg, Magnesium 0.7 - 13 mg, Iron 0.03 - 4 mg, Manganesium 0.02 - 2 mg, Zinc 0.05 - 2 mg, Copper 0.02 - 0.06 mg, Chromium 0.01 - 0.3 mg, Selenium 0.002 - 0.01 mg) and other substances 4% [8].

The importance of honey and other apiary products in human life has determined a continuous growth of consumption which accounts at present for 250-300 g in average per capita at the global level [36].

In consequence, world honey production has continuously raised and in 2019 reached 1.72 million tonnes. The highest growth rate was in the Asian countries, where China is the leader with a share of 25.81% in the global honey production, followed by India, both of them being able to produce over 10 thousand tonnes per year. In contrast, Europe and the Americas showed limited increases.

As a result, the international trade with honey, especially the export flows have been intensified during the last decades [19, 25, 26].
In the EU agriculture, beekeeping occupies a very important place. First of all because honey demand has been showing a constant increase [39].
Europe is the top consumer of honey, accounting for more than 20% of the total global consumption. The EU is among the largest consumer of honey, but the amount differs from a member state to another. In 2019, the top honey consumers were Germany (69 k tonns), France (52 k tonnes) and United Kingdom (45 k tonnes), representing 38% of the EU-28 consumption. Also, other countries including Spain, Poland, Italy, Greece, Romania, Netherlands, Portugal, Czechia and Croatia, all together had a weight of 47% in the total consumption at the EU level.
Regarding the average consumption of honey per inhabitant and year, three EU countries are in the top: Croatia (2.50 kg), Greece (2.47 kg), and Romania (1.13 kg) [14].
Besides honey and other apiary products (pollen, royal jelly, propolis etc), bee colonies have a special role in pollination together with other insects, also in maintaining biodiversity and landscapes beauty, in environment preservation, and rural areas development, beekeeping being a pleasant job outdoors and also an income source, which could reduce migration of rural population to the cities [17, 33].
The honey production in the EU is one of the priorities in its Policy Common Agriculture, as the main source for covering the consumption need and also for increasing agricultural production by pollination and for maintaining biodiversity and ecosystems.
Honey production increased in general, but it is still not sufficient to cover the internal market requirements, and that it is why the EU is the top importer of honey in the world accounting for more than 38% of the global imports [5].
In this context, the paper aimed to analyze the dynamics of honey production in the EU in the period 2008-2019 both at the EU level and by member state in order to establish in what measure production has been developed, which is the position occupied by each member state based on production performance, which are the top producing countries and which is their market share, how countries could be grouped based on their performance, and which was the average annual growth rate of production in the studied interval, which are the critical problems in the EU beekeeping and how the EU found solutions to sustain this sector of high importance in its agriculture.

MATERIALS AND METHODS

This research is based on the data provided by FAOStat and Reports of the EU Commission on honey market and literature in the field.
The indicator analyzed in this study is honey production at the EU-28 level and also in 26 member states, specifying that for Malta and Netherlands there were no available data.
Honey production was studied in its dynamics in the period 2008-2019 and also in the year 2019 compared to the year 2008, both at the EU level and also at the level of each member state.
The methodology applied to process the data included the well known procedures and techniques such as:
-Fixed basis index, $I_{FB\%} = (y_n/y_1)$ x100;
-Average annual growth rate, $\overline{R} = (\bar{I}$ x 100) - 100, where: $\bar{I} = \sqrt[n-1]{\frac{y_n}{y_1}}$
- Regression equation of various types depending on the dispersion of the variables in the chart. In the regression analysis, there were used both linear regression and polynomial regression of different degrees: regression of the 2nd degree (parabolic regression) $Y = ax^2 + bx + c$, of the 3rd degree (cubic polynomial regression) $Y = ax^3 + bx^2 + cx + d$ and also the polynomial regression of the 4th degree, $Y= ax^4 + bx^3 + cx^2 + dx + e$.
- Coefficient of determination, R^2, was also used for reflecting in which measure the variation of production was influenced by time variation.
-Spearman test "ρ" of rank differences for honey production and for average annual

growth rate was also applied according to the formula: $\rho = 1 - \frac{6 \sum D^2}{N(N^2-1)}$.

Based on honey production level, the EU member states were divided into three groups: (i)HighProd countries with a honey production over 10 tonnes, (ii) ModerateProd countries having the level of production between 5 and 10 tonnes and (iii) LowProd countries whose production was smaller than 5 tonnes.

Also, the EU member states were grouped based on the average annual growth rate of honey production into the following categories:

(i)High Growth rate countries with over 6% average annual growth rate,

(ii) Moderate Growth rate countries whose growth rate varied between 3% and 6 %,

(iii) Low Growth rate countries, having the rate ranging between 0% and 3 %,

(iv)Stagnating rate countries (0%) and

(v) Declining rate (a negative rate).

The obtained results were illustrated in charts and tables, accompanied by the corresponding comments.

At the end of the study, the main ideas resulting from this research work have been drawn.

RESULTS AND DISCUSSIONS

Dynamics of honey production in the EU-28

The EU is among the largest honey producers in the world, coming on the 2nd position after China. In the year 2019, it produced 280,000 tonnes honey, representing 16.27% of the 1.72 million tonnes global honey production [5, 16].

Honey production in the EU had a continuous increasing trend since 200,600 tonnes in the year 2008 to 280,000 tonnes in 2019, meaning +39.58% in the period of the last 12 years. The general trend pattern remained relatively stable reflecting a continuous increasing, but in certain years there were some fluctuations. The highest growth rate was registered in the year 2014 when production increased by 17.73% compared to the level of 2013. Also, in 2016 versus 2015, production raised by 12.8%. The year with a deep decline was 2012, when production decreased by 14% compared to the previous year. The last year registered slight increases, but in 2019 it was noticed a slight decline (-1%) versus 2018 (Fig. 1).

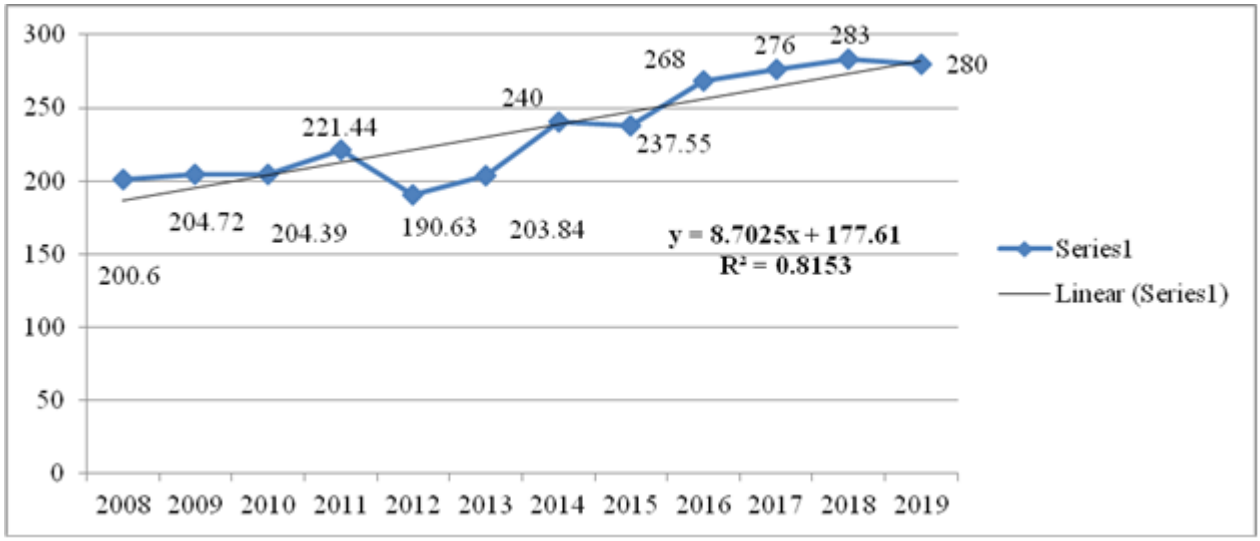

Fig. 1. Dynamics of honey production in the EU-28 in the period 2008-2019 (Thousand tonnes)
Source: Own design and processing based on FAOStat Data, 2021 [10].

The EU-28 honey production accounts for 70% of Europe's honey production in 2019, compared to only 57% in the year 2008 [9, 16].

The growth of production is justified by the fact that in the EU honey demand is high, bee colonies play an important role in the pollination of the agricultural crops, fruit trees and wild flora, also for maintaining biodiversity, the indirect role in "shaping" the landscapes, the functioning of the ecosystems and human health and life [15, 23, 35, 38].

The EU sustains beekeeping by implementing the EU apiculture programmes, because apiculture is essential for agriculture and biodiversity [3].

As a consequence, in 2019, the EU-28 had 18,214 thousand behives, by +5.1% more than in 2018, also it had 612,000 beekeepers and their number is continuously increasing and the apiary size accounts in average for 21 beehives [4].

The EU measures for funding beekeeping are destined to assure "technical endowment in apiaries, beekeepers' training, young beekeepers' business, beehives movement in the pastoral pickings helping the pollination of the agricultural crops, fruit trees and the wild flora, for combating the beehive invaders, product analysis and improvement, market monitoring and applied research" [6, 7].

As self-sufficiency in the EU domestic market is only 60%, the honey requirements are covered by imports. And the EU is the top importer of honey in the world, its share in the global import of honey being 38.3% [20, 25, 29].

In 2019, the EU imported 162,172 tonnes, the main suppliers being China, Ukraine, Argentina, Mexico and other countries [35].

The EU is not among the top honey exporting countries, but it accounts for 5.2% in the global exports and its honey is of the highest quality. As import exceeds export, the EU has a negative trade balance [14, 40].

Therefore, the EU is deeply oriented towards honey import due o the high demand on the internal market and production which is not able alone to meet the requirements. Regarding exports, the EU is not very competitive [18].

Dynamics of honey production in the EU member states was in general a positive one with a few exceptions during the last 12 years.

The performance in honey production differs from a country to another in close relationship with many factors among which the most important ones are: geographical position, soil and climate conditions, wild flora, structure of agricultural crops and fruit trees orchards, tradition in beekeeping.

Also, other factors influencing production of honey and economic efficiency in beekeeping sector are: the number of bee colonies and the apiary size being known that from at least 150 bee families we can discuss about profitability [21, 22, 27, 30].

In 2019, in the EU, there were 612,000 beekeepers having 18.2 million beehives, meaning 29.7 beehives per beekeeper. The countries where the beekeepers have the highest number of beehives per apiary are: Greece (147), Spain (103) and Romania (80) [5, 7].

The performance in honey production depends on the power of bee families, the breeding value of the queen bee, the picking availability in the stationary and also in the pastoral movement during the flowering season, bee colonies health, beekeepers' training level and experience.

The apiculturists with a higher education are interested in the adoption of new technology and create value added to beehive products [39].

Honey is the main product achieved by bees and which is commercialized by apiculturists assuring them a good gross margin, and bringing them income and profit [24, 27, 28, 32].

The structure of agricultural crops and hybrids has a deep influence on picking and honey production, the chemical treatments applied for crop protection and the use of the new hybrids have affected pollination and nectar picking by bees and other insects. The colony collapse disorder has become a more common phenomenon.

Therefore, in the EU there are disparities regarding beekeeping, honey production and

quality among the member states which have a deep impact on their contribution to the whole performance at the community level.

The situation of honey production by member state in the EU-28 in the year 2019 compared to the year 2008 is presented in Table 1 and Fig. 2.

Table 1. Honey production in the EU member states and their position in the year 2019 compared to 2008 (Thousand tonnes)

	2008		2019	
	Honey production	Position	Honey production	Position
EU-28	**200.6**	**-**	**280**	**-**
Spain	30.36	1	37.00	1
Hungary	22.39	2	29.00	3
Romania	20.04	3	31.00	2
Germany	15.73	4	26.00	4
France	14.86	5	15.75	8
Greece	14.11	6	22.84	5
Poland	14.00	7	19.03	7
Italy	11.58	8	22.00	6
Bulgaria	11.38	9	11.52	9
United Kindom	7.19	10	9.92	11
Portugal	6.65	11	10.10	10
Czechia	6.08	12	8.26	12
Austria	5.30	13	4.00	15
Slovakia	4.24	14	4.00	15
Croatia	2.71	15	7.44	13
Sweden	2.65	16	3.00	17
Lithuania	1.91	17	5.28	14
Belgium	1/69	18	2.00	20
Slovenia	1.58	19	1.75	21
Finland	1.50	20	3.30	16
Denmark	1.50	20	1.50	22
Latvia	0.69	21	2.15	19
Cyprus	0.63	22	0.66	24
Estonia	0.50	23	1.29	23
Ireland	0.24	24	0.21	25
Luxemburg	0.11	25	0.15	26

Source: Own calculation based on FAOStat data, 2021 [10].
Note: Malta and Netherlands- No available data.

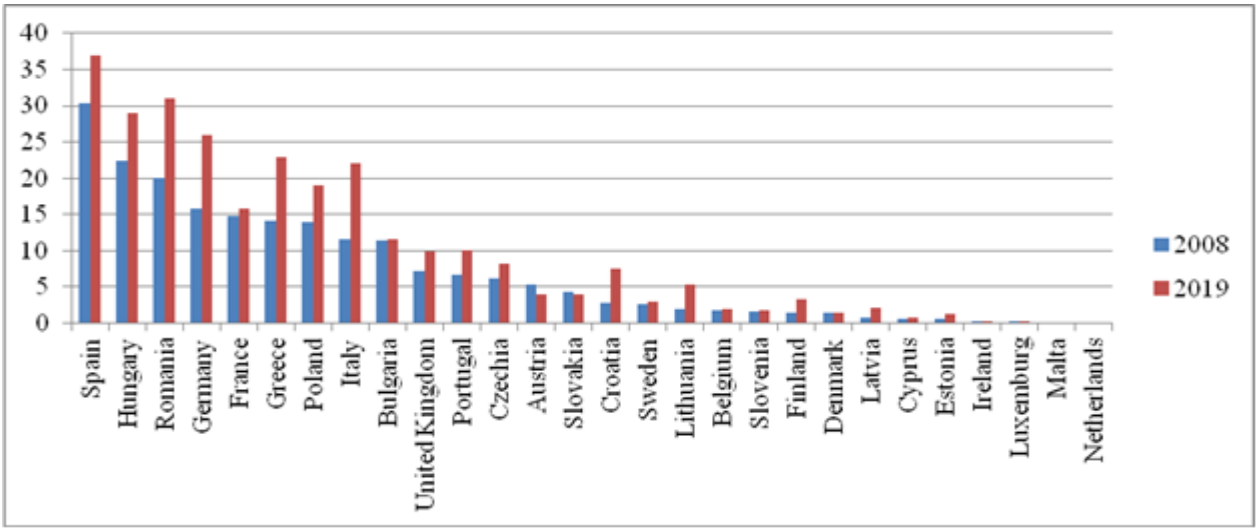

Fig.2. Honey production in the EU-28 member states in the year 2019 compared to 2018 (Thousand tonnes)
Source: Own design based on FAOStat data, 2021 [10].

The figures from Table 1 show that the top honey producers in 2019, in the decreasing order, were: Spain, Romania, Hungary, Germany, Greece, Italy, Poland, France and Bulgaria.

All the nine countries exceeded the EU average of 7.71 thousand tonnes in 2008 and of 10.77 thousand tonnes in 2019 in various amounts.

In 2008, the first three positions were occupied by Spain, Hungary and Romania, all together accounting for 36.28% of the EU honey production. In 2019, Spain registered 13.21% market share, followed by Romania with 11.07% and Hungary with 10.35%, all together accounting for 34.63% of the EU honey production.

In 2008, these three leaders were followed by Germany, France, Greece, Poland, Italy and Bulgaria, summing 40.49% of the EU honey production. In 2019, the decreasing order in this group of countries was: Germany, Greece, Italy, Poland, France and Bulgaria, all together accounting for a market share of 41.81%.

Relatively similar affirmations were made by IndexBox in 2020 [14].

Taking into consideration the market share of the top nine EU countries in honey production, they contributed by 76.97% in 2018 and by 76.44% in 2019 to the EU total honey output (Table 2).

Table 2. Honey production surplus over the EU average and the market share of the EU top 9 honey producing member states in 2019 versus 2008

	Changes over the EU-28 average (Thousand tonnes)		**Market share (%)**	
	2008	2019	2008	2019
EU Average	**7.71**	**10.77**	-	-
Spain	+22.65	+26.23	15.13	13.21
Romania	+12.33	+23.23	9.99	11.07
Hungary	+14.68	+18.23	11.16	10.35
Germany	+8.02	+15.23	7.84	9.28
Greece	+6.40	+12.07	7.03	8.16
Italy	+3.87	+11.23	5.77	7.85
Poland	+6.29	+8.26	6.97	6.79
France	+7.15	+4.98	7.41	5.62
Bulgaria	+3.67	+0.75	5.67	4.11
Total	-	-	76.97	76.44

Source: Own calculation based on FAOStat Data, 2021[10].

However, taking into account the whole honey production achieved in 2019 compared to 2008, there were noticed some changes in the hierarchy of the EU countries.

First of all, the top nine countries producing honey are the same, but their position changed with a few exception.

For the whole production of honey in 2019, the leaders in the decreasing order were: Spain, Romania, Hungary, Germany, Greece, Poland, France, Italy and Bulgaria. Therefore, compared to the positions occupied in 2008, Spain maintained its first position, Hungary passed from the 2nd position to the 3rd one, Romania raised its position to the 2nd place, Germany maintained its 4th position, Greece climbed one step from the 6th to the 5th position, Poland passed from the 7th position to the 6th place, France lost its 5th position and passed on the 7th position, Italy maintained its 8th place and Bulgaria its 9th position.

Making a comparison between the position occupied in 2019 for honey production achieved in this year and the position for the whole production in the last 12 years, we may notice that Spain, Romania, Hungary, Germany, Greece and Bulgaria maintained their positions, France went up one position from the 8th position to the 7th one, Poland went up from the 7th position to the 6th, Italy went down from the 6th position to the 8th (Table 3).

We have to point out the high development of beekeeping in Romania which has a long tradition and continues to increase the number of bee hives, apiary size, honey production and intensify its export with honey of the highest quality [1, 20, 33, 34, 35].

For the whole honey production carried out in the period 2008-2019, other changes took place in the following countries: Portugal, United Kingdom, Czechia, Croatia and Slovakia remained on their positions: the 10th, the 11th, the 12th and the 13th and, respectively, the 15th.

Table 3. Mean, standard deviation and coefficient of variation for honey production in each EU member state in the period 2008-2019

	Mean	St. Dev.	CV (%)
EU-28	234.18	34.74	14.83
1 Spain	32.63	2.56	7.87
2 Romania	24.61	4.59	18.67
3 Hungary	24.25	5.15	21.24
4 Germany	21.58	3.93	18.23
5 Greece	18.50	3.17	17.13
6 Poland	15.98	3.51	21.96
7 France	14.37	2.56	17.81
8 Italy	12.47	4.94	39.66
9 Bulgaria	10.41	0.93	8.94
10 Portugal	9.50	2.44	25.77
11 United Kingdom	8.62	0.91	10.60
12 Czechia	8.35	1.49	17.91
13 Croatia	6.32	3.02	47.81
14 Austria	4.95	0.70	14.24
15 Slovakia	3.97	0.56	14.15
16 Sweden	3.27	0.36	11.07
17 Lithuania	2.51	1.12	44.94
18 Finland	1.84	0.67	36.73
19 Denmark	1.58	0.288	18.22
20 Slovenia	1.56	0.61	39.23
21 Latvia	1.40	0.57	41.00
22 Estonia	0.95	0.27	28.84
23 Cyprus	0.46	0.13	29.13
24 Ireland	0.25	0.02	8.40
25 Luxemburg	0.18	0.16	92.77
26 Belgium	0.12	0.04	34.16

Source: Own results based on FAOStat data, 2021 [10].

The countries which passed to a superior position were as follows: countries going up one position Austria, Slovenia, Estonia, Cyprus, Ireland, Luxemburg; Finland climbed two positions; countries which went up three positions: Lithuania and Denmark; countries which lost their positions: Sweden -1 position, Latvia -2 positions, and Belgium - 6 positions (Table 3).

At the EU level, the value of the variation coefficient of honey production in the period 2008-2019 was 14.83% reflecting a relative heterogeneous series of data, depending on the performance carried out in each member state.

In Spain, Bulgaria and Ireland, the value of the variation coefficient was below 10% reflecting that the performance in honey production was homogeneous from a year to another and as a result the mean is representative.

In case of Romania, Germany, Greece, France, United Kingdom, Czechia, Austria, Slovakia, Sweden, and Denmark, the value of the variation coefficient ranged between 10% and 205 showing that the levels of production were relatively heterogeneous and the average is less representative.

Also, in case of Hungary, Poland, Italy, Portugal, Croatia, Lithuania, Finland, Slovenia, Latvia, Estonia, Cyprus, Belgium and Luxemburg, the data regarding production were very different from a year o another for many reasons and in this case the average is not representative.

Therefore, the means and the variation coefficients attest the large differences existing among the EU countries regarding their performance in honey production, the causes and factors of influence being multiple and having an impact of various intensity in beekeeping (Table 3).

Grouping the EU countries based on the whole honey production in the period 2008-2019

Based on the whole performance in the analyzed interval, the EU member states were divided into three categories as follows: (i) HighProd group, having a higher production than 10 tonnes; (ii) ModerateProd group, with a production ranging between 5 and 10 tonnes, and (iii) LowProd group, including the countries producing less than 5 tonnes (Table

4). The HighProd group registered in average 277.59 tonnes honey, and the variation coefficient showed a high heterogeneity among the data. The ModerateProd grup produced in average 91.01 tonnes honey, and the variation was a little bit lower compared to the HighProd group. In case of the LowProd group, the average was more than four times lower than in the ModerateProd group, and 11.18 times lowers compared to the HighProd group of countries (Table 4).

Table 4. Mean, standard deviation and variation coefficient by country group according to honey production, 2008-2019

Group	Countries	Mean	St. Dev.	CV%
HighProd (over 10 tonnes)	**Group total honey production = 2,048.32 tonnes**			
	Spain, Romania, Hungary, Germany, Greece, Poland, France, Italy, Bulgaria	227.59	85.31	37.48
ModerateProd (5-10 tonnes)	**Group total honey production = 455.06 tonnes**			
	Portugal, United Kingdom, Czechia, Croatia, Austria	91.01	22.09	24.27
LowProd (below 5 tonnes)	**Group total honey production = 306.78 tonnes**			
	The remaining EU countries	20.34	14.20	69.81

Source: Own conception and results.

Table 5. Grouping the EU countries based on the average annual growth rate of honey production in the period 2008-2019 (%)

	Country	Average annual growth rate (%)
	EU-28	**3.07**
High growth rate (Over 6%)	1 Latvia	10.88
	2 Lithuania	9.68
	3 Croatia	9.61
	4 Estonia	8.99
	5 Finland	7.43
	6 Italy	6.00
Moderate growth rate (3%-6%)	7 Germany	4.67
	8 Greece	4.47
	9 Romania	4.04
	10 Portugal	3.87
	11 United Kingdom	2.96
	12 Luxemburg	2.85
	13 Czechia	2.82
	14 Poland	2.82
	15 Hungary	2.37
Low growth rate (0-3%)	16 Spain	1.81
	17 Belgium	1.54
	18 Sweden	1.13
	19 Bulgaria	1.11
	20 Slovenia	0.93
	21 France	0.53
	22 Cyprus	0.42
Stagnating production	23 Denmark	0.00
Decline rate	24 Slovakia	-0.01
	25 Ireland	-1.21
	26 Austria	-2.53

Source: Own conception and results.

We have to specify that the classification of the countries in these three groups based on honey production is different than the hierarchy established by FAO and Eurostat in 2008, as mentioned by Formato and Smulders (2011). Their classification consisted of five groups of countries as follows:

(i)countries with honey production between 21.9-31.8 thousand tonnes including only Spain and Germany;

(ii) countries with production between 10.9 and 21.8 thousand tonnes, including: Hungary, Romania, Greece, France and Poland;

(iii) countries with production between 4.6 and 10.8 thousand tonnes, including: Italy, Bulgaria, Portugal, Austria and Czechia;

(iv) countries with production ranging between 1.2-4.5 thousand tonnes including: United Kingdom. Slovakia, Sweden, Finland, Denmark;

(v) countries with the lowest production varying between zero and 1.1 thousand tonnes, including: Lithuania, Latvia, Estonia and Ireland [13].

Average annual growth rate of honey production in the interval 2008-2019

At the EU level, the average growth rate was 3.07 %. From a country to another, the average growth rate varied having either higher values, lower values, or stagnating or even negative values.

A high growth rate was noticed in six countries: Latvia, Lithuania, Croatia, Estonia, Finland and Italy, varying between 6% in Italy and 10.88% in Latvia.

A moderate growth rate ranging between 2.37% to 4.67% was registered in Germany, Greece, Romania, Portugal, United Kingdom, Luxemburg, Czechia, Poland and Hungary.

A low growth rate between 0.42% and 1.81 % was achieved in Spain, Belgium, Sweden, Bulgaria, Slovenia, France and Cyprus.

In Denmark, honey production stagnated at 1.5 tonnes almost every year, therefore there was no growth or decline.

In Slovakia, Ireland and Austria, honey production registered a decline rate varying between -0.01% in Slovakia and -2.53% in Austria (Table 5).

Spearman test of the rank differences for honey production and for average annual growth rate

The result of Spearman rank correlation was ρ = 0.140, a very weak correlation, and consulting the tabled ρ for the degrees of freedom in Thornton table, it was noticed that the calculated ρ is smaller. Therefore, there is not a significant correlation between the two variables: honey production and average annual growth rate, or, in other words, the average annual growth rate has no influence on honey production level.

Honey production trend line by EU member state

The trend in honey production in the analyzed period 2008-2019 was represented in corresponding equations and R^2 as well for each member state as presented in Table 6.

A linear increasing trend of honey production was noticed at the EU-28 level, Y = 8.7025x + 177.61, reflecting that for one more year, production will increase by 8.70 units. The R^2 = 0.8153 explains that 81.53% of the variation in honey production is caused by time and the difference of 18.47% depends on other factors.

Table 6. Trend line regression equations and coefficient of determination for honey production by member state in the period 2008-2019

	Trend line regression equation	**R^2**
EU-28	**$Y = 8.7025x + 177.61$**	**0.8153**
Austria	$Y = 0.0025x^4 + 0.06x^3 - 0.4796x^2 + 1.3316x + 4.331$	0.3853
Belgium	$Y = -0.00x^4 + 0.00x^3 - 0.03x^2 + 0.10x + 0.05$	0.2000
Bulgaria	$Y = 0.0097x^3 + 0.2321x^2 - 1.4833x + 12.418$	0.4901
Croatia	$Y = -0.109x^2 + 2.0313x - 0.985$	0.6956
Cyprus	$Y = 0.0086x^2 - 0.108x + 0.6952$	0.5126
Czechia	$Y = -0.006x^4 + 0.1583x^3 - 1.4411x^2 + 5.3373x + 1.6069$	0.4590
Denmark	$Y = -0.004x^3 + 0.0138x^2 - 0.0907x + 1,6212$	0.2132
Estonia	$Y = 0.0729x + 0.4797$	0.9191
Finland	$Y = 0.0056x^3 - 0.0842x^2 + 0.3714x + 1.1285$	0.6151
France	$Y = 0.0112x^3 - 0.0823x^2 - 0.4921x + 16.364$	0.3772
Germany	$Y = 0.0426x^3 - 0.8097x^2 + 4.9365x + 11.761$	0.5549
Greece	$Y = 0.0222x^2 + 0.5437x + 13.767$	0.9030
Hungary	$Y = -0.0526x^3 + 1.136x^2 - 5.989x + 28.332$	0.6430
Ireland	$Y = -0.0003x^3 + 0.0052x^2 - 0.0215x + 0.2624$	0.4045
Italy	$Y = 0.2925x^2 - 2.8886x + 15.405$	0.8675
Latvia	$Y = -0.0074x^2 + 0.2416x + 0.2348$	0.8527
Lithuania	$Y = 0.0515x^2 - 0.4132x + 2.407$	0.9252
Luxemburg	$Y = -0.00x^4 + 0.00x^3 - 0.03x^2 + 0.09x + 0.05$	0.2000
Poland	$Y = -0.0269x^3 + 0.6096x^2 - 3.178x + 17.269$	0.7467
Portugal	$Y = -0.032x^3 + 0.5617x^2 - 2.0516x + 8.634$	0.8327
Romania	$Y = 0.0264x^3 - 0.4352x^2 + 2.685x + 17.353$	0.6040
Slovakia	$Y = -0.0009x^4 + 0.0158x^3 - 0.0286x^2 - 0.4265x + 4.9625$	0.3714
Slovenia	$Y = 0.003x^4 - 0.0015x^3 - 0.0441x^2 + 0.3123x + 1.3625$	0.1780
Spain	$Y = -0.0029x^4 + 0.118x^3 - 1.3864x^2 + 5.628x + 26.128$	0.5377
Sweden	$Y = -0.0005x^4 + 0.0122x^3 - 0.1211x^2 + 0.6029x + 2.1623$	0.5235
United Kingdom	$Y = 0.2525x + 6.9764$	0.0991

Source: Own results.

Among the countries, the dispersion of the points reflecting production in the chart varied from a country to another and from a year to another depending on the specific local conditions and determinant factors.

A linear trend line of honey production was recorded in Estonia with $R^2 = 0.919$, reflecting the continuous development of beekeeping. In United Kingdom, it was also recorded an increasing trend as proved by the linear regression and $R^2 = 0.991$.

In the other countries, the most suitable trend equation was the polynomial of various degrees as follows:

- a polynomial equation of the 2nd degree in case of Lithuania ($R^2 = 0.925$), Greece ($R^2 = 0.903$), Italy ($R^2 = 0.867$), Latvia ($R^2 = 0.853$), Croatia ($R^2 = 0.696$) and Cyprus ($R^2 = 0.513$);
- a polynomial equation of the 3rd degree in case of Portugal ($R^2 = 0.832$), Poland ($R^2 = 0.746$), Hungary ($R^2 = 0.643$), Finland ($R^2 = 0.615$), Germany ($R^2 = 0.554$), Bulgaria ($R^2 = 0.490$), Ireland ($R^2 = 0.404$), France ($R^2 = 0.377$) and Denmark ($R^2 = 0.2132$);
- a polynomial equation of the 4th degree in case of Spain ($R^2 = 0.538$), Sweden ($R^2 = 0.532$), Czechia ($R^2 = 0.459$), Austria ($R^2 = 0.385$), Slovakia ($R^2 = 0.317$), Luxemburg ($R^2 = 0.20$), Belgium ($R^2 = 0.20$) and Slovenia ($R^2 = 0.178$)(Table 6).

The problems the EU beekeeping is facing

The main challenges the EU beekeeping is facing to maintain the number of beehives and production are the following ones:

- the continuous increase of the apiary input prices and of production costs;
- the honey cheap imports from the third countries making the EU beekeepers' honey to become uncompetitive and the apiculturists to register huge income losses [11];
- the loss of bee colonies due to the increased frequency of the bee collapse disorder and the incidence of diseases, the increase of the number of beehives invaders, the attack of various predators;
- climate change has a more a more impact on bee colonies and honey production, as the weather extreme phenomena produce disturbances in pickings during flowering season, as it happened in Hungary, Portugal, Italy, France, which registered important production losses [2, 12];
- the more and more limited access to pickings in the agricultural crops due to the use of new hybrids especially for sun flower which do not allow the bees to collect the nectar;
- the intensification of agriculture using pesticides reduces the pickings availability and implicitly creates a loss of bees and production,
- the intensification of urbanization which affects bees habitat [3, 37, 38];
- honey price volatility varying from a country to another in close relationship with honey type and quality and also with demand/offer ratio [31];
- the low export capacity, the EU being able to export only 8% of its total honey production.
-the lack of international import standards and regulations regarding honey quality has lead to the commercialization of a honey whose quality is susceptible. In the EU there are some regulations regarding honey labeling, but they are extremely low, because they do not indicate exactly how much honey of various origins is in the blended honey [11, 19].
- the fake or counterfeit honey has appeared on the EU market as a consequence of cheap imports and because the use of weak tests for honey quality, which imposes a more severe regulation regarding the checking of honey authenticity and the improvement of the traceability standards [37];
-the decline in bees colonies could affect the whole food chain in the EU and also at the global level, being known that bees pollinate between 5 and 8% of global food production [11].

Under these circumstances, it could be possible as the number of beehives not to increase, to remain stable or even to decline, and in consequence agriculture, horticulture and biodiversity in the EU to be affected due to the drift in pollination which threatens not only agriculture but also other sectors of the economy and could have a deep economic and social impact [11,37].

For sustaining beekeeping, the EU Commission established National Apiculture Programmes 2020-2022 which continues the measures taken before [7].

Taking into account all these aspects, the EU Commission approved a budget of Euro 240 million for the period 2020-2022, by 11% more than for the period 2017-2019, for the implementation of the national apiculture programmes. Each country could contribute by 50% and the rest of 50% funding will come from the EU for beekeeping development, the allocation being in close relationship with the number of bee hives exiting in each country.

CONCLUSIONS

The research led to the conclusion that the EU was and still is an important honey producer despite that the production potential is different from a country to another. The sector performance is sustained by Spain, Romania and Hungary, as the main producers, followed by Germany, Greece, Poland, France, Italy, Bulgaria and Portugal, whose contribution to the EU production is around 76%. The other EU countries will also continue to make efforts to increase their contribution to the honey production.

The increasing demand for honey will determine the EU to complete honey offer on the internal market by imports under the condition as imported honey to be of high quality attested by the authorized laboratories and the traceability of the final product to be assured.

The analysis of the evolution of the EU honey production proved that beekeeping must continue to be developed as being an important sector of agriculture.

Increasing production of honey, the EU could become less dependent on imports to cover the domestic market demand, and beekeepers will be sustained to perform and increase efficiency along the honey chain obtaining the expected and deserved returns.

Bees will continue to play an important role in the development of the sustainable agriculture, for maintaining balanced ecosystems and a healthy environment, for increasing agricultural production, creating jobs in the rural areas and reducing migration to cities and for preserving biodiversity and the beauty of the landscapes.

That is why this sector is strongly financed both from the EU and national budgets for the coming years.

The objectives of the national apiculture programmes are destined to assure beekeeping development by enhancing technical conditions, improving beekeepers training level, sustaining business of the young apiculturists, fighting against diseases and strengthening bee colonies, increasing the number of bee hives and honey production as well as its quality.

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LABOR FORCE IN THE EUROPEAN UNION AGRICULTURE - TRAITS AND TENDENCIES

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Abstract

The paper aimed to analyze the features of work and work force in the EU agriculture and identify the changes regarding the number of working persons, number of farmers, type of work, utilized agricultural land, standard output, and age, gender, education level structure, based on the data provided by Eurostat. The authors made a comprehensive approach of the main aspects concerning labor force as a reflection of the EU policy measures. The main indicators were described and classified according to the type of work: family work and non family work, pointing out that the EU agriculture is running mainly in family farms of a small size, in which the activity is done both by the farmer and his family members. Family farms represent 95.2% of the total number of farms. They work 62.2% of the total utilized agricultural land and contribute by 59.5% to agricultural output. The higher the average farm size, the higher the average regular work force and the higher average standard output per farm and year. The farmers' ageing and workers' migration led to the decline of labor force in agriculture but to the growth of farms size and productivity. Training level of the most of working persons in agriculture is still low. The new technologies, the challenges created by climate change, the need of environment protection and biodiversity and landscapes preservation in the rural areas claims as farmers to become the main "actors" of the rural communities. Farmers have to be highly trained with entrepreneurial and technological knowledge and skills to be able to continue the sustainable development of agriculture in the future.

Key words**:** *labor force, agriculture, European Union, features, trends*

INTRODUCTION

Agriculture is one of the high importance branches of the economy as growing crops and raising farm animals are destined to offer raw materials to processing industry in order to achieve food products ready to cover the consumption needs of the population and to ensure food security.

The performance in agricultural output and gross value added produced in this sector is deeply conditioned by geographical position of the agricultural land, soil quality and structure, climate conditions, technical endowment, production systems, applied technologies, farming practices, farm inputs, labor force in terms of number of working persons, training level, age and productivity [26].

Agriculture is the main activity carried out by the rural population, and the main source of income which determines its living standard [22].

Labor force, land and capital form the well known "trilogy of production factors" in agriculture according to the theory of economic analysis [20, 27].

The harmonized combination between production factors is essential for assuring agriculture development. Work is the determining factor which values all the resources, that is the capital formed of

agricultural land and operational capital. The training level, practical experience and entrepreneurial skills of the people working in agriculture are very important for enhancing the progress in the field [23].

Work has a high share in production costs, usually varying between 30% and 60% depending on the agricultural sector: vegetal, animal and services, applied technologies and production systems (intensive, extensive, semi-intensive, organic etc), and farm size.

The European Union pays a special attention to agriculture and farmers whose role is vital in the sustainable development of the rural communities, in providing safe and affordable food to more than 450 million European citizens, assuring environment protection, preserving biodiversity and maintaining their countries' landscapes [4, 17].

The percentage of agricultural work force in the EU varies from a member state to another, and the general trend is the decline of the number of persons involved in agricultural activities due to ageing and migration to the cities especially of the young generation looking for better paid jobs.

Taking into account these aspects and also the impact of climate change on agriculture, by its Common Agricultural Policy, many times reformed and adapted to the new challenges, the EU supports farming sector by providing programmes and measures for assuring a sustainable development of agriculture, keeping pace with the last solutions given by scientific research and technological progress for producing more, of high quality and efficiently, for fighting against the climate change, for protecting environment, for encouraging the young generation of farmers and for better meeting consumers' demand for healthy food.

The reduction of labor force dealing with agriculture must not be seen as a negative tendency, on the contrary, it has a positive influence on the increase of productivity and also on the improvement of farm structure, assuring the growth of the farm size [5, 7].

In the EU agriculture, working people has a different number, age, gender, education level, productivity, income and living standard from a member state to another and these aspects are in a continuous change. For these reasons, they have to be statistically studied in order to set up new policies to ensure agriculture development [9, 24].

In this context, the paper aimed to analyze the status of labor force in the EU and the changes in the number of working persons, number of farmers, type of work, utilized agricultural land, standard output, and age, gender, education level structure, as a reflection of the EU policy measures and what it is needed to be done for the future to assure the sustainable development of agriculture.

MATERIALS AND METHODS

This research is based on the data provided by Eurostat data, Reports of the European Parliament, European Commission, and results mentioned in the literature in the field.

It presents a comprehensive analysis of the labor force in the EU during the last decade, having in mind a new approach based on the type of work emphasizing on the following aspects:

-peculiarities of work in agriculture,
-the number of persons working in agriculture,
-the type of work,
-the classification of farms,
-the dispersion of the utilized agricultural land, and standard output by type of work,
-the connection existing between average farm size, average regular work force, standard output and type of work,
- age structure of agricultural labor force
-farm managers evaluated by means of their age, gender and training level.

Indices of dynamics and structure have been frequently used in this study. Also, comparisons were made regarding various aspects analyzed about the labour force and allowed to create an image on the actual status of labour force in the EU member states.

For each of these aspects, there were made comments and given examples of the real situation in different EU member states.

The comments were sustained by the results presented in tables and graphics, and at the end of the research were drawn the main conclusions.

RESULTS AND DISCUSSIONS

The peculiarities of work in agriculture

Agriculture is the main sector of the EU economy where employment is still high due to the specificity of production systems, number of farms, farm structures and the peculiarities of agricultural products chain.

Compared to other economic fields, in agriculture work processes are of high complexity due to the large range of activities imposed by the biological specificity of plants and animals, production systems, technical endowment, natural conditions (soil climate etc), farm size.

More than this, work in agriculture is heterogeneous and not uniform across the year, it si hard and supposed to many risks outdoors, being under the influence of climate factors, which many times have a deep impact on the economic and financial results.

Therefore, work is different in the vegetal from the animal sector, and from the activities carried out by agricultural services.

In the vegetal sector, the work is achieved in agricultural campaigns of land clearing, plowing, sowing, fertilizing, maintaining the crops, harvesting etc according to the technology peculiar to each agricultural crop. Therefore, in general, in the vegetal sector many farmers have peaks of activity and also periods of a slight work, characterizing crop sector much more as a part-time activity than a full-time work.

In the animal sector, the work must continue over the year obliging the farmer and workers to be present every day, as farm animals needs everyday to be fed, watered, well kept, in a good health and hygiene condition during their way from "farm to fork".

Seasonality of work in agriculture is an important feature imposed by the technological processes, which determine peaks of hard work and also periods of slight work and even relaxation across the year.

As mentioned above, work in agriculture is done in accordance with the requirements of various crops and animal species and categories for achieving the planned production (fertilization, treatments, irrigations etc in case of the agricultural crops, and feedstuff, water, treatments etc on case of animal growing).

Specialization is lower in agriculture because the existence of two types of cultures: (i) policulture which is the most developed, meaning the mixture between the vegetal and animal farming or a combination of more vegetal sectors and this require farmers and workers with a high level of training in many fields; (ii) monoculture, where farmers are specialized in one direction of activity, as in case of viticulture, for instance.

Work in agriculture is in general a traditional one involving the farmer and his/her family members in most of cases, therefore it is a family work of whose involvement depends farm performance.

In the EU agriculture, many farms are family farms where the members of the family use to be deeply involved in the farm activities giving a help in hand to the head of the farm in different moments of the production year [1].

In agriculture, work is difficult to be quantified and mainly regarding its quality. Usually, the work carried out in the vegetal sector or animal production is quantitatively assessed at the end of the production cycle, meaning harvesting, milking, slaughtering etc.

Another important feature is related to age structure of the agriculturists. Work force dealing with agriculture is dominated by middle aged and elder persons living in the rural areas, most of them involving their families in the farm works. The young generation is tempted to quip the farm and go to the cities to find an easier and better paid job. Therefore, farmers ageing and migration have determined the decline of the number of workers in agriculture.

In this respect, an important role played the payments established by EU policy (CAP) destined to adjust this process by creating jobs in agriculture and services (like agrotourism etc) in the rural areas [2, 19].

Modern agriculture requires a high training level of farm managers, meaning knowledge, skills not only in the field of the new technologies but also regarding the managerial and entrepreneurial abilities. This means to create a new generation of farmers

who are called to develop the agriculture of the future [16].

Due to the seasonality of the agricultural work, the number of persons employed based on a permanent contract is very small, jobs are not stable and safe, and income is smaller than in other sectors of activity.

Therefore, across the year, a different number of persons is involved in the agricultural activities.

Table 1. Main features of the work and labor force in agriculture

Traits of agricultural work	**Traits of labor force in agriculture**
-High complexity activities	-High share in the production costs
-High specificity in accordance with crop and animal biology	-Dominant part-time labor force
-Heterogeneity	-Rarely full-time employment
-Lack of uniformity	-Seasonality of part time labor force
-Hard work	-Multiple knowledge and skills fir mixed farming
-Risky work outdoors	-Ageing
-Under the influence of the climate factors	-Middle aged and elder persons are dominant
-Seasonality of the activities	-Just a few young workers
-Low specialization	-A few young farm managers
- Highly mixed work	-Migration to cities
- Difficult assessment from a quantitative point of view	- Labour force decline
-Difficult appreciation of work quality	-Low training level is dominant
	- A small percentage of highly trained persons in agriculture
	-Job instability and insecurity
	-Small income from agriculture

Source: Authors' conception.

Due to these peculiarities, it is very difficult to make comparisons between employment in agriculture and employment in other economic sectors.

In agriculture, the statistics regarding employment includes both employed persons and self-employed persons, but often it does not take into account part-time farmers and the contribution given in agriculture by the farmer's family members.

For this reason, the EU approaches work in agriculture from four points of view as follows:

(a) employment in agriculture, which refers to the permanent labor force involved in the specific activities;

(b) the regular labor force in agriculture which includes all the persons working in this field, both the part-times workers and farmers and the work run by the farmer's family members.

(c) the volume of work carried out in agriculture which could be assessed into full-time equivalents which are named "Annual Work Units"(AWU) and this is the key which offers the possibility to compare the work volume run in various sectors of the economy;

(d) farm managers, who are those persons responsible of decision making regarding the assurance of the farm inputs (machinery, biological material: seeds, planting materials, animals, fertilizers, pesticides, fuels and lubricants, machinery parts, etc), the good running of production processes according to the adopted technologies specific either to vegetal or animal sector, product marketing and finally respond of the economic efficiency of the farm activity.

In most of cases, they are the owners of their farm and develop their own business in agriculture under a legal entity form.

Having in mind this approach of people working in agriculture, from the EU regular agriculture labor force of 20.5 million people in the year 2016, only 17% accounted for full-time working persons, that is only 3.49 million persons. Also, of the number of persons working regularly in the EU agriculture, 89.5% were sole farmers or family members of the farmer.

All these aspects are fundamental items in setting up the agricultural policy regarding work force, labor productivity and performance in agriculture.

People working in the EU agriculture

In the EU agriculture, in 2016, there were employed 9.7 million persons, representing 4.2% of the total number of employed people in the whole European community.

However, from a member state to another, the number of persons dealing with agriculture varies. The highest number of people working in agriculture is in Romania, accounting for 23 %, followed by Bulgaria with 17.5%, Greece with 10.7% and Poland with 10.1%. All these four countries together accounted for 61.3% of the labor force working in the EU agriculture.

Farm hierarchy according to the type of work

Work in the EU agriculture is running both by the farmer and his family members, in other words, meaning work in family farms and work which is running in farms where labor is employed and the members of the farmer's family are not involved or only in just a few measure.

In the EU, in 2016, there were 10,465 thousand farms, of which 9,956 thousands were family farms, representing 95.2% and only 509 farms were non family farms. Therefore, the work in the EU agriculture is mainly carried out by the farmer and his/her family (Fig.1.)[14].

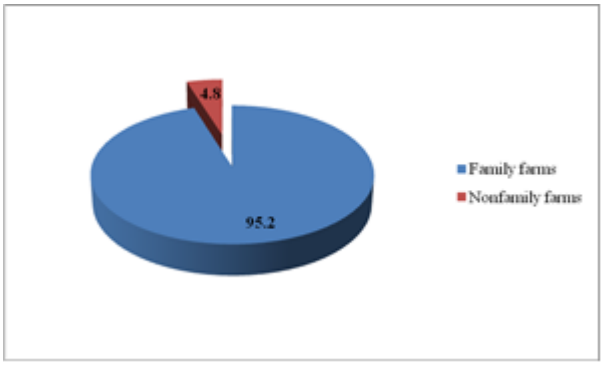

Fig.1. Farm structure by farm type of work (%)
Source: Own design based on the data from [11].

Of the total number of family farms, 9,728 thousands farms, that is 93%, solve the activities only with the family workers. Just a few farms, more exactly 228 thousands farms use family workers in a higher percentage than 50 but not 100 % [13].

In case of the non family farms, 333 thousands farms do not use any family labor, therefore, they employ labor force from outside to run the farm activities, and other 176 thousands farms utilize family workers in a lower proportion than 50 but not zero% (Table 2).

Table 2. Farm classification, distribution of the utilized agricultural area and standard output by farms according to the type of work force, EU-28 (2016)

Type of work force	Number of farms		Utilized agricultural area UAA		Standard output	
	Thousands	%	ha	%	Euro Million	%
EU-28, of which:	10,465	100.0	173,454	100.0	352,189	100.0
A. Family farms	9,956	95.2	107,960	62.2	209,722	59.5
(a)With only family workers	9,728	93.0	92,402	53.3	169,132	48
(b)Family workers make up 50% or more (but not 100%)	228	2.2	15,558	8.9	40,590	11.5
B. Non family farms	509	4.8	65,494	37.7	142,466	40.5
(a)Family workers make up less than 50% (not 0)	176	1.6	18,231	10.5	51,070	14.5
(b)No family labor force	333	3.1	47,263	27.2	91,396	26.0

Source: Own calculations based on the date from Eurostat, 2021 [11].

Therefore, the EU agriculture is dominated by family farms. The countries with the highest number of family farms are Romania (3,422 thousands, 32.6%), Poland (1,411 thousands, 13.4%), Italy (1,146 thousands, 10.9%) and Spain (945 thousands, 9%), all these four countries together summing 65.9% of the family farms existing in the EU.

The countries with the most numerous non family farms are: France (144 thousands farms) and Spain (121 thousands farms) [6, 15, 25].

The EU policy measures destined to new structural developments have been reflected in the reduction of the number of farms, in the increase of the farms size and production and re-specialization. In the EU-28, in the period 2005-2010, the number of farms decreased by 3.7%, while the average farm size raised by 3.8% annually. The growth of the farm size

allows the specialization of the farms either in vegetal sector (cereal cropping, for example) or in livestock growing and in this way mixed farming diminishes its share in the farm structure [18].

Dispersion of the utilized agricultural land (UAA) by type of farm labor force

In 2016, the EU-28 had 173,454 thousand ha UAA, of which 107,960 thousands ha were used by family farms, meaning 62.2% and the remaining of 37.75% was worked by non family farms.

The farms with only family workers keep 92,402 thousands ha UAA, representing 53.27% of the total EU UAA. A share of only 8.96% belongs to the farms where family workers make up 50% or more, but not 100%. (Fig. 2).

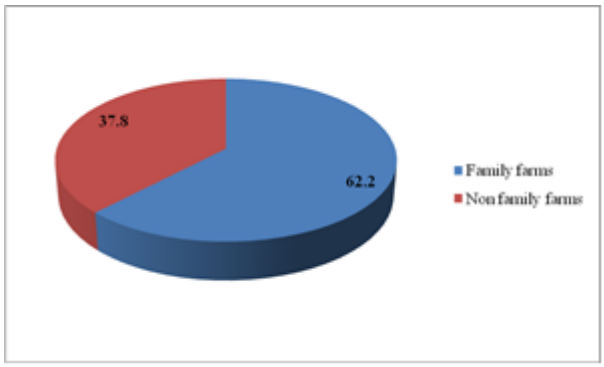

Fig. 2. The utilized agricultural area by farm type of work force (%)
Source: Own design based on the data from [11].

In case of non family farms, the largest UAA accounting for 47,263 thousands ha, that is 27.2% of the total EU UAA, belongs to the farms with no family labor force (Table 2).

Of the total EU UAA, the largest agricultural surface is worked in France (16%), Spain (13.3%), United Kingdom (9.6%), Germany (9.6%), Poland (8.3%), Italy (7.2%) and Romania (7.2%), all together these seven countries summing 71.2%.

The family farms with the highest share in the total UAA are: Spain (13%), France (11.5%), Poland (11.4%), United Kingdom (10.5%), Germany (9.9%), Italy (9.6%) and Romania (6.35). All together account for 72.2% of the total UAA worked by family farms.

The largest share of UAA worked by only family workers is in: Spain (13.7%), Poland (12.8%), Italy (10.2%), France (9.6%), United Kingdom (9.3%), Germany (8.8%) and Romania (7.4%), all together accounting for 74.5% of the total UAA worked by farms with only family workers.

The countries with the highest weight of non family farms' work are: France (23.4%), Spain (13.9%), Germany (9.1%), Romania (8.6%) and United Kingdom (8.3%), all these member states summing 63.3%.

The farms with no family labor force but with a significant UAA are in France (23.9%), Spain (15.9%), Romania (11.8%), Germany (6.1%) and United Kingdom (6%), totaling 63.7% [21].

Dispersion of Standard output by type of farm labor force

In 2016, in the EU-29 it was achieved Euro 352,189 Million standard output, to which the family farms contributed by 59.5% and non family farms by 40.5%.

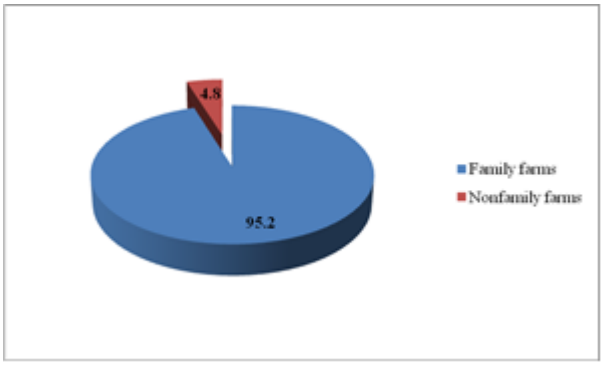

Fig. 3.Contribution of farms to standard output by farm type of work force
Source: Own design based on the data from [11].

The farms where work is made only by the farmer and his/her family members had the highest contribution accounting for 48%, while the farms with no family labor force contributed by only 26% (Table 2).

The relationship between average farm size (UAA ha), average regular work force (AWU), average standard output and type of farm labor

Making the calculation of the average farm size, average regular work force and average standard output per farm by type of farms based on the used labor force, it is easy to notice the following aspects:

- the family work is used exclusively in the smallest farms whose average size is around 10 ha, AWU accounts for 0.6 and the average standard output has the lowest average, about Euro 20,000 per farm;
- in the farms where family workers make up 50% or more, but not 100% of the regular labor force, the farm size is higher, reaching 70 UAA ha, the average AWU accounts for 2, and the average standard output is about Euro 175,000;
- in the farms where the family workers make up less 50% (but not 0) of the regular labor force, the average farm size reaches 100 ha, AWU accounts for 3.2 and standard output accounts in average for Euro 290,000 per farm;
- finally, in the farms where it is not used family labor, the farms size is the highest and accounts in average for 140 ha UAA, AWU mean is 2.7 and the average standard output is Euro 270,000 per farm [10, 11].

Therefore, the lowest average regular work force involved in farm activities is in the small farms, and the economic performance in terms of standard output is the lowest. The largest farms whose average size is about 100 ha have a higher regular work force and also a higher standard output, therefore a higher economic impact [29] (Table 3).

Table 3. Average farm size, average regular work force and average standard output by type of farm labor in 2016

Type of farms based on labor force	Average farm size (UAA HA/farm)	Average regular work force (AWU/farm)	Average standard output (Euro/farm)
Only family workers	10	0.6	20,000
Family workers make up 50% or more (but not 100%) of the regular labor force	70	2	175,000
Family workers make up less than 50% (but not 0) of the regular labor force	100	3.2	290,000
No family labor force	140	2.7	270,000

Source: Own calculations based on Eurostat data, 2021

However, the EU agriculture is dominated by family farms, and the average farm size is very small in most of the EU members states. The EU-28 average farm size accounted for 16 ha, and eleven member states have farms whose average size is smaller than the EU average. It is about Malta, Romania, Cyprus, Greece, Bulgaria, Hungary, Slovenia, Croatia, Portugal and Italy. Malta and Romania having in average between 1 and 2.6 ha farm size.

Other EU countries like: Lithuania, Slovakia, Spain, Austria, and Latvia have farms whose average size exceeds the EU average but they do not exceed 20 ha per farm.

In other member states like: Netherlands, Czechia, Ireland, Belgium, Sweden and France, the average farms size is ranging between 30 and 40 ha, while in in Finland and Germany the average farm size accounts for about 42 ha.

The counties with the largest farm size in the EU are: Denmark 53 ha, Luxembourg 63 ha and United Kingdom with 68 ha [9].

Age structure of labor force in the EU agriculture

In 2016, the age structure of the labor force working in the EU-28 reflected that the highest share of 55.2% belonged to the 40-64 years group, 42.4% to the 15-39 years group and only 2.4% to the elder group of 65 years and over (Fig. 4).

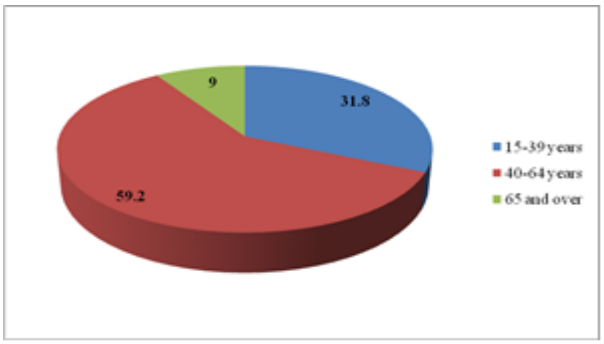

Fig. 4. Farm labor force structure by age (%)
Source: Own design based on the data from [11].

In the EU-28 agriculture, the top position was occupied by the 40-64 years group with a share of 59.2%, followed by the 15-39 years group with 31.8% and the elder group of 65 years and over with 9%.

The highest share of the persons working in agriculture and having 65 year and more is in the following countries: Portugal (41.6%), Ireland (21.7%), United Kingdom (18.6%), Slovenia (17.5%), Cyprus (15.7%), Croatia (14.2%), Austria (13.8%), and Romania (13.6%).

The highest share of the persons working in agriculture and belonging to the medium age group varying between 40 and 64 years exceeds 55% in almost all the EU member states, except Denmark, Cyprus, Luxembourg, Portugal, Romania, Sweden and United Kingdom.

Therefore, the EU agriculture is dominated by a work force whose age is high, and the young workers represent just one third of the working people in this sector.

The highest share of agricultural workers whose age is ranging between 15 and 39 years is in Luxembourg (50%), Denmark (44.7%), Spain (36.9%), and Slovakia (35%). The lowest share of the young agricultural workers was noticed in Portugal (13.9%).

If in 2005, the EU had 5.7% employed persons in agriculture, in 2016, their share was only 4.4% [12].

This was caused by the reduction in the regular labor force in agriculture by -31.7%, which in its turn was determined by work force aging and migration.

This led to a decline in work volume by 3.3 million AWUs in the interval 2005-2016.

The highest decline of the agricultural work force was registered in Romania (over 1 million AWUs), Poland (0.6 million AWUs) and Bulgaria (0.4 million AWUs0, all these three countries together summing 60% decrease.

The effect of the reduction in working people in agriculture was a positive one on labor productivity in this economic sector.

Farm managers- age structure by type of farm labor force

In 2016, in the EU-28, there were 10,306 farm managers of which 95.3% were managers of family farms.

About 55.7% of family farms managers had the age between 40 and 64 years and 33.9% were of 65 years and over. Therefore, only 10.4% are young with an age below 40 years.

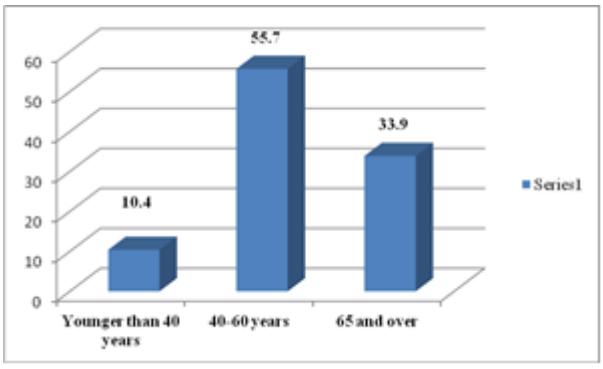

Fig. 5. Age structure of the managers of the family farms (%)

Source: Own design based on the data from [11].

The young farm managers accounted for only 1 million, that is 9.9%.

In case of the managers of non family farms, the highest share belonged to the 40-64 group (3.2%) and the youngest managers represented just 0.7% (Table 4).

Table 4. Farm managers by age group and type of farm labor force in 2016, EU-28

Type of labor force in the farms	Number of farm managers (Thousands)	%
All farm managers, of which:	10,306	100.0
A. Managers of family farms labor	9,823	95.3
- Less than 40 years	1,022	10.4
- Between 40 and 64 years	5,474	55.7
- 65 years and over	3,325	33.9
B. Managers of non family farms labor	483	4.7
- Less than 40 years	81	16.7
- Between 40 and 64 years	336	69.5
- 65 years and over	66	13.8

Source: Own calculations based on Eurostat, 2021 [11].

The EU countries with the highest number of the farm managers of family farms and with the age of 65 years and over are: Romania (1,514 thousands), Italy (459 thousands), Spain (269 thousands), Greece (227 thousands), Poland (163 thousands) and Hungary and Portugal (130 thousands each).

The countries with the highest number of family farms managers whose age varied between 40 and 64 were: Romania (1,632 thousands), Poland (948 thousands), Italy (556 thousands), Spain (489 thousands) and Greece (394 thousands).

The members states with the youngest farm managers of family farms and with the age below 40 years are: Poland (282 thousands) and Romania (250 thousands) [8].

Farm managers structure by age group and gender

In 2016, in the EU, the farmers who are over 55 years accounted for 39.5% in case of male farmers and 19.5% in case of female farmers, all together summing 59% of the total number of farm managers [11].

Therefore, the elder managers still dominate the EU agriculture and the young generation of managers has still a smaller weight. Male farmers are 3 times more numerous than the young female managers.

However, in the age group of 45-54 years, 17.5% of the farmers are men and 5.5% are women (Table 5).

Table 5. Age and gender structure of the EU farm managers (%)

Age group (years)	Male farm managers	Female farm managers
65 and over	21	12.5
55-64	18.5	7.0
45-54	17.5	5.5
40-44	7	2.0
35-39	4	1.5
25-34	3.5	1.0
Less than 25	0.2	0

Source: Adapted based on Eurostat data, 2018 [11].

Gender structure is very different from a county to another. In Netherlands, Malta, Denmark and Germany, the female managers had a very low weight (5.2%, 6%, 7.7% and respectively 9.6%) of all the farmers, in Latvia and Lithuania about 45% of the farm managers are women. [28].

Therefore, in agriculture and rural development, participation of men and women is inequal, as most of the activities as dominated by men, women role is almost invisible, and just a few women have the courage and abilities to develop a business in agriculture [3].

If we approach the farmers' age in relationship with the farm size, we may notice a positive and strong connection.

The farm managers' aging determines them to abandon at a moment their job because their age and health status does not allow them to manage a farm any longer.

In this case, usually their farm joins another farm and in this way, the number of farmers and also the number of farms decline from a year to another, Therefore, the change in farm structure and farm managers' age could contribute to the improvement of farm structures, age of the farm managers, and also of labor productivity, and farm performance.

Structure of work force in the EU agriculture based on the training level

In 2019, of the EU total number of persons employed and being between 20 and 64 years old, 6,294.7 thousands, just 3.28% represented the skilled workers dealing with agriculture, forestry and fishery. This reflects that in agriculture the degree of training is much lower than in other sectors of activity in the EU [14].

In 2016, in the EU-28 agriculture, 50.2% persons had a medium training level, 40.7% had a low training level and only 8.9% had a high one.

The countries with the highest share of the highly trained agricultural workers were: United Kingdom (25.5%), Germany (23.5%), Belgium (20%) and Austria (20%).

The highest share of the agricultural workers with a medium training level was registered in over 40% of almost all the EU member states, except: Italy (34.7%), Greece (31.2%), Cyprus (30.4%), Spain (16.8%), Portugal (7.9%).

The countries with the lowest training level of the labor force in agriculture are: Greece (64.2%), Spain (72.5%) and Portugal (87.6%).

Farm managers training level

The farmers over 65 keep in general the smallest farms, which are usually subsistence households destined to cover the family needs, therefore with a low agriculture return, but their share is 81.7%.

Only 7% of this age category owns medium and large sized farms.

This situation is explained by the low training level existing among the elder farmers, only 2.6% of them having high agricultural training. Most of them practice agriculture as they have learnt from their parents and based by their own experience over the time.

The young farmers with high agricultural training have a share of 20% and their skills and knowledge allowed them to develop a successful business in larger farms. The statistics confirms that 27.5% of the young farmers manage medium and large-sized farms.

About 68.3% farmers have got experience across the time practicing agriculture, on the principle "learning by doing". Other 22.6% farm managers have a basic training and only 9.1% have a full agricultural education level.

The lowest training level among the farm managers is in Romania and Greece, where only 0.4% and respectively 0.6% of them have full agricultural education. In these cases, the most numerous farmers run agricultural activities based on their practical experience and their share is very high: 96.7% and 93.2%, respectively.

At the opposite pole, there are the farmers with the highest training level in agriculture. The highest share of these farmers exists in Luxembourg (52.5%), Czechia (38.7%), France (34.9%) and Latvia (31.3%) [11].

CONCLUSIONS

According to the type of work force, the EU has two types of farms: family farms and non family farms. Each of them have two subdivisions depending on how much the farmer's family members are involved in the farm activities.

In the EU, family farms represent 95.2% of the total number of farms. They work 62.2% of the total utilized agricultural land and contribute by 59.5% to agricultural output.

In the family farms of the EU, there are two types of farms in accordance with the contribution of the farmer's family members to the farm activities. It is about: (i) farms where the family work accounts for 100% and (ii) farms where the agricultural works are made up 50% but no 100%.

Among the non family farms of the EU, there also two types of farms: (i) farms where the farmers' family members work less than 50% but not zero%, and (ii) farms with no family work 100%.

The farms where work is made 100 by the farmer's family members are the smallest farms, they have the lowest average regular work force and the lowest average standard output.

The higher the average farm size, the higher the average regular work force and the higher average standard output per farm and year.

Labor force in the EU agriculture is ageing. The age structure shows that 59.2% represent the category with the age between 40-64 years and 9% the one with persons of 65 and over.

The young work force is just one third of the total number of persons working in agriculture.

Only 10.4% of the total number of farm managers are younger than 40 years.

The farmers of 40-60 years dominate agricultural labor force with 55.7% share and the oldest farmers represent one third of the total number of farmers.

Women farm managers represent only 28.3%, therefore agricultural business is dominated by men.

In the EU agriculture, over 50% of the labor force has a medium training level and 40.7% has a low training. Only 8.9% of the agricultural labor force is highly trained.

In general, the farmers having the smallest farms have also the lowest training level, farming is based on their own experience. Only 2.6% of this category of farmers has a high education level.

About 20% of the young farmers are highly educated in the field of agriculture.

Despite of this positive and less positive aspects related to labor force, and even though

the existing differences existing between the member states, the EU agriculture is of high performance.

Due to the Common Agricultural Policy, all the EU countries are aligned and involved in the competition to perform better, to produce more products and of high quality, keeping pace with the technological progress and results obtained in the applied scientific research in order to face the new developing challenges and strong competition inside the EU and also in the international market.

In the prospect of the coming future, the new CAP reform emphasizes the role of farmers in finding solutions against the impact of climate change, in producing high quality and healthy food, in assuring environment protection, biodiversity and rural landscape preservation.

Farmers have to become the core of the rural communities and that is why the EU policy encourage young farmers to assure the stability of work performance in agriculture and the continuous development of the rural areas.

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RESEARCH ON SOCIO-ECONOMIC PROBLEMS OF REGIONAL RURAL DEMOGRAPHY

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Abstract

According to the United Nations forecasts, by 2050 the number of Russian citizens will decline to 132.7 million, mainly due to a decrease in the number of rural residents. Negative demographic trends are also noted in the Penza region, where over the past 25 years the population has decreased by 235 thousand people. In this context, the goal of the paper was the identification of socio-economic problems in rural areas based on a comprehensive analysis of the demographic situation, production potential, social structure and other factors, taking into account their potential change in conditions of turbulence in the external environment. The article analyzes the size of the rural population, its distribution by major age groups, household sizes. Indicators of life expectancy, natural movement and migration of the population of the Penza region and the Volga Federal District are reflected. Taking into account the actual socio-economic problems of the rural population and trends in the rural demography, the state should develop a new strategy for increasing birth rate, for decreasing mortality, assuring jobs and a corresponding living standard and life quality.

Key words*: *: *demography, rural areas, migration, unemployment, Penza region, Russia*

INTRODUCTION

Ensuring food security of the Russian Federation is possible only through sustainable integrated rural development. The ambitious goal of doubling exports to $ 45 billion by 2024 is to be met by rural residents. Therefore, the solution of demographic problems, the creation of effective jobs, the employment of young specialists, a decent level of wages, comfortable living, the development of social infrastructure are the key areas of work for authorities at all levels and private business in the form of public-private partnership [12].

Among the basic problems affecting the process of achieving the goal, a significant place belongs to demographic ones. In the ranking of the countries of the world in terms of population, Russia is in 9th place, but the situation is worsening. The totality of unresolved demographic and socio-economic problems that occur in almost all regions of Russia, and in the Penza region, in particular, are the most serious barrier to the transition of Russian agriculture to sustainable development [2, 3].

The purpose of the research is to analyze the factors affecting regional rural demography. The main results of the study are based on the assumption that only state regulation of economic and social processes in rural areas is the foundation for the preservation of population and rural demography.

MATERIALS AND METHODS

Study area

The Penza region is located in the middle Volga region on the western slope of the Volga Upland. In the structure of the gross regional product in 2019, the share of the main types of economic activity was: "Mining", "Manufacturing", "Provision of electricity, gas and steam; air conditioning", "Water supply; wastewater disposal, waste collection and disposal, activities to eliminate pollution "- 23.2%, "Agriculture" - 12.2, "Construction" - 7.1, "Transportation and storage" - 6.7, "Activities in the region

information and communication"- 2.4, "Wholesale and retail trade, repair of motor vehicles and motorcycles" - 15.2%. The traditional agricultural sector of the Penza region's economy occupies a special position among other sectors of the national economy.

Agricultural lands account for 70.1% of all lands in the region, arable land - 52.2%. The main areas of crop production are grain, sugar beet and sunflower production. Rye, wheat, cereals and grain fodder crops are grown. The production of potatoes and vegetables is well developed. Animal husbandry is mainly meat and dairy [9].

Retail trade turnover in 2019 amounted to RUB 217.6 billion, or 101.4% (in comparable prices) by 2018. In the structure of retail trade turnover, the share of food products amounted to 47.3%, non-food products - 52.7 % (in 2018, respectively, 46.5 and 53.5%).

In the volume of investments in fixed assets, 34.3% borrowed own funds, 65.7% - borrowed funds.

The region's foreign trade turnover amounted to 560.8 million US dollars, including exports - 308.4 million US dollars, imports - 252.4 million US dollars. Exports to the level of 2018 amounted to 103.3%, imports - 92.6%.

Data collection

The information base was the materials of the Federal Service of State Statistics of the Russian Federation, the Ministry of Agriculture of the Russian Federation.

Methodological aspects

Research based on the analytical method has confirmed the severity of the accumulated problems that hinder the growth of the rural population in Russia. These problems are also relevant for the Penza region.

The research methodology was based on the use of a monographic, abstract-logical, analytical, statistical method of cognition [6, 7].

RESULTS AND DISCUSSIONS

Situation of rural population

The research materials indicate that as of 01.01.2020 the population in the Penza region is 1,304,825 people, the urban population is 899,237 people (68.9%), the rural population is 405,588 people (31.1%) (Figure 1).

Over the past 15 years, the number of Penza residents has decreased by 117.1 thousand people, respectively, the urban population has decreased by 33.5 thousand people, and the number of villagers has decreased by 83.6 thousand people.

The structure of the rural population by age groups is changing towards an increase in the proportion of persons of pre-retirement and retirement age [1] a decrease in the number of children, youth and people of working age (Table 1).

Thus, the share of children from birth to 14 years old decreased from 14.7% in 2005 to 14.6% in 2020, and in numerical terms decreased by 13 thousand people, young people aged 15-29 years - respectively, from 19% to 14%, able-bodied persons aged 30-49 years - from 28.8% to 26.6%, and the proportion of persons of pre-retirement and retirement age increased from 24.2% to 31.5%.

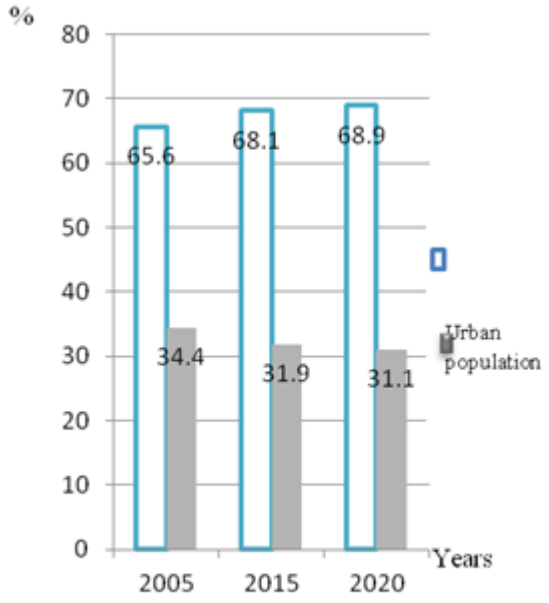

Fig. 1. The share of the rural and urban population in the total population of the Penza region, %

Source: Penza region. Key development indicators from 2005 to 2019: a comprehensive statistical collection // Federal Service of State Statistics of the Russian Federation. Territorial body of the Federal State Statistics Service for the Penza region, 2020. - 481 p.

Table 1. Distribution of the rural population of the Penza region by age groups (thousand people)

	2005	**2015**	**2020**
0-14	72.3	64.0	59.3
15-29	93.9	70.9	56.8
30-49	140.9	113.9	108.1
50-69	118.4	129.2	128.0
70 years and older	63.8	54.4	53.4
Total	489.3	432.4	405.6

Source: Penza region. Key development indicators from 2005 to 2019: a comprehensive statistical collection // Federal Service of State Statistics of the Russian Federation. Territorial body of the Federal State Statistics Service for the Penza region, 2020. - 481 p.

The rural population is aging. In 2019, over a third of women and 19.1% of men were aged 60 and over.Since 2000, 149 settlements have been abolished in the region due to the lack of officially registered residents. The main culprit is considered urbanization, or the migration of the rural population to large cities, where there are more chances of getting a job with a decent level of wages [4, 5]. Low fertility is one of the reasons for the constant decline in the population. During 2005-2019, the birth rate in the region (the number of live births per 1,000 people per year) decreased from 8.4 to 7.3 (Table 2).

Table 2. Main indicators of the natural movement of the rural population of the Penza region

Years	**Total people**			**For 1,000 people population**		
	Births	Deaths	Natural increase, decrease (+ .-)	Births	Deaths	Natural increase, decrease (+ .-)
2005	4,063	10,911	-6,848	8.4	22.5	-14.1
2015	4,035	7,319	-3,284	9.4	17.0	-7.6
2019	2,991	6,488	-3,497	7.3	15.9	-8.6

Source: Penza region. Key development indicators from 2005 to 2019: a comprehensive statistical collection // Federal Service of State Statistics of the Russian Federation. Territorial body of the Federal State Statistics Service for the Penza region, 2020. -481. p.

The most important indicators characterizing the demographic situation is the mortality rate of the population. Since 2015, there has been a decrease in the general mortality rate of the region's population, that is, the number of deaths from all causes per 1,000 people, from 17.0 to 15.9.

In 2019, life expectancy in the Penza region was 73.85 years (2nd place among the regions of the Volga Federal District, 18th place in Russia).Life expectancy is expected to be 78 years by 2024.

Unfavorable demographic processes exacerbated by negative migration rates. Not only the difference between fertility and mortality remained minus values, last year 4.5 thousand people left the Penza region. The largest share of those who left (41.2%) make up the basis of interregional migration, in particular to Moscow. Only 756 people left abroad, or just over 2% of migrants (Table 3).

The main reason that rural citizens leave the Penza region is the low quality of life in the countryside. The Penza region ranks 26th in the ranking of Russian regions in terms of the quality of life of the rural population.

Table 3. Overall results of migration of the population of the Penza region in 2019, people

	No. of arrivals	**Dropouts**	**Migration decrease (-)**
Migration - everything from it	31,438	35,939	-4,501
within Russia, incl.	28,268	31,701	-3,433
intraregional	16,881	16,881	0
interregional	11,387	14,820	-3,433
international, incl.	3,170	4,238	-1,068
with CIS countries	2,764	3,482	-718
with other foreign countries	406	756	-350

Source: Penza region. Key development indicators from 2005 to 2019: a comprehensive statistical collection // Federal Service of State Statistics of the Russian Federation. Territorial body of the Federal State Statistics Service for the Penza region, 2020. - 481 p.

The average rating of the region is 53.7 points, while in the neighboring regions of the Volga Federal District it is much higher, in

particular, in the Republic of Tatarstan - 61.5, in the Samara region - 60.6, in the Ulyanovsk region - 60.3. The Penza region has a subsidized budget, most agricultural organizations -the main village-forming enterprises have not yet overcome the consequences of the crisis of the 1990s. In addition, the overwhelming majority of the young able-bodied population went to work in the capital's metropolis. The structure of rural settlement is dominated by small settlements that require large expenditures for social development.

Low living standards of villagers, discrimination of agricultural labor, deep demographic problems lead to unsustainable development of rural areas of the region [7, 8].

Assessment of the quality of rural life in Russian regions is an integral part of monitoring socio-economic processes in the countryside. The analytical material underlies the formation of state target programs for the development of rural areas. The positive results of the development of the agro-industrial complex of the Penza region have been achieved to a certain extent thanks to the existing programs for the development of agriculture. At the federal level, the state program for the development of agriculture continues to operate, extended until 2025,the main goal of which is to ensure stable growth in agricultural production and ensure food security. At the regional level, the Penza region program "Development of the agro-industrial complex of the Penza region for 2014 - 2022" operates, its priority task is to ensure the fulfillment of the indicators of the Food Security Doctrine of the Russian Federation in the field of crop and livestock production. The measures taken by the government to support the agricultural sector have strengthened food security in the region.

In 2020, the state program "Comprehensive Development of Rural Areas" until 2025 was launched. It is a logical continuation of federal measures for rural development, implemented since 2002, and is aimed at the social and infrastructural improvement of the village, diversification of the rural economy, and increasing employment and incomes of the rural population. The program acquires particular relevance in a post-pandemic reality, when the attractiveness of life in small towns and rural areas increases, and a more even distribution of the population across the country reduces the risks of epidemics and other emergencies, and becomes an essential condition for national security.

The results of the study confirmed that the issue of housing remains an important and complex issue. In the countryside, this is no less acute problem than in the city. The Government of the Russian Federation plans to offer the agro-industrial complex workers attractive conditions for improving housing conditions - preferential mortgages up to 3% per annum, as well as improving the improvement of the housing stock of the rural population by increasing the share of residential premises with access to all types of utilities. Currently, only 32.5% of the total rural housing stock meets this criterion, the target indicator of the state program is planned to be brought to the level of 50%.

The problems of water supply and sewerage were identified. The volume of treated water is 77.1% of the total water consumption in the region. Coverage of the population with centralized water supply in cities and workers' settlements is 100%, in rural areas - 70%. Moreover, 33% of the total length of water supply networks have a wear rate of more than 60%. In 2019, as part of the implementation of the measures of the state program of the Penza region "Provision of housing and utilities of the population of the Penza region for 2014 - 2022", the repair of water supply systems will be carried out using subsidies from the regional budget. Repair works of 88 objects will be carried out on the territory of 63 municipalities. The volume of co-financing from the regional budget will amount to 104.1 million rubles, but this is a small part of the total amount of funds required.

The development of the engineering infrastructure of the village is associated with the functioning of a high-quality road network. The total length of regional, municipal and local roads is 16,241.5 km, of which 11,299.8 km are local roads [10].

Considering that the development of agricultural production in rural areas is directly related to the development of rural areas, the region is reconstructing and building new public roads connecting rural settlements, as well as providing for the construction of access roads to agricultural production facilities. which is subject to obligatory direction for these purposes - not less than 5 percent of the total volume of proceeds to the road fund from transport tax and excise taxes on petroleum products.

The provision of funds to municipalities is carried out within the framework of the subprogram "Sustainable development of rural areas of the Penza region for 2014-2017 and for the period until 2022" of the state program of the Penza region "Development of the agro-industrial complex of the Penza region for 2014-2022". At the same time, according to the terms of the program, 99% of the cost of construction and installation work is allocated from the regional budget. Municipalities must provide co-financing for the construction of agricultural roads in the amount of only 1%.

Achieving the goal of the program to preserve the share of the rural population in the total population of the country is associated with providing villagers with high-quality medical care. Since 2015, organizational and structural measures have been carried out on the territory of the region to form primary health care through the optimization of existing facilities [11].

In order to increase the availability of medical care to citizens living in rural areas within the framework of another regional project "Creation of a unified digital circuit in health care based on the state information system in the health sector of the Penza region" in 2019-2021, it is planned to equip all feldsher-midwife stations with automated workstations by connecting to the regional information and analytical system.

The program for the integrated development of rural areas should be based on a social principle related to the reproduction of life support. At the same time, social reproduction should be expanded, since it is not only the physical increase of the rural population that is important, but a qualitative change in the peasant community should become a priority.

In general, the level of social development of the village has a direct impact on the provision of the rural economy, including the agro-industrial complex, with qualified personnel [13].

Besides, By order of October 20, 2020, the Government of the Russian Federation approved the draft subprogram "Assistance in the voluntary resettlement of compatriots living abroad to the Penza region for 2021-2025" of the regional state program "Promotion of employment in the Penza region". The activities of the subprogram for 2021-2025 provide for attracting at least 1,000 compatriots to the Penza region. The volume of financing for the subprogram is planned at 6 million rubles with the possibility of additional attraction of subsidies from the federal budget. The amount of funding will be updated annually when the budget for the next financial year is adopted. the territory for the settlement of compatriots includes 27 rural areas of the region, as well as the city of Kuznetsk. As part of this work, the authorities plan to assist in the selection of options for temporary housing for compatriots and their family members, pay one-time financial support, compensate for the costs of medical examination, which is necessary to obtain a temporary residence permit or residence permit. Also, compatriots will be provided with assistance in employment and support in the creation of small and medium-sized businesses or farms.

CONCLUSIONS

In the current conditions of turbulence in the external environment, the state should actively influence demographic processes, creating conditions for an increase in the birth rate, a decrease in mortality, and an improvement in other demographic characteristics. If in modern Russia a free market economy cannot ensure accumulation and sustainable growth of “human capital”, this problem must be solved by pursuing a purposeful state policy. The way out of the demographic crisis in rural areas is not only

an increase in the rural population, but also an improvement in the quality of life of people. Modernization and rapid development of the economy, the creation of modern jobs for agricultural workers, the comprehensive development of rural areas - a solid foundation for the future.

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THE QUALITY OF EDUCATION IN RURAL AREAS FROM THE PERSPECTIVE OF PRIMARY AND SECONDARY SCHOOL TEACHERS

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Abstract

The rural education development is a strategic objective in Romania, especially due to the present challenges like: the drop in the number of students, poverty, lack of infrastructure, etc. The pressure to the sector was even higher during pandemic period when the rural educational infrastructure wasn't prepared for the infrastructural necessities. The present paper aimed to analyse the quality of education in rural areas from Arges county by a survey among 107 teachers from 7 middle schools and 1 high school, situated in five rural villages. The results revealed the needs of the teachers from rural areas to assure a good education, the needs of students to learn, the measures needed to be implemented regarding curricula, teaching methods and learning techniques.

Key words**:** *rural education, primary and secondary schools, quality of education*

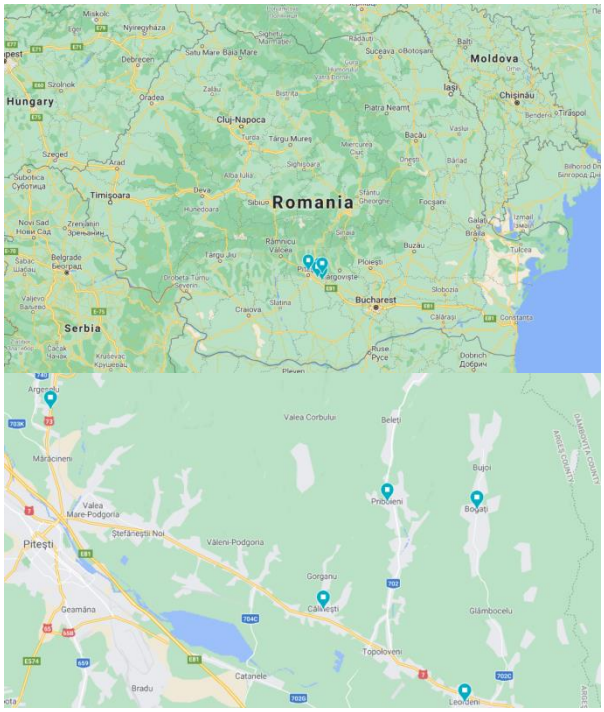
INTRODUCTION

In Romania, in 2019, were around 3.5 million persons included in the education system, from which 27.4% are in rural areas.
Education is the key of economic and social progress and the next generation has to be better trained to better pass over the challenges the rural areas are facing [1, 9, 11].
The main level of education which can be followed in rural schools are from early childhood education until primary and lower-secondary education (very rarely 2nd cycle secondary education because the high schools are usually in urban areas. According to [2, 5, 8], the Romanian education presents discrepancies between urban and rural areas regarding rural population training level, and especially of the new generation, infrastructure, teaching staff, teaching and assessment methods and didactical materials. Also, Romania is facing a drop in the number of pupils and specific challenges in rural areas (like poverty, ethnicity, etc.) which impede the access to education [6], [10]. Additionally to the insufficient resources, the rural schools were confronted in the last years with the difficulty to attract new qualified teachers or with the lack of ICT skills among teachers and students, especially in secondary level schools [4, 7].
Starting from all this situation our paper aims to create an overview over the quality of rural education by emphasizing the opinion of teachers from rural areas.

MATERIALS AND METHODS

From the almost 1 million children in kindergartens and students enrolled in the formal training and educational process from Romania during 2019 school year, around 3% are in Arges County. The particularity of this county is that it has more children and students in rural areas than national average: 44.1% in preprimary (preschool) education (compared with 41.6% at national level); 44.59% in primary and lower-secondary education (compared with 42.96% at national level. In this context, in 2020, we organized a questionnaire-based survey to analyse and assess the quality of rural education. Our survey was conducted in 7 middle schools and 1 high school, situated in five rural villages (Maracineni, Calinesti, Priboieni, Leordeni and Bogati) from Arges County, from south of Romania (Map 1). We used a questionnaire with 26 questions structured on the following

subjects: quantifying the teachers effort to ensure the quality of teaching activity; the quality of teaching style in relation with learning styles; the quality of school infrastructure; the quality of communication in school; the quality of school management.



Map 1. Area of research
Source: Google map [3].

We had 107 teachers which were willing to respond to our survey and the main characteristics of our database are shown in Table 1.

Table 1.The main characteristics of the respondents

	Frequency	Percent (%)
Total	107	100.0
Seniority in education under 10 years	25	23.4
Seniority in education over 10 years	82	76.6
Seniority in school under 10 years	44	41.1
Seniority in school over 10 years	63	58.9
Status - tenure teacher	84	78.5
Status - qualified substitute teacher	16	15.0
Status - unqualified substitute teacher	1	0.9
Status - detached teacher	6	5.6
Level - preschool	11	10.3
Level - primary school	30	28.0
Level - middle school (secondary school)	56	52.3
Level - high school	10	9.3

Source: Own calculation in SPSS based on data survey.

The data were processed using IBM SPSS Statistics by using descriptive statistics (frequencies).

RESULTS AND DISCUSSIONS

The assessment of teachers' involvement

The process to implement quality in rural education is a continuously effort for Romanian teachers.

Table 2.The distribution of teaching effort in rural areas

	Frequency	Percent (%)
Teaching hours in the department		
Between 16-18 ore at school	96	89.7
25 ore	11	10.3
Total	107	100.0
Internal commissions responsible		
Under 2 hours per week	8	7.5
Over 2 hours per week	43	40.2
NR	56	52.3
Total	107	100.0
School service		
Under 6 hours per month	38	35.5
Over 6 hours per month	68	63.6
NR	1	0.9
Total	107	100.0
Additional training for improvement		
Under 3 hours per week	20	18.7
Over 3 hours per week	45	42.1
NR	42	39.3
Total	107	100.0
Involvement in remedial programs		
Under 3 hours per week	43	40.2
Over 3 hours per week	20	18.7
NR	44	41.1
Total	107	100.0
Participation in school competitions		
Under 5 hours per month	43	40.2
Over 5 hours per month	20	18.7
NR	44	41.1
Total	107	100.0
Other activities		
Under 5 hours	20	18.7
Over 5 hours	73	68.2
NR	14	13.1
Total	107	100.0

Source: Own calculation in SPSS based on data survey.

This effort implies:
- participation to professional training - in the last three year, 42.1% of the respondents followed more than two training courses, 20.6% participated in 2 courses and 24.3% in just one.
- the teachers expenditure for this courses - 27.1% of the teachers spent over 220 euro, 31.8% spent between 110-220 euro and 23.4%

under 110 euro (the minim net wage in Romania is around 308 euro per month). What is important is that 38.3% of the teachers paid this classes with their own money. Only 17.8% were 100% sustained by the school.

- every teacher have to work 40 hours per month in school (Table 2).
- additionally the teachers have extracurricular activities (under 10 hours per week - 88.8%; over 10 hours per week - 11.2%), preparation of teaching activities (under 15 hours per month - 46.7%; over 15 hours per month - 53.3%) and commissions/conference activities (under 10 hours per month - 90.7%; over 10 hours per week - 9.3%).

According to 79.4% of the questioned teachers, the degree of time occupancy per month exceeds 90% and many of them are forwards a lot of their free time to work activities.

The assessment of organization (school) internal procedures, processes and infrastructure

Table 3. The assessment of attitude of teachers towards school management and environment

	Agree (%)	Disagree (%)
The behavior of the school administration towards staff is supportive and encouraging	65.4	5.6
You are satisfied with the salary received	37.4	37.4
Teachers participate in making important educational decisions in this school	57.9	16.9
The necessary materials are available as needed	53.2	6.5
The principal is concerned with obtaining resources for this school	68.2	4.7
Routine tasks and documents are involved in teaching	70.1	-
Your principal applies the school's rules of student conduct and supports you when needed	76.7	1.9
The rules of this school are constantly applied by teachers, even for students who are not in their classrooms.	74.8	4.7
The principal talks to you frequently about personal training practices	60.8	10.3
Most of your colleagues share with you the beliefs and values that should be the mission of the school.	65.5	6.5
Staff members make efforts to cooperate	66.3	6.5
The principal knows what kind of school he wants and communicates this to the staff	71.0	3.7
The teachers in this school are recognized for a job well done	65.4	5.6
The goals and priorities for the school are clear	71.0	1.9

Source: Own calculation in SPSS based on data survey.

The schools to which the interviewed teachers belong to offer good conditions for the participants to teaching processes and activities (76.6% of the teachers have access to computers, phones, printers, etc. during working hours).

Also, regarding the management of these schools we may say that almost 70% of the teachers are pleased with the internal process of activity assessment and the communication with the manager.

The relation teacher - school can be summarize as presented in Table 3.

Our research took in consideration also their opinion regarding the strong points of their school. On the first places stand the communications skills of the staff, the studying environment and the connection of teachers with students (Table 4).

Table 4. The strong points of the school

	Percent (%)
Communication skills	21.5
A favorable environment for studying	15.0
Teacher - student relation	14.0
Empathy	10.3
Captivated students	10.3
Interactive methods	9.3
Pedagogical tact	9.3
Uniformization of knowledge	7.5
Qualified teaching staff	2.8
Total	100.0

Source: Own calculation in SPSS based on data survey.

Regarding the week points of their schools, the teachers indicated first of all the lack of technology (29.0%), lack of respect from students (14.0%) and the lack of parents involvement (11.2%) (Table 5).

Table 5. The week points of the school

Items	Percent (%)
Lack of technology	29.0
Lack of respect	14.0
Lack of parent involvement	11.2
Loaded curricula	9.3
Disinterest students	9.3
Too many changes in the educational system	9.3
Students with special educational requirements	8.4
Lack of teacher collaboration	7.5
Professional training	.9
Large number of children	.9
Total	100.0

Source: Own calculation in SPSS based on data survey.

To improve the quality of education in their schools, the teachers indicated especially to change the methods of teaching: 37.4% to

implement modern methods, 27.1% to implement interactive methods and 14.0% to implement Montessori methods (Table 6).

Table 6. New teaching methods that can be implemented in school

Items	Percent (%)
Modern methods	37.4
Interactive methods	27.1
Montessori education	14.0
Computer assisted training	5.6
Partnerships with other institutions	4.7
Traditional methods	3.7
Scheduled training	3.7
Team work	3.7
Total	100.0

Source: Own calculation in SPSS based on data survey.

The assessment of teaching activities and processes

The quality of the teaching style is also very important for the educational system. 42.1% from the teachers indicated as a basic pillar of the teaching style the dialogue with the students, 19.6% the knowledge developed on the subject, 19.6% the modern learning methods and 18.7% the introduction of modern technology in lessons.

To perform their duties in the classroom, the interviewed teachers mentioned that the following elements are important: didactic materials (books, maps, interactive games, etc.) (45.8%); the devotion of the teacher (19.6%); video projectors and TV (15%); modern technology and software (14.9%); training (4.7%).

On the other hand the teachers were ask to point out what they think can motivate a student to learn. 29.9% of the teachers point out the student engagement in the educational process; 18.7% the creation of a positive environment; 17.8% the need for clear instructions; 14% the use of modern technologies; 9.3% the equal opportunities for success and 9.3% the freedom of speech and 1% didn't mention anything.

In the teaching process the teachers ensure a continuous flow of communication: 58.9% discuss with parents during scheduled meetings and 35.5% by phone; 72.0% prefer to discuss directly with the students during classes and 23.4% during advisory hours; the feedback is usually given verbally (64.5%) or in the personal notebook (30.8%); the progress of the students are communicated tot the parents in writing (59.8%), individual discussions (21.5%) and during parents meetings (17.8%); over 80% of the teachers utilize the feedback from students to improve their work.

The assessment of the main challenges in assuring quality and proposals for improving

Teachers were asked to indicate at least three challenges facing rural education. Their agregate responses permitted us to identify the following: lack of involvement of students and parents (72%); lack of modern educational means (90.7%); overloaded curriculum (51.4%).

To overcome the challenges in rural education, we identified the following main proposals: changing the school program (27.1%); investing in modern technology (18.7%); changing the educational system (15%); decreasing the number of students in the classroom (12.1%) and others (like training, increasing parents involvement; attracting funds. removal of formalism, etc.).

CONCLUSIONS

The analyzed rural schools create a work environment which is evidently appreciated by the majority of interviewed teachers. With a good collaboration between staff and managers, these schools offer a favorable environment for studying and for communication. However, many challenges have to be faced (especially in 2020), like the lack of technology, of respect from students and of parents involvement. But the teacher are committed to quality and despite the hard effort involved (summarized by the long hours needed to assure a quality teaching level) they are very implicated. Based on their responses we were capable to indicate: the needs of a teacher from rural areas to assure a good education; the needs of students; the measures needed to be implemented regarding curricula, teaching methods and learning techniques.

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EFFECT OF DIFFERENT LEVEL OF NITROGEN FERTILIZER ON GRAIN YIELD OF WHEAT IN CENTRAL PART OF OLTENIA

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Abstract

Nitrogen is an important nutrient that plays a significant role in maximizing crop yields worldwide. Optimizing nitrogen fertilization ensures suitable grain yields and reduces environmental pollution. The aim of the research was to investigate the effect of different nitrogen levels on grain yield of wheat and nitrogen use efficiency. The field research was performed at Agricultural Research and Development Station Șimnic on a reddish preluvosoil, during three consecutive growing seasons. Five nitrogen levels: 0 (control), 30, 60, 90 and 120 kg N/ha were used. Statistical analysis showed that nitrogen levels had a significant effect on grain yield in all years of study. On average, the three-year data indicated that nitrogen fertilizers generated increases of 30-114%, representing 7.8-29.2 q/ha compared to the control. The highest agronomic efficiency of nitrogen (33.7 kg/kg) was at a level of 60 kg N/ha, which is considered a rational application in terms of nitrogen emissions to the environment.

***Key words*:** agronomic efficiency; fertilization; nitrogen; *Triticum aestivum*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important cereal globally that plays an important role in food security, being cultivated on 214 million hectares [9].

Nitrogen is an important fertilizer used intensively in field crops to maximizing the grain yield and quality.

In 2019, the quantity of N fertilizer used in agriculture worldwide was about 118.2 million tons. The increased use of these fertilizers has led to a rapid rise in prices, being a significant concern for farmers [13].

At a high fertilization rate, nitrogen can remain in the soil, being absorbed by the following crops or can lead to environmental pollution such as nitrate leaching and greenhouse gas emission [25].

Agronomic response to the use of fertilizer is a strategy that helps to avoid excessive application and economic losses [14].

Low nitrogen use efficiency at a high N input threatens the sustainability of agro-ecosystems [26].

Many studies showed that the nitrogen use efficiency can be increased through good management practices and crop breeding.

Usually, the values of agronomic efficiency for cereals crops vary between 10 and 30 kg/kg N.

The values above 30 kg/kg N can be found in well-organized growth systems or low levels of soil nitrogen [8, 16].

Previous researches indicated that climatic conditions and soil types are environmental factors that have significant impacts on yield of wheat [2, 11, 22].

The central part of Oltenia is often affected by drought and heat, with only two out of ten years being favourable to crops [4, 5, 6, 18, 23].

The optimization of nitrogen fertilizers is considered to be a primary means of increasing grain yield, in improving use efficiency [3].

The aim of this study was to investigate the grain yield and the agronomic nitrogen efficiency of wheat cultivated under agro-climatic conditions of central part of Oltenia.

MATERIALS AND METHODS

This study was conducted at the Agricultural Research and Development Station Șimnic - Craiova under rain-fed conditions for three consecutive growing season (2015/16, 2016/17 and 2017/18), in the long-term crop rotation after pea (pea-wheat-maize-wheat-sunflower). The variety Dropia was the test variety in all growing seasons.

The field trial was laid out under randomized block design with three replications on a reddish preluvosoil, which is characterized by a humus content of 2.2-2.7%, poorly supplied with nitrogen (0.071-0.072 mg/kg), well supplied in phosphorus (32.2-52.2 mg/kg) and medium supplied in potassium (104-125 mg/kg) and a pH = 5.08-5.33 [17].

Five different levels of nitrogen i.e. 0 (control), 30, 60, 90, 120 kg N/ha were assessed.

Nitrogen fertilization (in the form of NH_4NO_3) was done before sowing and in early spring.

All the agronomic practices were carried out similar for all plots.

Agronomic efficiency (AE) was calculated according to [3]:

$$AE\ (kg/kg) = \frac{Gf - Gu}{Na}$$

where Gf = grain yield in the fertilized plot (kg);

Gu = grain yield in the unfertilized plot (kg) ;

Na = the quantity of nitrogen applied (kg).

The data were analyzed statistically using ANOVA, and LSD test was applied at 5%, 1% and 0.1% probability level to compare variant averages.

Pearson's correlation coeffcient and linear regrresion were used to assess the relationships among N levels and grain yield.

The amount and distribution of precipitation and average air temperature, varied significantly across the three growing seasons (Tables 1 and 2).

In terms of precipitations, for the first growing season (2015/16) and for the third season (2017/18), the sum of precipitation was extremely high, above to multiannual average (+232.0 mm, +340.3 mm, respectively), having negative influence on grain yield. For the second season (2016/17) it was lower, below the multiannual average (-81.7 mm).

The average air temperature was above to multiannual average in all growing seasons (+1.8°C, +0.6°C and + 1.4°C, respectively).

Table 1. Monthly precipitation in 2015/16, 2016/17 and 2017/18

Months	2015/16	2016/17	2017/18	Multiannual average
October	70.3	63.3	100.2	44.5
November	11.5	75.2	70.3	44.9
December	0	5.0	62.0	45.1
January	66.2	11.1	36.3	32.7
February	37.3	31.2	72.5	30.6
March	127.2	32.1	95.0	33.7
April	48.1	71.1	11.1	46.0
May	101.2	74.2	60.2	66.9
June	121.3	0	182.3	67.9
July	44.1	89.2	177.3	61.5
August	26.0	5.0	19.2	48.9
September	40.2	26.0	19.0	42.4
Sum	797.1	483.4	905.4	565.1

Source: Own processing based on data from Meteorological Station Șimnic, Craiova.

Table 2. Monthly average air temperature in 2015/16, 2016/17 and 2017/18

Months	2015/16	2016/17	2017/18	Multiannual average
October	11.0	10.3	12.7	11.8
November	8.9	5.2	6.4	5.5
December	4.7	-0.3	3.2	0.4
January	-2.5	-5.1	1.4	-1.4
February	7.5	1.6	0.8	1.0
March	7.7	9.8	3.9	5.6
April	14.7	11.1	16.6	11.8
May	16.3	16.7	19.2	16.9
June	21.9	23.4	21.6	20.4
July	23.9	24.2	22.3	22.6
August	23.1	25.4	24.1	22.1
September	19.5	19.4	19.2	17.5
Average	13.0	11.8	12.6	11.2

Source: Own processing based on data from Meteorological Station Șimnic, Craiova.

RESULTS AND DISCUSSIONS

Grain yield

According to ANOVA results, grain yield was significantly affected by increasing nitrogen fertilization in all growing seasons. The contribution of nitrogen on wheat yield is remarkable (Table 3).

The first (2015/16) and third (2017/18) growing seasons were extremely hot and rainy, therefore the yields were lower per fertilization variant compared to 2016/17 season.

Excessive precipitations cause the problem of water logging, reducing the availability of nitrogen [2, 3].

Similarly, low rainfall restrict root growth and reduce N availability and uptake [10].

In all growing season, the highest grain yields were recorded at the highest nitrogen level (120 kg N/ha).

On average, over three seasons, increase of nitrogen level from 0 to 30, 60, 90 and 120 kg N/ha increased grain yield by 7.8, 20.2, 25.7 and 29.2 q/ha, respectively, or by 30%, 79%, 100% and 114%, respectively (Figure 1).

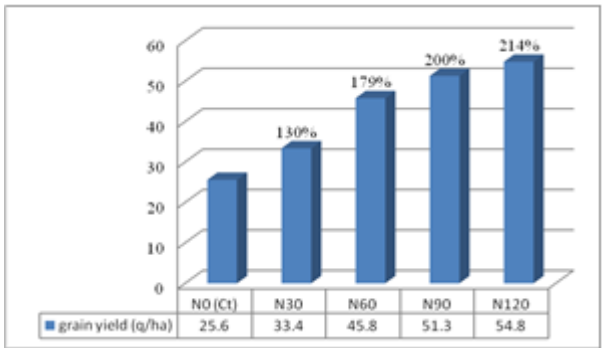

Fig. 1. Effect of nitrogen fertilization on grain yield (three-year average)
Source: Own calculation.

Trend of regression changes of grain yield for different levels of nitrogen is presented in Figure 2.

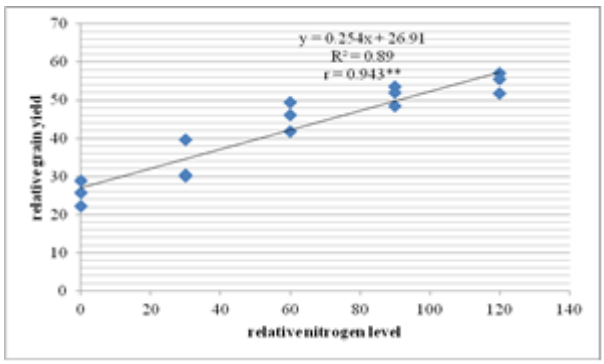

Fig. 2. Trend of regression changes in grain yields with different nitrogen levels
Source: Own calculation.

Grain yield of wheat had a linear and positive significant relationship ($p = 0.01$) with different levels of nitrogen.

Coefficient of correlation was $r = 0.943$ and coefficient of determination was $R^2 = 0.89$ which revealed that the variation in levels of nitrogen explained about 89% of the variation of grain yield.

Many studies showed similar results for variation in grain yield due to level of nitrogen and climatic conditions [2, 15, 19, 21, 24].

Agronomic efficiency

The agronomic efficiency of nitrogen is a valuable indicator of optimizing of N supply.

In our study, differences in agronomic efficiency were observed due to the variation in N level and due to climatic conditions from growing seasons (Figure 3).

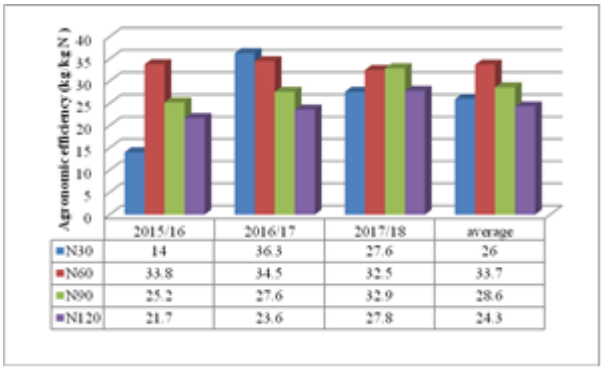

Fig. 3. Effect of nitrogen fertilization on use efficiency (Agronomic efficiency)
Source: Own calculation.

In 2015/16, the values of nitrogen agronomic efficiency ranged from 14 kg/kg in variant of 30 kg N/ha to 33.8 kg/kg in variant of 60 kg N/ha. Thus, the nitrogen use efficiency increased in response to application N up to 60 kg N/ha, but decreased progressively as the level increased.

In 2016/17, the agronomic efficiency values ranged from 23.6 kg/kg in variant with 120 kg N/ha to 36.3 kg/kg in variant with 30 kg N/ha. However, efficiency declined when N level was raised from 60 to 120 kg N/ha.

In 2017/18, the values of agronomic efficiency ranged from 27.6 kg/kg in variant with 30 kg N/ha to 32.9 kg/kg in variant with 90 kg N/ha. Thus, increases in agronomic efficiency were observed only up to 90 kg N/ha.

[2 and 22] also showed that the values of agronomic efficiency in a year with excessive rainfall were lower than the values of the year with less rainfall.

On average, agronomic efficiency increased to application N level up to 60 kg N/ha, but decreased when N level was raised from 90 to 120 kg N/ha.

Table 3. Effect of nitrogen fertilization on grain yield of wheat

Variant	Grain yield (q/ha)	Difference (q/ha) ±	% to N_0 (control)	Significance
2015/16				
N_0 (control - Ct)	25.8	Ct	100	-
N_{30}	30.0	4.2	116	*
N_{60}	46.1	20.3	179	***
N_{90}	48.5	22.7	188	***
N_{120}	51.8	26.0	201	***
LSD 5% = 4.2; LSD 1% = 5.5; LSD 0.1% = 7.2				
2016/17				
N_0 (control - Ct)	28.8	Ct	100	-
N_{30}	39.7	10.9	138	***
N_{60}	49.5	20.7	172	***
N_{90}	53.6	24.8	186	***
N_{120}	57.1	28.3	198	***
LSD 5% = 1.9; LSD 1% = 2.5; LSD 0.1% =3.3				
2017/18				
N_0 (control - Ct)	22.2	Ct	100	-
N_{30}	30.5	8.3	137	***
N_{60}	41.7	19.5	188	***
N_{90}	51.8	29.6	233	***
N_{120}	55.5	33.3	250	***
LSD 5% = 2.4; LSD 1% = 3.3; LSD 0.1% = 4.2				

Source: Own calculation.

These results suggest that, under rainfed conditions from the central part of Oltenia, wheat crops should not be fertilized to levels higher than N_{60}.

This supports findings of other authors [15] and [20], who reported that variation in climatic conditions between the different growing seasons is a major limiting factor for optimal nitrogen fertilizer application in wheat production.

A decreasing trend in agronomic efficiency of wheat with increasing nitrogen levels also was reported by other researchers [1, 7, 12].

Also, the type of soil is a factor that limits the availability of nitrogen applied as fertilizer to wheat crop.

[22] reported that under the level of nitrogen 60 kg/ha was obtained the maximum agronomic efficiency of 32.7 kg/kg under soil conditions of Luvic Chernozem.

In contrary, [11 and 24] reported that the best agronomic efficiency was obtained at the rate of 100 - 120 kg N/ha in Dyschrochrept soil (according to USDA Taxonomy) and at the rate of 100 kg N/ha in Pseudogley soil (Stagnosol), respectively.

CONCLUSIONS

The results of this study (obtained during three growing seasons) indicated that wheat yield and agronomic efficiency of nitrogen depends greatly on both the level of nitrogen fertilization and the growing season (climatic conditions).

The application of nitrogen level of 120 kg/ha improved grain yield (up to 114%) in comparison to control variant, but had a detrimental effect on agronomic efficiency.

The best agronomic efficiency of nitrogen (33.7 kg/kg) was at a level of 60 kg N/ha. Thus, the application of nitrogen at this level is considered a rational application in terms of obtaining an optimum yield of wheat and nitrogen emissions to the environment in the study area.

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ABSORPTION OF RURAL DEVELOPMENT FUNDS. A LESSON LEARNED?

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Abstract

This article presents an analytical survey on the perspectives and impacts of the absorption of rural development funds in Romania. The study makes an x-ray of the level of support and absorption rate in two financial years 2013-2017 and 2014-2020. The aim is to highlight the impact of these capital infusions in the Romanian rural area. The learning mechanism policy of the two programming periods analysed should be "a lesson learned" for the next period. This is particularly important in view of the future funds allocated through the new multiannual financial framework 2021-2027, as well as recovery and resilience assistance through the post-pandemic instrument NextGeneration EU. The main conclusion that emerges is that the absorption rate of the rural development fund in Romania is an appropriate one, being above the NMS-13 average. However, Romania's needs, objectives and priorities in terms of rural development, which are well identified in the National Rural Development Programs, are not addressed in the financial allocations materialized through selected measures and sub-measures. Greater coherence and clarity is needed between what is strategically stated as objectives and priorities and the content of the funding program. The ideas, solutions and suggestions formulated by the authors may have practical applications in developing future programs and the rural strategy on the horizon 2050.

Key words*: Common Agricultural Policy, rural development, Romania, objectives, allocations, impact*

INTRODUCTION

The Common Agricultural Policy (CAP) is one of the most important sectoral policies of the European Union. It accounted 66% of the EU budget in the early 1980s, 37.8% of the Community budget in the 2014-2020 period and represents 31% for the 2021-2027 period [12]. Originally conceived as a sectoral policy, the CAP now has a stronger territorial vocation, allowing for possible overlaps and convergences with the objectives of the Cohesion Policy [7]. It is built around two pillars: the first pillar comprising direct payments for agriculture and market measures, with a share of 75.3%, and the second pillar, rural development, with an allocation of 24.4% of the CAP budget [12]. Direct payments are the main financial mechanism of the CAP, enjoying an allocation of 71.3% of the European Union's agricultural budget. Direct payments were introduced in 1992 as "transitional payments", representing financial support to farmers to compensate for losses caused by falling agricultural prices. Today, farmers' problems are completely different, which is why some authors [21; 31; 32] argue that there is no clear justification for continuing this form of support of farmers. They argue that traditional EU agricultural policies, such as subsidies, are not enough to increase agricultural incomes. These need to be linked to increased investment in agriculture [23] in order to increase farmers' incomes. Also, current payment schemes should be better targeted, providing compensation for farmers who produce agri-environmental public goods and/or clearly contribute to animal welfare [17].

In the opinion of several specialists [5; 21; 30] pillar II (rural development) is the best way to improve the performance of the CAP according to the most socio-economic and

environmental criteria. The development of rural entrepreneurship is a key element of rural development. The aim is to reduce poverty in rural areas by increasing the number of competitive businesses, both in the agricultural sector and in related sectors (manufacturing, tourism, services). The large number of applicants for this type of project shows an increased interest from people, leading to a high degree of absorption of European funds for rural development [26].

An important focus of the rural development program is on the LEADER approach. It involves a public-private partnership that, through local action groups, leads to the development of local communities. The involvement of LAGs was found to have a positive impact on peoples, leading to an increase in the number of initiatives and the absorption of European funds. This is observed in Poland [6; 15], Greece [4], Spain [22]. In Romania, LEADER has clear elements of evolution, representing the most solid and widespread model of small-scale local development [28].

In this context, the present study makes an x-ray of the level of support and absorption rate for rural development in Romania for two financial years 2013-2017 and 2014-2020. The aim is to highlight the impact of these capital infusions in the Romanian rural area. The analysis is outlined around five categories of activities, grouping measures and sub-measures within the National Rural Development Programs (NRDP) 2013-2017 and 2014-2020. We hope that the ideas, solutions and suggestions can be used for future programs and for the rural strategy on the horizon 2050.

MATERIALS AND METHODS

This section comprises the methodological approach of the research and the process of data collection. The article analyses the evolution of public financial flows (amounts received by Romania for the EU budget plus the national contribution) dedicated to financing rural development, for the 2007-2013 and the 2014-2020 programming periods. Based on the allocated amounts and of made payments, the absorption degree of the rural development programs was calculated. In the literature, there are two ways to express the absorption rate: either by reference to the EU contribution quota, or by total funding, including co-financing. In this study, the absorption rate is expressed by reference to the total public funding, including Romanian state co-financing.

A special attention was paid to analysing the management way of financial resources for rural development [2; 14; 16], as well of the structure and implementation level of objectives which are set in the National Rural Development Program [25; 27]. In order to highlight and capitalize some noticeable evolutions in the execution of the two financial periods, we proceeded to group the measures and sub-measures from NRDP on five groups of activities: agriculture; food industry; non-agricultural activities; rural infrastructure and other activities. The primary data were taken from European Commission releases and Ministry of Agriculture and Rural Development of Romania, as well as various national and international publications in the field.

RESULTS AND DISCUSSIONS

Overview of public funds allocated to rural development in Romania. Period 2007-2013 versus 2014-2020

A first finding regarding the implementation way of the NRDP 2007-2013 (Table 1), over the years, refers to the fact that many changes were made compared to the initial version approved by the European bodies. It thus reached its 16th version. Most of the changes resulted in a reduction in allocations to measures that were provided to bring a significant national contribution. In this situation, the total amounts allocated in the initial version, of EUR 9,970.8 million, decreased in the 16th version, to EUR 9,296.5 million. There was a decrease of EUR 674.3 million, a real loss for the rural Romanian area, but an image advantage by artificially increasing of the absorption degree from 84.82% to 90.97%. Most of the amounts redistributed were allocated to the measures

targeting "green payments", which led to an increase in the ceiling for these payments, from EUR 2,492 million (initial version) to EUR 3,165.7 million (in the latest version). Under these conditions, the share of green payments in total payments destined for agricultural activities increased to 55.3%.

Table 1. Comparative situation 2007-2013 vs. 2014-2020 regarding the level of public funds allocation of the Romanian National Rural Development Program, by types of activities, EUR million, and absorption rate on April, 2020

ACTIVITIES	Period 2007-2013					Period 2014-2020		
	Allocation V_1, € mil.	Allocation V_{16}, € mil.	Payments € mil.	Absorption rate, V_1, %	Absorption rate, V_{16}, %	Allocation V_{10}, € mil.	Payments € mil.	Absorption rate, %
I. Agricultural activities	5,814.7	5,721.1	5,364.3	92.25	93.7	6,315.1	4,182.2	66.2
- of which: green payments	2,492.0	3,165.7	3,110.3	124.81	98.2	3,624.6	2,638.9	72.8
II. Food industry	1,071.2	719.9	518.2	48.38	71.9	546.8	159.7	29.2
III. Non-agricultural activities	927.6	741.3	454.7	49.02	61.3	288.1	186.5	64.7
IV. Rural infrastructure	1,546.1	1,596.6	1,525.2	98.60	95.5	1,319.6	837.3	63.5
V. Other activities	611.2	517.6	594.9	97.33	114.9	972.0	478.4	49.2
Total	**9,970.8**	**9,296.5**	**8,457.3**	**84.82**	**90.9**	**9,441.6**	**5,844.2**	**61.9**

Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19].

Regarding the current financial year, we find that in this case as well, several adjustments were made, reaching in April 2020 the 10th version. We consider important to note that the funds intended for NRDP financing in the financial year 2014-2020 are EUR 529.2 million lower than in the initial version of the previous financial year due to the decrease of the contribution from the national budget by EUR 533.2 million, which positions Romania on last places in terms of national financial effort for rural development measures. This decrease is due to the increase of the amounts intended for green payments from EUR 2,492 million, in the initial version of NRDP 2007-2013, to EUR 3,624.6 million in the current version. There have been reached at the point that green payments to account for 38.4 % of the total NRDP and 44.6 % of the Community allocation from the European Agricultural Fund for Rural Development (EAFRD). We mention that Regulation (EU) no. 1305/2013 regarding rural development provides a minimum level of 30 % of the EAFRD to be allocated to green payments.

Another issue worth mentioning is the sharp reduction in funding for the development of non-agricultural activities, which should make a substantial contribution to increasing rural employment and thus reducing poverty [13]. In fact, the total amount allocated to measures targeting non-agricultural activities, including food industry and rural infrastructure, is lower than the amount intended for green payments. The analysis of the evolutions in amounts allocated by types of activities, in the two financial years, highlights a series of aspects presented in the following figures.

Analysis of the National Rural Development Program by types of activities

For **agricultural activities** (Figure 1), in the financial year 2007-2013, the initial allocated amount was of EUR 5,814 million. According to the latest version of the NRDP (16th version), the allocated amount decreased to EUR 5,721 million, of which EUR 5,364 million were actually consumed, resulting in an appreciable absorption of 94%. In the NRDP 2014-2020 for agricultural activities there is allocated an amount of EUR 6,315 million, amount that exceeds the allocation from the 16th version of the previous program by EUR 594 million.

It should be mentioned the fact that from the total amount allocated to agricultural activities, only 42.6% are actually intended to productive investments, the difference being attributed to other activities, mainly to green payments.

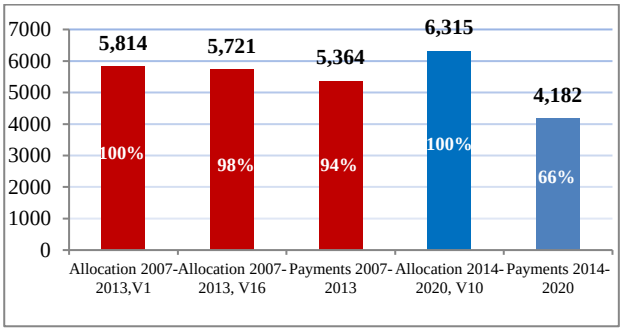

Fig. 1. Allocations, payments (EUR million) and absorption of funds (%) for agricultural activities
Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19].

The latest version of the NRDP 2007-2013 meant a sharp decrease in the amounts allocated for the development of **food industry** (Figure 2) creating new jobs in rural areas, from EUR 1,071 million to EUR 720 million. The absorption degree was of only 48%, compared to the initial version, respectively 72% compared to the final version.

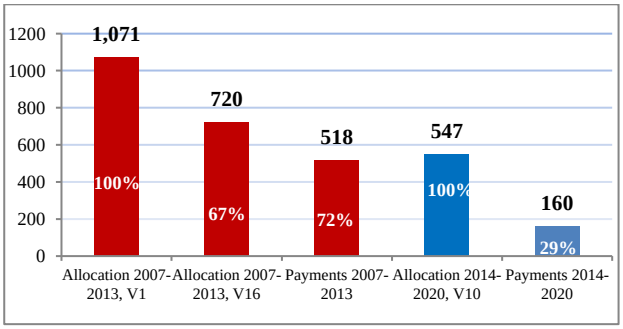

Fig. 2. Allocations, payments (EUR million) and absorption of funds (%) for food industry
Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19].

For the current financial year, out of the 26 needs identified in the documentary part of NRDP 2014-2020, Chapter 4.2, the need that explicitly requests "*Increasing the number of jobs in rural areas*" should find solution by financing **food industrial activities** and **other non-agricultural activities [**24**]**. However, for the period 2014-2020, in order to support food industry, the amount of EUR 546.8 million is proposed, which represents only 76% of the amount allocated in the previous program (the 16th version), and only 51% of the initial version. The low absorption degree in the financial year 2007-2013 for this activity should not have been a reason to reduce the allocations for the current period, but rather, given the actual need for the food industry development, should identify adequate leverage to support those interested in implementing these types of projects, including by reducing the beneficiary's contribution. The current absorption degree, extremely low, of only 29%, we consider to be the consequence of the multiple required conditions and of the contribution of unattractive public funds, problems that remained unresolved since the previous year. The consequence of an inadequate approach to these issues represents the weak development of food industry and maintaining of a high level of imports of processed agricultural products and, at the same time, the maintaining of a low added value of domestic agri-food production **[**3; 9**]**.

For the **non-agricultural activities** (Figure 3), other than food industry, the amount of EUR 288.1 million was provided, which represents 39% of the last version of the previous program (period 2007-2013) or 31% of the initial version. This means a decrease in financial resources allocated in the current financial year of EUR 639.5 million. In fact, the EUR 288.1 million provided for the period 2014-2020 show a negative difference even compared to the amounts actually consumed in the previous program, of EUR 54.7 million.

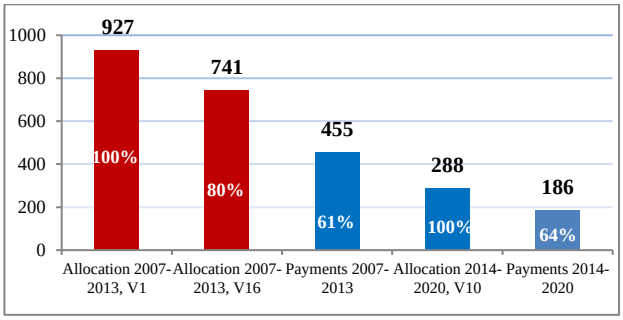

Fig. 3. Allocations, payments (EUR million) and absorption of funds (%) for non-agricultural activities
Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19].

This situation proves, on one hand, that there is a total disagreement between the needs and priorities of the Romanian rural area, identified in NRDP 2014-2020, and the amounts allocated by the proposed measures

and sub-measures. On the other hand, highlights a total neglect of social issue of the rural space which is becoming more and more precarious. The current absorption degree is quite high (64%), which indicates the increased interest of investors to develop these activities, as evidenced by the contracting level based on projects which are submitted and in progress of implementation (over 90 % of allocated amounts).

Solving the complex issues of rural localities also requires significant financial efforts to **improve rural infrastructure** (Figure 4), to reduce poverty and the risk of social exclusion, to preserve local heritage **[**1; 20**]**, which finally means to increase the living standard of rural population **[**29**]**. The amount proposed for the development of rural infrastructure for the period 2014-2020 (EUR 1,319 million) is well below the provisions of the previous program (EUR 1,596 million) and even below the amount actually consumed in the previous year (EUR 1,525 million). However, the highest absorption degree was achieved precisely at this measure (98% compared to the initial version and 96% compared to the latest version in 2007-2013), which proves both the need to strengthen rural infrastructure and the capacity to prepare projects and to use the capital allocated by local authorities. This time also we find the same deficient approach, in total disagreement with the real needs of the rural area. The actual absorption rate in the current programming period is 63%, given that the projects submitted and contracted have already exhausted the full allocated amount.

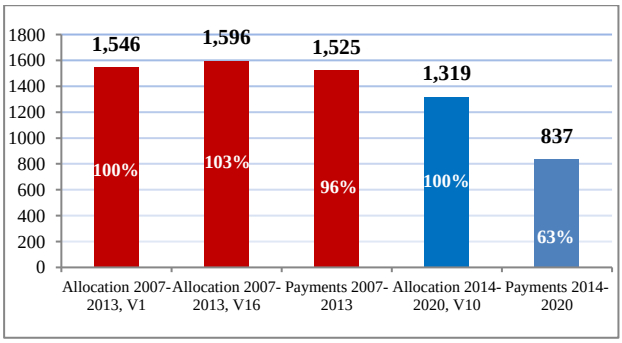

Fig. 4. Allocations, payments (EUR million) and absorption of funds (%) for rural infrastructure
Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19].

For **other activities** (Figure 5), which include the measures included in the LEADER axis from the previous program, respectively measure *M19 Local development of LEADER* from the current program, to which is added the measure *M20 Technical Assistance - Member States*, there were allocated EUR 972 million, which represents 159 % of the amount initially allocated in the previous period, and well above the EUR 595 million actually consumed in the previous year. From the total of EUR 972 million, the following sub-measures are financed: ”*Preparatory support”*; ”*Support for the implementation of actions within the local development strategy”*; ”*Preparation and implementation of the cooperation activities of the Local Action Group”*; ”*Support for operating and running costs”* and ”*Technical Assistance”*, which are important but that we consider that they do not need such financial support to the detriment of other priorities, even if the projects to be carried out on these measures (especially in the context of LAGs) will partially affect the other types of activities.

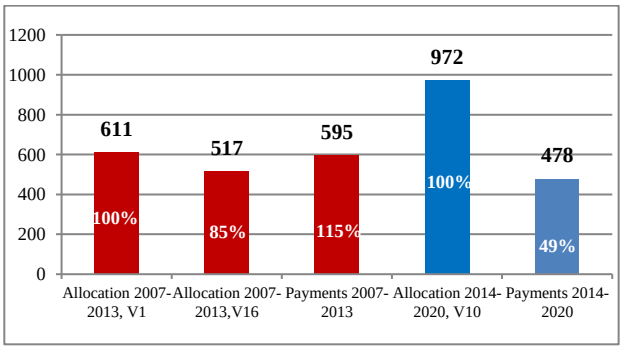

Fig. 5. Allocations, payments (EUR million) and absorption of funds (%) for other activities
Source: Authors' development based on Ministry of Agriculture and Rural Development [18, 19]

For the financing of knowledge needs **[**8**]**, counseling and research, the allocation of only 2% **[**16**]** is considered superficial, highlighting another deficient aspect of NRDP for the period 2014-2020. The modernization of the agricultural education infrastructure (vocational schools, high schools, agricultural universities), although mentioned as a priority need, does not have financial coverage to any measure.

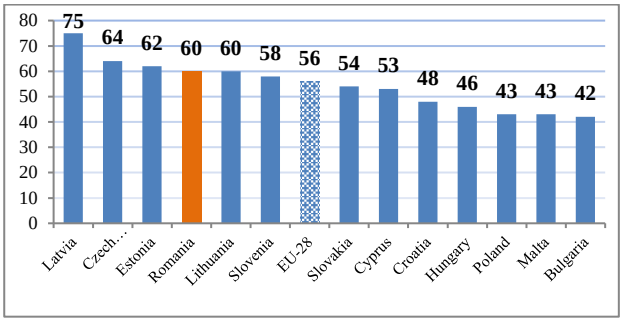

Fig. 6. Absorption rate of rural development fund for 2014-2020 programming period in New Member State and EU average (%, situation at the end of 2019)
Source: EC, 2020 [10].

Regarding the absorption rate of the rural development fund, the situation is much more encouraging in Romania, this being double the absorption rate of the structural and cohesion funds. With an absorption rate of 60% (Figure 6), Romania is above the EU average, being on the 4th place in the top of NMS-13, but far from the first ranked, Latvia, which has an absorption rate of 75%. The consumption in a large proportion of the sums destined for rural development has a maximum importance considering the multiple problems that the inhabitants of the Romanian rural area face.
The question arises: Has Romania learned its lesson? Does Romania manage to absorb the funds made available to it? Because for the period 2021-2027 the amounts expected to be allocated are important (Table 2).

Table 2. European funds allocated to Romania for the period 2021-2027 (EUR million)

Multiannual financial framework 2021-2027, of which:	**51,280.2**
- Cohesion policy	30,305.0
- European Agricultural Guarantee Fund	13,991.9
- European Agricultural Fund for Rural Development	6,983.3
NextGenerationEU	**30,500.0**
Total EU funds	**81,780.2**

Source: Author's development based on EC [11].

CONCLUSIONS

The absorption of rural development funds is an important objective for Romania. It significantly influences the future developments in terms of agricultural and non-agricultural investments, sustainability of rural areas and economic growth.
In Romania, the National Rural Development Program has the highest degree of absorption of all programs (co)financed from European funds. The explanation comes from the fact that most of the beneficiaries are private beneficiaries, and it is verified that the absorption is higher among them compared to the beneficiaries of the public system. On the other hand, there are some measures (called green payments) allocated to farmers which do not require development of projects. All this has led to a better absorption rate of the rural development fund.
Analysing the Romania's needs, objectives and priorities in terms of rural development, presented in the National Rural Development Programs, and the financial allocations materialized through selected measures and sub-measures, several uncorrelations could be identified. For example, the absorption of funds intended for the processing of agricultural products is greatly hampered by the multiple requirements, conditions and of the contribution of unattractive public funds. These issues remained unresolved since the previous year. The consequences are the weak development of food industry and maintaining of a high level of imports of processed agricultural products and, at the same time, the maintaining of a low added value of domestic food production.
Another example of non-correlation can be found in the amounts allocated for non-agricultural activities. There is an increasingly lower allocation for such activities, given that there is an increased demand for such projects. This situation highlights a total neglect of social issue of the rural space which is becoming more and more precarious.
We also find a deficiency of budget allocations in the field of educational infrastructure, with a visible impact now, in the era of the pandemic.
For the financing of knowledge needs, counselling and research, the allocation of only 2% is considered superficial. The modernization of the agricultural education infrastructure (vocational schools, high schools, agricultural universities), although

mentioned as a priority need, does not have financial coverage to any measure. So a greater coherence and clarity is needed between what is strategically stated as objectives and priorities and the content of the funding program.

The analysis shows that the legislation, design of the programmes, bureaucracy, multiple requirements to be met, create constraints in the absorption of rural development funds We conclude that there is a need for reforms in the national institutional framework and structures along with a different philosophy in approaching the Community funding initiatives in rural areas.

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THEORETICAL AND PRACTICAL ASPECTS REGARDING THE AGROMARKETING STRATEGIES (A CASE STUDY AT S.C. AGRICOLA VERŞENI S.R.L., NEAMŢ COUNTY)

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Abstract

Agricultural marketing is aimed at presenting the concept and methodology in this area, issues related to the knowledge of the market and its requirements in the broad field of the circulation of agri-food products. In the context of economy globalization, specific methodological aspects are addressed, which condition the creation and functioning of the agri-food market. Agricultural production has represented an important industry for our country. It can be argued that Romania is a privileged country in this respect, as it has a rich past and various cultural traditions in the production and distribution of agricultural and food products. The foundation and deployment of all the economic activities and processes that make up agribusiness in terms of marketing optics are intended to fully ensure this, as marketing increasingly asserts itself as a science of rationalization and optimization. The used methods of research consisted in processing primary data gathered from the studied unit. Several interviews took place at the unit headquarters in Neamț county. The authors concluded, among other aspects, that A quantitative and qualitative increase of the agricultural plant and animal production is possible only by capitalizing the national productive potential and promoting organic farming systems, stimulating the increase of the performances of agricultural producers and the competitiveness of Romanian agri-food products on the domestic and international market

Key words**:** *evolution, agromarketing strategies, financial optimization*

INTRODUCTION

Agricultural production has represented and continues to represent an important industry for our country [23]. One can argue that Romania has a rich oenological past and very diverse cultural traditions in the production and distribution of agricultural and food products [6].

Romania's status as a country producing and exporting agricultural products is due to several factors. Favourable pedoclimatic conditions (continental climate moderated by certain local factors, Cambrian soils) make it possible to develop excellent crops [8].

The paper on marketing strategies of agri-food production starts from the need to explore this field, which is considered to be a primordial part in the creation of an efficient mechanism and in the achievement of a strategy and a complex of measures [1].

The first part of the paper contains data on agriculture with a special emphasis on the situation of Iasi County by presenting the crop, food and animal production.

The objectives and methodology of agri-food marketing research are aimed at presenting the concept and methodology in this field, issues related to the knowledge of the market and its requirements in the broad field of the circulation of agri-food products [3]. In the context of the globalization of the economy, which addresses specific methodological issues that condition the creation and functioning of the agri-food market, the factors that ensure competitiveness of

production and integration into this type of market, with reference to food security, are highlighted [22], [24].
The second part of the paper presents in detail the own contributions made by S.C. Agricola Verseni S.R.L., both by characterizing the natural framework in which the research was carried out and by the results obtained.

MATERIALS AND METHODS

The necessary studies for the elaboration of this paper have been carried out during the years 2020 – 2021, using as sources of information especially the primary data.
S.C. Agricola Verseni S.R.L. is an agricultural company which cultivates cereals, leguminous crops and oilseeds producing plants. The company also has a distribution department in its structure. The foundation and deployment of all the economic activities and processes that make up agribusiness in terms of marketing optics are intended to fully ensure this, as marketing increasingly asserts itself as a science of rationalization and optimization.
The agricultural sector specific to Iasi County must be in close contact with the downstream entities, providing them with the information they need to ensure the functioning of the market and the traceability of food products [11, 12]. The very development of the economy leads to the creation of more sophisticated and more efficient systems of agricultural marketing [4].
For this study care, a series of interviews were carried out at the headquarters of the agricultural unit studied. The documents of the unit regarding its evolution, the financial accounting documents regarding the evolution of the economic indicators, the evolution of the technical capacity through the investments made and other aspects were analyzed.
On the other hand, data from secondary sources, respectively the specific literature in Romania and abroad was used, including the statistical directories available at national level.
Both the data obtained in the analysis of the documents of the agricultural units as well as those of the specialized literature were processed and interpreted in order to highlight the most relevant aspects.

RESULTS AND DISCUSSIONS

The company where the research was conducted mainly operates in the Commune of Mirosloveşti, Village of Verşeni, where it owns the largest share of agricultural land. The landforms have natural variations and limited external factors, so that temperate-continental temperature oscillations, under the influence of Atlantic and East-European anti-cyclones appear, with mean annual temperatures ranging between 9 to 10 degrees Celsius, with minimum temperatures reaching -27 degrees Celsius in wintertime and maximum temperatures slightly going above 39 degrees Celsius in the summer.
The Moldova floodplain (Lunca Moldovei) has significant reservoirs of groundwater, as well as sand, gravel and blocks, which are of economic importance to the gravel pits in the area. Analyzing the above, we can infer that the general potential of landforms is mostly favourable to agricultural and social-economic activities.
Average annual temperatures fluctuate from year to year, ranging from 9 to 10 degrees. The soil temperature varies according to the chemical characteristics, soil colour, altitude, snow layer, plant vegetation stage, and the orientation and the level of slope development, as well as the degree of soil exploitation as a result of agricultural activities etc. have a contribution here [10].
Annual mean rainfall ranges from 813 mm/sqm to 1,102 mm/sqm, with a multi-annual average of 800 mm/sqm.
Draught is encountered both in the winter season and in the summertime, the annual moisture deficit reaching 175-200 mm, which implies a compensation thereof by installing irrigation systems.
The hydrographic network is rich due to the influence of Moldova River, being represented by surface and groundwater.
The Moldova River is the main hydrographic artery. In the main riverbed of Moldova River, there is a sufficiently rich water table with a significant flow. The aquifer is maintained by

both the river and groundwater. The types of soil of the Verseni Village are divided into several categories, ranging from soils of the soft soil class, but also less developed soils (e.g. alluvial protosoils, as well as marshy soils) [21].

Agricultural marketing is an essential branch of agribusiness. The activities included in agricultural marketing refer to the achievement of certain proportions to ensure the optimal fulfilment of its functions [5]. The marketing plan includes the technical-economic and administrative actions performed on a permanent basis [29]. The forecasts of these activities lead to the setting of agricultural marketing objectives, while establishing, coordinating and undertaking the programs designed to achieve these objectives in relation to the markets. Thus, the agricultural marketing objectives capture the relation between the volume and the structure of sales with the industrial and agricultural production, the relation between the volume and the structure of stocks with the seasonality of the agricultural production included, ensuring an optimum ratio between the sales capacity and the volume of the demand.

With regard to the development of marketing forecasts, it is very important to take into account the factors that directly or indirectly influence the demand and supply of agri-food products. Thus, the marketing program/plan corrects the commercial policies of the agricultural entrepreneur and sets the optimal strategies to be achieved [26]. At the same time, the agricultural marketing plan is an information and decision-making tool, while the practical implementation of the decisions taken is a necessity for marketing control. The plan sets both the long-term objectives (taking into account the current position of enterprise development, with related directions and means of action), as well as short-term goals (product distribution and promotion) [25]. Therefore, the plan needs to be adjusted on a market-by-market basis and must follow trends and at the same time act as a means of further verifying the plan's provisions, providing the necessary information for future planning. Programming in agricultural marketing requires first and foremost technical and practical studies that determine the possible and necessary directions of the evolution of demand for agri-food products. Generally, agribusiness comprises a variety of the most complex activities, which ensure the conduction of agricultural manifestations of producers, distributors and buyers, such as: the collection, processing, distribution and marketing of agricultural products. Given the current economic framework, these activities involve national companies with Romanian capital and international companies with foreign capital, either small or large, helping to perpetuate agricultural marketing programs and distribute agricultural products in different quantities, prices and qualities. In order for the agricultural marketing process to be sustainable in time and maintain functional standards, it is imperative that producers know the needs of consumers and thus broadly anticipate both the quantity and the quality required, which is frequently encountered in economically developed countries, where the focus has been on agricultural, industrial and other key industries.

Bernard Yon, in his paper "Le marketing agro-alimentaire", claims that there are several processing phases that the agricultural product must go through to become food, four of which are essential: physical transformation; dimensional transformation; time transformation; space transformation.

Applying high efficiency marketing to a company's business is limited by a number of factors, so that the physical distribution infrastructure of the goods is not adequately adapted to the needs for the following reasons:

•It is not possible to carry out transports with minimal time and maximum efficiency, with much lower costs, because the communication routes (road and rail) are technically and administratively deficient;

•Halls where the products are to be stored, conditioned and packaged are small and inadequately equipped and adapted to the new loading requirements given the significant gauge of the new machinery;

•The fleet of road transport means of agricultural and food products faces in time a physical wear and tear, with a minimum degree of specialization of the staff working in the field.
•Product channels often record unrealistic contracts due to weak negotiators, in relation to the position of processors and integrators on the market;
•Specialized markets are organized in a manner which is inconsistent with the agricultural realities in Romania and the legislative area addressed to these activities is often limited and insufficient by the imposed administrative regulations and rules;
•Information on agricultural marketing of products is briefly given by providers in the field and is most often insufficient or inappropriate for the region concerned [9].
As a whole, agricultural marketing applied both at macro and micro levels is analysed from several perspectives, the main ones being:
•of the farmer (the one actually carrying out the production process);
•of the processor (the one bringing product to a stage compliant with the demanding requirements of the consumer market);
•of the intermediary (the one ensuring connection between the chain links for the product to reach the final consumer);
•of the consumer (the one freely disposing of the product)
In view of the above, we can assume that the functions of agricultural marketing within the society can be classified into:
a) Exchange functions (buy-sell)
b) Physical functions (storage, transport, processing)
c)Facilitating functions (standardization, financing, risk taking and bearing, marketing studies)
The main objectives of the agri-food marketing agencies that the company seeks on a permanent basis are:
•Permanent organization of both the manager and the agronomist engineer;
•Establishing the actual prices of the controlled products in agreement with the company's management body;
•Creating a fair competitive framework, helping us to adjust to market requirements;
•Marketing activity has been regulated through training programs;
•The ability of intermediaries to monopolise the sale of products and manipulate the profits of agricultural producers and processors has been reduced, so we have made the decision to purchase two trucks;
•Creating the conditions for increasing the degree of concentration of agricultural production;
•Supervising compliance with the marketing practices and procedures we have established;
•Providing services such as: risk management, providing marketing information, conducting market studies, etc.;
•Conducting purchase, conditioning, storage and resale of surplus production for controlled products, etc.
•Making more favourable crediting arrangements for agricultural production and other activities in the agricultural marketing system;
The company managed to start making business by cultivating straw cereals, corn, sunflower and rapeseed from a few hectares of arable land at its establishment in 2014, significantly increasing cultivated areas (by lease, concession, and purchase), in 2014-2015: 118 ha, in 2015-2016: 288 ha.
The company also seeks to apply strategies for pricing, distribution and promotion specific to agri-food products and actions directed to the integration of marketing policies and strategies into the company's mission and overall objectives. Following these objectives, through a careful monitoring of environmental quality, we use minimal invasive methods to preserve a competitive soil, quality fertilizers, but also composts, so as not to affect soil quality over time, and low-pollutant modern machines, but also agricultural aggregates that have the role of maintaining and improving the soil structure.
The agribusiness developed by the company duly combines product policy and distribution policy to an appropriate extent for the purposes set, facilitation of the works done and agricultural market requirements.

Once the company determined the markets it wanted to enter, it carefully studied the access conditions, and had to define its "product strategy" that it will adopt and adapt according to the new markets: what products and quantity of products will it export and under what seal, what changes will it bring to its existing products. Achieving a product suitable for foreign markets requires involving all members of the undertaking, respecting the safety, storage quality and transport criteria [14].

In general, international product policy refers to all the decisions of a classical product policy by adding some improvements that actually seem to be restrictions related to the approach of foreign markets. These restrictions can be categorized into two categories:

(1) Domestic restrictions:

•Financial: are there sufficient resources to meet the marketing budgets necessary to develop the competitive position in foreign markets?

•Production: is the production capacity necessary to increase production volume and diversify the range of products? Are manufactured products complying with international standards? Does the undertaking have the ability to transfer the necessary equipment? etc.

•Logistics, relating to logistic flow multiplication, inventory and shipment management.

(2) International restrictions:

•Relating to the socio-cultural, political and economic particularities of each country;

•Relating to the evolution of the manufacturing technologies of the products;

•Relating to the nature of products: adaptation or standardization of products traded on foreign markets?

•Relating to the ability of an enterprise to define the nature and extent of its product range with regard to its competitors on each market.

There are many reasons that urge us to get out of the domestic market and sell across borders. Saturation

The fact that the domestic market is saturated with a product is the most common reason to focus our marketing efforts abroad. Although saturation at an absolute level is rare, it is sometimes easier to penetrate foreign markets than a new internal market, especially if it is a country like ours, with an increasingly efficient agriculture and very well developed economically speaking.

Exchange rate

The value of national currencies may vary quite a lot, often with damaging effects on the company's estimated profit, as the company makes a profit forecast based on preliminary contracts concluded with foreign companies and finds with a heavy heart that it was affected by the exchange rate. The effect is even worse since the company bought foreign material for production in 2015, such as chemical fertilizers for agricultural crops.

Expensive products are the most affected, although consumer goods can sometimes be affected as well. Unless customs authorities intervene, our products normally destined for the domestic market are also exported abroad. Given that domestic consumption stays still, prices will rise internally due to the drop in supply. S.C. Agricola Verseni S.R.L. Company achieves positive effects on both markets, both domestic and international. Goods such as beef meat and coffee are often subject to sudden increases in demand abroad, but our grain and oil oilseed plants are also highly demand on the market.

Brand value and selection

Some companies have created an international brand name that is recognized virtually anywhere in the world. Such relatively famous names are often part of the market language before even their products come out of the halls, cross the borders and reach the end consumers. However, most companies do not have such a reputation behind them before entering a new market and must practically start from scratch, as was the case with S.C. Agricola Verseni S.R.L. company, which is a small, new agricultural holding with a fairly limited market opening. This situation has both negative and positive aspects.

If we refer to the positive side, the target market had no preconceived idea about what the company stands for. For example, not only do large holdings bear the burden of the

quality level of their products, but they are often seen as representatives and promoters of dominating foreign cultures, which reviles the image of those companies. It is not unusual for a project to stumble upon local protests, even if a known company is only involved as a small investor or supplier for that project.

Besides the question of notoriety, there is also the question of wealth. New markets suppose that rich corporations will throw money away (legally and illegally), and local partners may be indignant to find the tight financial control that is an intrinsic part of their business both locally, nationally and internationally. The price strategy is part of the market-based agricultural marketing strategy, being part of the company's long-term strategy and then detailed through short-term strategies that are reflected in pricing tactics.

A. Pricing strategies

To discover and understand pricing strategies which the undertaking under review uses, we will make a classification based on some criteria, which, at management level, we consider to be essential.

1. Pricing strategies correlated with costs are made based on:

- a. Average unit cost, b. Marginal cost, c. Profitability threshold, d. Return on investment.

These strategies require the calculation of production costs to which a profit is added, thus identifying the minimum price, i.e. the lowest acceptable level, which the enterprise requires, in order to meet the profit objective.

2. Pricing strategies correlated with demand are based on the knowledge not only of production costs, but also of the following aspects: a. Elasticity of demand in relation to price; b. Consumer behaviour; c. Psychological (accessibility) price; d. Price correlated with the life cycle of the product.

These strategies are often used when the price displayed is the key factor in the customer's decision. For this purpose, the price ceiling is identified, which is the maximum level the buyer can offer and which normally depends on the elasticity of demand.

3.Pricing strategies correlated with competition involve making prices depending on competitors' prices, taking into account a number of factors such as loyalty, quality, image, etc. This category of strategies includes: a. High pricing strategy, b. Penetration pricing strategy.

4. The combined strategy, which takes into account the three previous strategies, adapting to market conditions.

B. The position of the product requires the use of: (Ph., Kotler, op. cit., p. 773-791) [16]

1. Pricing strategies for new products, that address two situations:

2. Pricing strategies for a set of products, that aim to maximize profits not for a product but for a set of products

3. Price adjustment strategies, aimed at reflecting the differences between consumers and changing market situations.

The most common ones are: a. Granting bonus rebates; b. Differentiated pricing strategy; c. Psychological pricing strategy; d. Promotional pricing strategy; e. value-oriented pricing strategy; f. Pricing strategy based on geographic criteria; g. International pricing strategy.

C. The length of use of the strategy has led to delimiting:

I. Long-term strategies, materialized in: 1. Stratification pricing strategy; 2. Penetration pricing strategy; 3. Peak pricing strategy; 4. Product line pricing strategy, 5. Discriminatory pricing strategy; 6. Final pricing strategy, 7. Odd pricing strategy.

II. Short-term strategies, materialized in tactics focused on:

1. Receipts, 2. Volume 3. Competition, 4. Consideration-oriented tactics

4. Choosing the right strategy is the task of the manager responsible for determining and tracking the use of the price as a tool to achieve the fundamental goal of obtaining the highest profit. The company's manager, Bogza Oana-Elena, together with the agronomist engineer Isachi Andrei studied the market and the statistics provided by suppliers and subsequently used a range of methods available to establish fair prices that take into account the needs of the company, the customer and external factors, including the competition and the absolutely natural phenomena that influence the evolution of crops. The most valued methods, which are

commonly implemented, are: cost of production plus the mark-up, target price, minimum price, critical point, local market penetration, psychological method, price line method, competition, etc.

Price policies were not completed with price fixing based on the adopted strategy, because, by itself, the price is dynamic and fluid, and the business environment, generally the agricultural market, is constantly changing. As a result, for the price, as an element of the agricultural marketing mix, to be able to meet its established objectives, it has been constantly changed to match the other components of the marketing mix [7]. On the market, during this period, the partners finally reached a mutual acceptance, mainly using, especially on the organizational market, types of prices such as administered, auctioned, negotiated, transfer. For these reasons, S.C. Agricola Verseni S.R.L. Company initially adopted the market penetration strategy in 2014 and at the end of 2016 it managed to adjust its pricing strategies depending on competition and demand. In conclusion, pricing tactics that permanently involved the implementation of specific marketing strategies have been constantly altered so as not to lose too much on the financial side, but also in terms of the interest and the trust of clients, one the objectives were achieved and new ones were established.

The distribution strategy is an important basis for a company's agricultural marketing plan.

Distribution policies and strategies were aimed explicitly at ensuring customers' loyalty [2].

The tools for implementing the distribution strategies used relate to the following:

• Distribution channels • Distribution network • Assortment of goods • Storage • Transport • Inventory management etc.

Some of the manufacturer's targets for the products offered for sale have been:

•They must reach the consumer in a fresh state and in short times

•Delivery time limits and quality assurance were set

•In order to prevent customers' availability requirements, the most efficient fractioning and assortment must be ensured.

However, there are some strategic alternatives used permanently for distribution policy:

•Distribution through own means;

•Distribution through own means and intermediaries;

•Distribution through intermediaries.

For each of the above-mentioned variants, S.C. Agricola Verseni S.R.L. calculates the price obtained by the producer, the expenses incurred by the latter and the expected sales (Table 1).

Table 1. Distribution variants and sales trends

Variants of distribution	The price obtained by the producer	The expenses incurred by the producer		Expected sales
		With distribution	With promotion	
Own appliance	Increases	Increases	Decreases	Increases
Own appliance and intermediaries	Decreases	Decreases	Increases	Decreases
Intermediaries	Decreases	Decreases	Increases	Decreases

Source: own research, [28].

Taking into account the price variation according to the mode of distribution of agricultural products, S.C. Agricola Verseni S.R.L. Company decided to increase its profits by acquiring two trucks, both financially and in terms of leading times [28]. The Company made the purchase because with own means of transport you no longer have to look for distributors and wait for their availability. Now the company has its own distribution channel, thus making an economic plus and ensuring the timely delivery of its products, without compromising on quality.

The company wants its products to come as close as possible to potential customers, and

for this reason, it implemented a series of tactics to streamline the promotion of the products in its portfolio. It chose several methods, taking into account various ideas learned on the market, such as: contrary to common beliefs, a high-quality product does not sell itself.

Although quality should speak for the product and not the advertisement, there is still the need to promote products in different forms and in different environments, otherwise the customer does not get to know and be interested in that product.

An essential part of a promoting/marketing strategy is communicating the utility and benefits of a product. There are several methods and channels for promoting agricultural products and services by choosing own combination, depending on the target segments, the specificity of the offered products/activity.

Advertisements: mass media, street posters and among local officials, advertisements placed on the main roads, near Hanul Ancuței, a renowned inn, where the undertaking has land leased.

The invasive and aggressive method, especially in its traditional forms, classic advertising tends to lose ground in favour of new means of promotion. This loss is caused even by the enormous amount far beyond what we can capture - advertising information. TV commercial also has the disadvantage of high costs. Advertisements in TV, printed magazines/newspapers are especially suited to agricultural companies because they reach the target audience, landowners and those interested in agricultural products that are quite anchored in this type of traditionalist advertising that S.C. Agricola Verseni S.R.L. used it in agricultural campaigns.

Internet advertising has more advantages in the case of a marketing strategy, but it has been used only sequentially, in the short run, as the company has no official website, just by using small ads on specialised sites. We intend to have a website made, both in Romanian and English, to make our products known and to make it easier to be noticed because this promotion method suggests:

- The possibility of optimal targeting, meaning a high impact on the number of visitors;
- Low, almost insignificant cost;
- It may be easier to provide interested people with detailed, specialist information, which is why it is well suited for legal customers;
- Practically unlimited flexibility in terms of approach.

This type of promotion is appropriate for higher value agricultural products and services intended for all customers, in general, to those who are open to new, but especially to other large companies operating as suppliers or potential partners and buyers [20].

For advertising purposes, S.C. Agricola Verseni S.R.L., as a young undertaking, established an advertising budget of 2,000 lei, broken down as presented in Table 2.

Table 2. The structure of the promotional budget allocated by S.C. Agricola Verseni S.R.L. in 2016

The means of mass communication	Duration / size	Audience (nr. of people)	Frequency	Monthly cost (lei)
TV	10 s	1,750	8 times / week	900
Newspapers	¼ page	350	1 time / 2 weeks	350
Internet	¼ web page	3,250	At each access	750
Total		5,350		2,000

Source: own research, [28].

Technical factors play an important role in increasing production by means of mechanization, chemistry, irrigation, etc., while the influence of the socio-economic factors is manifested through the capacity and level of training of the labour force and the entire economic context in which this branch of economy is developing. Like any economic

activity, the agricultural activity has the purpose of satisfying the human needs and the general progress of the country [27].

The development of agriculture is influenced in a large percentage by natural, technical and socio-economic factors.

In order to maintain and perpetuate the soil quality used for crops, we have adopted the following ecological and technical standards regarding the quality of work. The procedures used refer to the following:

- The company may not cultivate twice in a row sunflower or sugar beet on the same soil;
- The burning of stubble fields, land of any kind for cleaning and fertilization purposes was done only when absolutely necessary and with approval from the competent authorities in the territory where such cleaning and care activities took place;
- Earth moving or minimal soil coverage to prevent erosion;
- Avoiding damage to habitats by observing the minimum densities of livestock and appropriate regimes;
- Maintaining landscapes;
- Protecting and maintaining stubble fields;
-Avoiding the growing of undesirable vegetation on agricultural land, for which we used various chemical fertilizers and minimally invasive agricultural practices.

CONCLUSIONS

As far as the crop production in Iasi County is concerned, the highest share belongs to field crops. The fact is explicable because arable land is 67.9%, vineyards are 3.8% and fruit trees 2.5% of the agricultural area.

In terms of economic activity in the agricultural field, the plant production has a relatively high importance in relation to the regional and national production. Iasi County's fauna is closely related to the specifics of the plant cover, and there are species living in the deciduous forests, forest steppe, floodplains, river and lake waters [15].

A quantitative and qualitative increase of the agricultural plant and animal production is possible only by capitalizing the national productive potential and promoting organic farming systems, stimulating the increase of the performances of agricultural producers and the competitiveness of Romanian agri-food products on the domestic and international market [13].

The agricultural sector in Romania, including the one specific to Iasi County, must be in close contact with the downstream entities, providing them with the information they need to ensure the functioning of the market and the traceability of food products.

Food quality and safety must be obtained and monitored through Production Quality Management Systems and by methods that ensure systematic treatment of potential hazards and provide information to identify the undertaking, production team, date of manufacture, batch, quantity, type and quality of the products [16, 19].

In order to understand market phenomena, we need to know the correlations and mutual influences of factors that condition a phenomenon. This is possible only by using abstractions, first of all referring to the study of the influences of a single adopted measure, and considering the other factors as being constant, after which other previously ignored factors are successively introduced, which makes it possible to finally know the forces of economic life often interfering with supply and demand tendencies on the market [17].

Marketing studies and research are considered investigations based on analyses and forecasts meant to determine the potential market and its evolution, the characteristics of the existing market and the sales mechanism, etc., for which combinations of different methods and processes are used, mainly statistical and mathematical ones [18].

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GIG ECONOMY, ALTERNATIVE FORMS OF WORK IN RURAL AREAS, IN THE CURRENT ECONOMIC AND SOCIAL CONTEXT

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Abstract

In the current economic and social context, dominated by the influences of the rapid development of technology and communications, the labour market is undergoing structural changes, job demand and supply are reshaping, labour arrangements are resizing in form and volume. Another factor that significantly affects the structure and dynamics of the labour market is the current health crisis. The negative impact on the various economic sectors affected by the crisis implicitly entails changes in the balance between job demand and supply, as well as the reassessment and decision to choose effective work arrangements. GIG economy, representing all atypical forms of work, presents an increasingly complicated and difficult to predict dynamics, as a result of the economic and social impact of current factors of influence. The purpose of the article is to analyze and predict the dynamics of different forms of work in the Romanian rural areas, starting with the forms of full time, permanent contracts to contingent forms of work. The analysis method used in this paper is the quantitative one. From the analysis performed, it can be deduced observations and results that define the general framework of all forms of work in Romanian rural environment and the dynamic tendencies of the different forms of work commitment during the analyzed period. Full time contracts, regardless of how they are registered, as a determined or indefinite period, have the largest share of the total number registered at national level in rural areas. On the other side, part-time contracts register different dynamic trends, in the sense that the permanent ones have an ascending trend, and the contingent forms register a sudden collapse in the period 2017-2018, by approximately 400% compared to previous years. Part time permanent jobs increase with 67.43% in 2020 compared to 2010.

Key words**:** *GIG economy, permanent work, full-time, part-time, temporary work, rural statistics, Romania*

INTRODUCTION

All forms of temporary work below and define GIG economy. In the last decade, the GIG phenomenon has grown, the contingent work model being more and more considered and applied [1]. People are moving towards contingent work patterns, either for reasons of financial independence or for rounding incomes, autonomy and efficiency in general [7]. From the category of exogenous determinants on the GIG labour market, we must mention the speed of development of communication and technologies, with immediate effect in removing these types of barriers for online access, in the search and contracting process. At the same time, the great online work platforms have been developed, the job offer belonging to different economic sectors moving mainly in the online environment. The fast connection and easy access model to an important supply volume continues to influence the movements on the labour market, as volume and as different types of contracting (permanent or temporary contracts, project type, full time or part. time). Working in rural areas has different characteristics and dynamics than in urban one. The indicators of influence on the rural work dynamics depend on the infrastructure of transport level, the entrepreneurship volume and dynamics, the number of companies operating in this environment, the level of education of the working population, income or poverty degree, social benefits volume in rural environment, the results of the

implementation of European and national economic development policies in rural areas etc. We also must consider the classification of rural areas, because each type has different characteristics and impacts on different work patterns [4]. Therefore, they are: rural areas on the outskirts of cities, characterized by longer distance to work, mostly in urban areas; rural agricultural areas, with seasonal and temporary traits of forms of work [3], seasonal areas with predominant activity in tourism and services; rural areas derived from former production or extraction activities, where the number of jobs is very limited. And last but not least, the health crisis started in 2020, has as impact the resizing of the functional companies' volume in the rural area and implicitly of the immediate changes of the labour supply, with effects on the employment rate [5]. In this context, the purpose of the analysis is to highlight the dynamics of the mentioned categories of indicators, for the reference period, to understand better how the GIG phenomenon evolves.

MATERIALS AND METHODS

This analysis approach of rural areas forms of work is based on the quantitative method; data being provided by National Institute of Statistics (INSSE). Analysis data include: number of employees with different work commitments, classification by type of gender, level of education or different weekly working hours. The evolution of the different forms of work for the period 2010 - 2020 is calculated, respectively the forms of permanent and contingent work contracts. The availed statistical data referring to 2020 represent an average of the values of the first and the second quarters related to this year, during the analysis there were no significant value differences compared to the other years of the analyzed period, which would influence the results of the study.

RESULTS AND DISCUSSIONS

Permanent forms of work

The permanent forms of work represent the most common way of contracting between employer and employee and regardless of the environment in which they are registered (national, urban, rural areas), considering also the Romanian state of economic stability in the last decade and the influencing factors on the Romanian labour market dynamics, the number of permanent contracts is increasing constantly.

At national level, as can be seen from the data included in Table 1, the number of permanent employment contracts decreased in 2020 by about 90,000 compared to the previous year, as an immediate result of the impact of the pandemic crisis on economic activity. However, even under the pandemic effect, in rural areas the number of permanent employment contracts increased in 2020 compared to 2019, with 3,438. At the same time, it should be mentioned that the share of permanent full-time contracts in rural areas in the national total is between 25.82% in 2010 and 32.19% in 2020.

In the following, the analysis is performed in terms of the number of worked hours per week and are highlighted both the share of different categories in the total number of permanent employment number in rural areas and the way they evolved in the reference period 2010 – 2020.

Statistical data and the dynamics of each type of contract can be shown in Table 2 and graphically represented in the Figure 1. The highest share in total number has the category of permanent contracts with 40 hours per week - full time contracts (with values between 75.69% for 2010 and 80.58% for 2020, with an upward trend throughout the analyzed period and insignificant decrease at the level of 2020, of 5.16% compared to 2019), followed by those with the number of hours worked higher than 46 (the values vary between 18.41% of the total for 2010 and 7.82% at the level of 2020 , the trend being significantly decreasing throughout the analysis period), the lowest weights being those of permanent contracts of 1-35 hours (from 1.89% in 2010, to 2.21% registered in 2020 and a constant trend of evolution) and 36-39 (0.08% in 2010 and 0.15% registered in 2020) and 41-45 (from 1.71% for 2010 to

0.72% registered in 2020) of hours worked weekly.

If we consider that a full-time contract has 40 hours worked weekly, from the current data in Table 2 we can see that the first category highlighted, with 1-35 hours worked weekly, represent a significant part of the partial work form category and also, we can say that the volume of this form of work increases with 67.43% in 2020 compared to 2010.

Table 1. Permanent forms of work in rural areas

Permanent forms of work	Period										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total national	5,589,982	5,615,359	5,645,702	5,661,074	5,762,816	5,977,359	6,114,668	6,313,216	6,425,327	6,484,865	6,398,010
Rural	1,443,213	1,432,928	1,463,649	1,493,160	1,512,534	1,731,107	1,831,774	1,955,116	2,019,322	2,056,278	2,059,716
rural dynamic	:	-0.71%	2.14%	2.02%	1.30%	14.45%	5.82%	6.73%	3.28%	1.83%	0.17%
% from total national	25,82%	25.52%	25.93%	26.38%	26.25%	28.96%	29.96%	30.97%	31.43%	31.71%	32.19%

Source: author`s calculation, based on NIS data [8].

Table 2. Employees with a permanent work schedule according to the usual working hours of the working week

Effective duration of the working week (unit: no. of persons)	Period										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	1,443,213	1,432,928	1,463,649	1,493,160	1,512,534	1,731,107	1,831,774	1,955,116	2,019,322	2,056,278	2,059,716
1 - 35 hours	27,216	25,050	32,204	29,704	25,831	36,035	34,244	43,196	41,849	41,291	45,568
% total	1.89%	1.75%	2.20%	1.99%	1.71%	2.08%	1.87%	2.21%	2.07%	2.01%	2.21%
1 - 35 hours, dynamics		-7.96%	28.56%	-7.76%	-13.04%	39.50%	-4.97%	26.14%	-3.12%	-1.33%	10.36%
36 - 39 hours	1,118	691	865	357	770	1,746	1,993	1,712	1,292	2,899	3,185
% total	0.08%	0.05%	0.06%	0.02%	0.05%	0.10%	0.11%	0.09%	0.06%	0.14%	0.15%
36 - 39 hours, dynamics		-38.19%	25.18%	-58.73%	115.69%	126.75%	14.15%	-14.10%	-24.53%	124.38%	9.85%
40 hours	1,092,345	1,104,429	1,121,001	1,165,408	1,225,111	1,461,032	1,563,052	1,691,178	1,750,289	1,747,311	1,659,633
% total	75.69%	77.07%	76.59%	78.05%	81.00%	84.40%	85.33%	86.50%	86.68%	84.97%	80.58%
40 hours dynamics		1.11%	1.50%	3.96%	5.12%	19.26%	6.98%	8.20%	3.50%	-0.17%	-5.02%
41 - 45 hours	24,679	21,820	17,384	24,429	25,402	16,239	14,117	15,230	19,705	24,004	14,831
% total	1.71%	1.52%	1.19%	1.64%	1.68%	0.94%	0.77%	0.78%	0.98%	1.17%	0.72%
41 - 45 hours dynamics		-11.58%	-20.33%	40.53%	3.98%	-36.07%	-13.07%	7.88%	29.38%	21.82%	-38.22%
46 hours and over	265,712	252,966	259,482	241,296	200,811	182,472	187,996	173,066	170,711	206,895	160,974
% total	18.41%	17.65%	17.73%	16.16%	13.28%	10.54%	10.26%	8.85%	8.45%	10.06%	7.82%
46 hours and over dynamics		-4.80%	2.58%	-7.01%	-16.78%	-9.13%	3.03%	-7.94%	-1.36%	21.20%	-22.20%

Source: author`s calculation, based on NIS data [8].

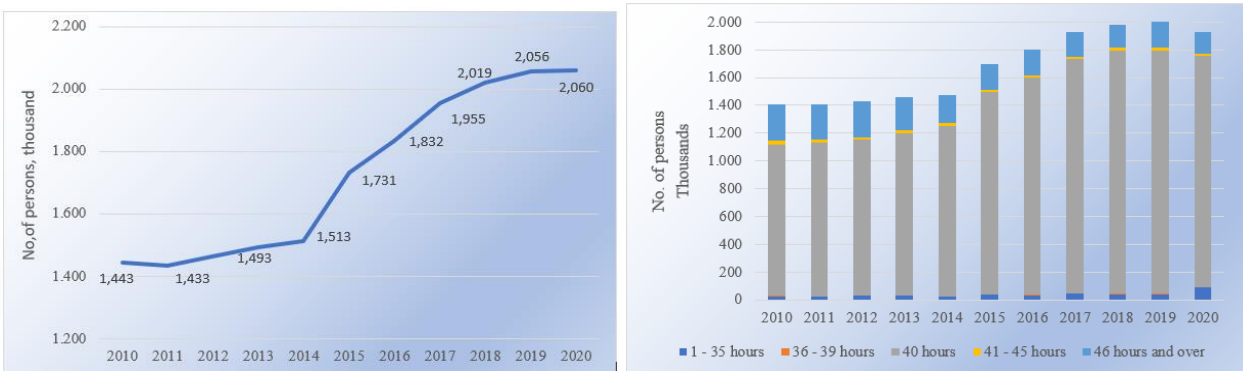

Fig. 1. Dynamics (a) and comparison in total indicator value (b) of employees with a permanent work schedule, according to the usual weekly working hours
Source: author`s calculation, based on NIS data [8].

GIG forms of work – employees with temporary work regime

Regardless of the complete or partial form of work, temporary contracts are part of the GIG work category, along with the project-type contracting forms, for example. Their evolution and characteristics over time describe and define the GIG economy, a phenomenon triggered in the last years and which has an evolution worth following and analyzing. Temporary contracts or project-type forms of work are beginning to increase in volume, both globally and nationally. The reasons why the dynamics of this phenomenon are changing are first related to technological and communication changes in recent years, by facilitating access to the global job offer or individual reasons leading to a decision in this regard.

The general characteristics of the temporary work model are primarily related to the precariousness status and the level of remuneration lower than the permanent type of work. At the same time, it can be attributed flexibility traits or it can be considered a first starting point in the career, in finding a permanent job for example, much more satisfying for other reasons.

Statistical data regarding the number of contingent labour contacts in the Romanian rural area, by gender categories and working hours worked weekly are included in Table 3 and the share of each category in the total GIG forms of work commitments in rural areas is represented graphically in Figure 2.

Therefore, there is a significant share of temporary employment contracts full time, with values between 58.51% in 2010, 54.87% in 2020, followed by temporary forms of contract with a number of hours over 40, with values between 26.94% for 2010 and 33.00% for 2020. The lowest share in the total number of contingent forms of work is represented by those with a number of hours worked per week less than 40 for hours, meaning the part-time contracts, on a temporary basis. The fact that they have a low share in the total parameter can be considered a positive thing, meaning that there is a significant stability of the balance between supply and demand on the labour market.

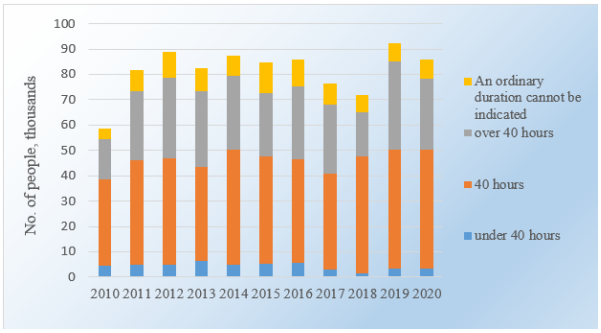

Fig. 2. Comparison of permanent forms of work, weekly worked hours, from total indicator value
Source: author`s calculation, based on NIS data [8].

By categories like the number of hours weekly worked or gender, in Table 4 the component values are presented in the total number of contingent contracts. It can be observed a higher share of men in employment type with 40 hours weekly duration (between 62.51% in 2010 and 72.38% in 2020) and over 40 hours (64.18% registered in 2010 and 80.66% in 2020) and a higher share of women in the category of

temporary jobs with less than 40 hours worked weekly (63.05% in 2010 and 82.47% for 2020), meaning, the part time contracts.

Table 3. Temporary employees in rural areas by weekly working hours and by gender

Temporary employees by usual duration of the working week (unit: no. of people)	Gender	Period										
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	Total	58,625	81,876	88,790	82,419	87,440	84,885	85,971	76,516	71,859	92,380	85,669
	male	36,065	51,733	60,348	53,789	57,314	55,442	59,697	50,848	45,546	63,417	63,120
	female	22,560	30,143	28,442	28,630	30,126	29,443	26,274	25,668	26,312	28,963	22,549
under 40 hours	Total	4,401	4,804	4,693	6,330	5,067	5,187	5,815	2,936	1,432	3,328	3,188
% from total		7.51%	5.87%	5.29%	7.68%	5.79%	6.11%	6.76%	3.84%	1.99%	3.60%	3.72%
dynamics			9.16%	-2.31%	34.88%	-19.95%	2.37%	12.11%	-49.51%	-51.23%	132.40 %	-4.21%
-	male	1,627	1,455	3,039	3,038	1,995	1,857	1,966	2,003	1,077	1,663	559
-	female	2,775	3,349	1,655	3,292	3,072	3,330	3,849	932	356	1,666	2,629
40 hours		34,300	41,483	42,354	37,145	45,114	42,617	40,597	37,927	46,120	46,814	47,010
% from total	Total	58.51%	50.67%	47.70%	45.07%	51.59%	50.21%	47.22%	49.57%	64.18%	50.68%	54.87%
dynamics			20.94%	2.10%	-12.30%	21.45%	-5.53%	-4.74%	-6.58%	21.60%	1.50%	0.42%
-	male	21,442	24,130	25,473	22,763	28,205	27,123	27,985	22,917	28,225	29,947	34,027
-	female	12,858	17,353	16,881	14,383	16,909	15,494	12,612	15,010	17,895	16,867	12,983
over 40 hours		15,792	27,035	31,456	29,969	29,060	24,795	28,960	27,207	17,603	34,843	28,275
% from total	Total	26.94%	33.02%	35.43%	36.36%	33.23%	29.21%	33.69%	35.56%	24.50%	37.72%	33.00%
dynamics			71.19%	16.35%	-4.73%	-3.03%	-14.68%	16.80%	-6.05%	-35.30%	97.94%	-18.85%
-	male	10,136	19,562	22,598	21,446	20,842	17,525	21,549	19,974	10,877	26,663	22,806
-	female	5,656	7,473	8,858	8,523	8,218	7,270	7,411	7,232	6,725	8,180	5,469
An ordinary duration cannot be indicated	Total	4,131	8,553	10,286	8,975	8,200	12,285	10,600	8,447	6,703	7,396	7,197
male		2,860	6,586	9,238	6,543	6,272	8,937	8,198	5,953	5,367	5,144	5,729
female		1,271	1,968	1,048	2,432	1,927	3,349	2,402	2,494	1,336	2,251	1,468

Source: author`s calculation, based on NIS data [8].

Table 4. Share of permanent forms of work by gender

Share of permanent forms of work, by gender		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
male	% under 40 hours	36.97%	30.29%	64.76%	47.99%	39.37%	35.80%	33.81%	68.22%	75.21%	49.97%	17.52%
	% 40 hours	62.51%	58.17%	60.14%	61.28%	62.52%	63.64%	68.93%	60.42%	61.20%	63.97%	72.38%
	% over 40 hours	64.18%	72.36%	71.84%	71.56%	71.72%	70.68%	74.41%	73.41%	61.79%	76.52%	80.66%
female	% under 40 hours	63.05%	69.71%	35.27%	52.01%	60.63%	64.20%	66.19%	31.74%	24.86%	50.06%	82.47%
	% 40 hours	37.49%	41.83%	39.86%	38.72%	37.48%	36.36%	31.07%	39.58%	38.80%	36.03%	27.62%
	% over 40 hours	35.82%	27.64%	28.16%	28.44%	28.28%	29.32%	25.59%	26.58%	38.20%	23.48%	19.34%

Source: author`s calculation, based on NIS data [8].

People with a second job in rural areas

The increasing dynamics of temporary jobs (2020 compared to 2010, in Figure 4) derives generally from the volatility of jobs, the insecurity of the existing and forecast supply volume in the labour market. For the same reason, the need for a second job is created, precisely to alleviate the financial pressure on the individual or the household [10]. Regarding the number of people who have a second job, we considered it necessary to emphasize their classification according to the level of education, in order to better understand their share in the total number analyzed and to draw conclusions in this regard. As can be seen, according to the statistical data in Table 5, the highest share of the total indicates the category of qualified persons in vocational or apprenticeship schools (with values between 42% in 2010 and 32.36% registered in 2020, with a slightly decreasing trend throughout the period of reference).

Table 5. People who have a secondary activity, by level of education, in rural areas

People with a second job, in rural areas, by level of education	Period										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	212,023	187,473	180,534	155,674	146,561	112,951	105,371	111,786	114,463	121,725	104,826
University	:	14,954	14,436	13,695	13,436	10,928	9,968	9,991	9,031	8,243	8,436
% from total	:	7.98%	8.00%	8.80%	9.17%	9.67%	9.46%	8.94%	7.89%	6.77%	8.05%
dynamics	:	:	-3.46%	-5.13%	-1.89%	-18.67%	-8.78%	0.23%	-9.61%	-8.73%	2.34%
Postgraduate specialized or technical foreman	5,546	7,550	7,416	5,562	3,265	3,249	3,239	3,046	2,938	2,285	880
% from total	2.62%	4.03%	4.11%	3.57%	2.23%	2.88%	3.07%	2.72%	2.57%	1.88%	0.84%
dynamics		36.13%	-1.77%	-25.00%	-41.30%	-0.49%	-0.31%	-5.96%	-3.55%	-22.23%	-61.49%
High school	58,990	47,482	55,047	55,391	55,550	43,816	42,831	48,014	50,179	54,174	47,601
% from total	27.82%	25.33%	30.49%	35.58%	37.90%	38.79%	40.65%	42.95%	43.84%	44.51%	45.41%
dynamics	:	19.51%	-15.93%	-0.62%	-0.29%	21.12%	2.25%	-12.10%	-4.51%	-7.96%	12.13%
Professional, complementary or apprentice	89,624	75,535	68,125	55,204	47,152	34,446	32,332	31,950	33,567	40,305	33,922
% from total	42.27%	40.29%	37.74%	35.46%	32.17%	30.50%	30.68%	28.58%	29.33%	33.11%	32.36%
dynamics		-15.72%	-9.81%	-18.97%	-14.59%	-26.95%	-6.14%	-1.18%	5.06%	20.07%	-15.84%
Gymnasium	30,727	27,452	25,128	19,198	26,601	19,086	16,219	16,964	17,232	15,453	12,588
% from total	14.49%	14.64%	13.92%	12.33%	18.15%	16.90%	15.39%	15.18%	15.05%	12.70%	12.01%
dynamics		-10.66%	-8.47%	-23.60%	38.56%	-28.25%	-15.02%	4.59%	1.58%	-10.32%	-18.54%
Primary (grades 1 - 4)	3,748	1,403	2,433	1,856	557	1,262	558	1,600	1,516	1,264	1,400
% from total	1.77%	0.75%	1.35%	1.19%	0.38%	1.12%	0.53%	1.43%	1.32%	1.04%	1.34%
dynamics	:	-62.57%	73.41%	-23.72%	-69.99%	126.57%	-55.78%	186.74%	-5.25%	-16.62%	10.76%

Source: author`s calculation, based on NIS data [8].

Table 6. People who have a second job in rural areas

People who have a second job	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
total	1,501,838	1,514,804	1,552,439	1,575,579	1,599,974	1,815,992	1,917,745	2,031,632	2,091,181	2,148,658	2,145,385
people who have a second job	212,023	187,473	180,534	155,674	146,561	112,951	105,371	111,786	114,463	121,725	104,826
the share of people who have a second job	14.12%	12.38%	11.63%	9.88%	9.16%	6.22%	5.49%	5.50%	5.47%	5.67%	4.89%

Source: author`s calculation, based on NIS data [8].

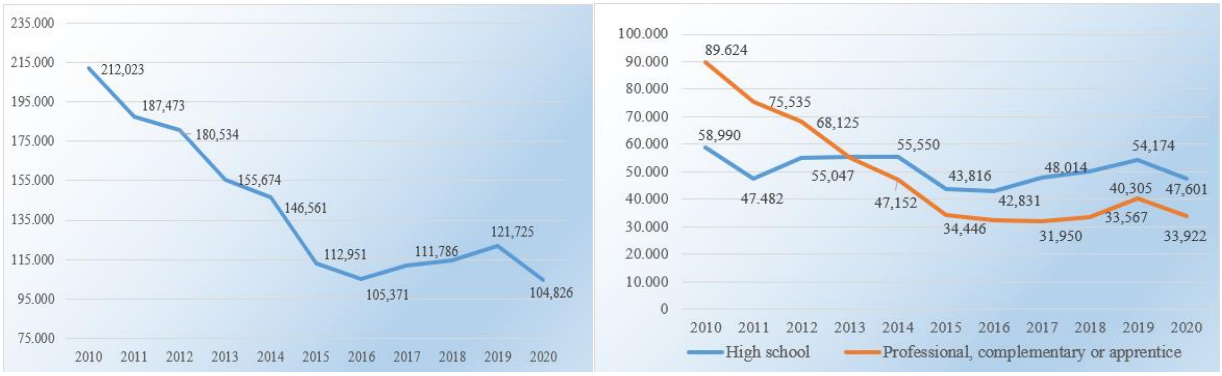

Fig. 3. Evolution of people who have a second job in rural areas (a), and by education level (b): with high school and professional, complementary or apprentice graduated

Source: author`s calculation, based on NIS data [8].

Evolution of permanent, temporary, full time, part time forms of work

Some of the influence's factors on the balance of the labour market in rural areas is given by the way that jobs demand and supply meet, by the demographics of enterprises operating in rural areas, the evolution of the number of available jobs, the degree of employment, the income level etc. [9]. The level of national economic stability that results in job stability or the way in which the forms of work commitment change their volume or characteristics also influence the evolution of the balance in the labour market. Whether we refer to permanent or temporary forms of work, or to a partial or complete mode of activity, it is certain that all forms of work are in a continuous dynamic of form and volume. A parallel between the evolution of permanent and temporary forms of work, classified also in terms of worked hours, full time or part time, can be observed in Figure 4, the statistical data referred to them being included in Table 7.

Table 7. Evolution and dynamics of different forms of work in rural areas

rural forms of work (unit: no. of people)	Period										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
total	1,443,213	1,432,928	1,463,649	1,493,160	1,512,534	1,731,107	1,831,774	1,955,116	2,019,322	2,056,278	2,059,716
permanent work	1,384,588	1,351,052	1,374,859	1,410,741	1,425,094	1,646,222	1,745,803	1,878,600	1,947,463	1,963,898	1,974,047
temporary work	58,625	81,876	88,790	82,419	87,440	84,885	85,971	76,516	71,859	92,380	85,669
full time	1,126,645	1,145,912	1,163,355	1,202,553	1,270,225	1,503,649	1,603,649	1,729,105	1,796,409	1,794,125	1,706,642
% from total	78.07%	79.97%	79.48%	80.54%	83.98%	86.86%	87.55%	88.44%	88.96%	87.25%	82.86%
permanent work	1,092,345	1,104,429	1,121,001	1,165,408	1,225,111	1,461,032	1,563,052	1,691,178	1,750,289	1,747,311	1,659,633
% from full time	96.96%	96.38%	96.36%	96.91%	96.45%	97.17%	97.47%	97.81%	97.43%	97.39%	97.25%
temporary work	34,300	41,483	42,354	37,145	45,114	42,617	40,597	37,927	46,120	46,814	47,010
% from full time	3.04%	3.62%	3.64%	3.09%	3.55%	2.83%	2.53%	2.19%	2.57%	2.61%	2.75%
part time	32,735	30,545	37,762	36,391	31,668	42,968	42,052	47,844	44,573	47,518	51,941
% from part total	2.27%	2.13%	2.58%	2.44%	2.09%	2.48%	2.30%	2.45%	2.21%	2.31%	2.52%
permanent work	28,334	25,741	33,069	30,061	26,601	37,781	36,237	44,908	43,141	44,190	48,753
% from part time	86.56%	84.27%	87.57%	82.61%	84.00%	87.93%	86.17%	93.86%	96.79%	93.00%	93.86%
temporary work	4,401	4,804	4,693	6,330	5,067	5,187	5,815	2,936	1,432	3,328	3,188
% from part time	13.44%	15.73%	12.43%	17.39%	16.00%	12.07%	13.83%	6.14%	3.21%	7.00%	6.14%

Source: author`s calculation, based on NIS data [8].

A significant share of full-time contracts can be observed, for an indefinite contractual period, from 96.96% in 2010 to 97.25% in 2020. Another important proportion resulting from the statistical data is represented by the part time contracts for a permanent period of time, the values approaching 87% for 2010 and 94% for 2020. In addition, it can be observed the upward trend of the permanent part-time work model that should be highlighted, with 28,334 contracts registered in 2010 and 48,753 in 2020. In the other sense, the quotas referring to the forms of full time or part time work, in temporary regime, have much lower values than those in permanent work regime. Thus, the full-time model on a temporary basis has values starting from 3.04% in 2010 to 2.75% in 2020 of the total value, and the part-time form of temporary work registers values from 13.44% in 2010 to 6.14% in 2020.

It is also important to observe how and in what way the dynamics of the forms of work in the rural environment change during the analysis period, as well as differences in values at its lower and upper ends. Comparing the values registered in 2020 for all categories of forms of work with those registered in 2010, as shown in Table 8, we can see increases for both permanent and temporary forms of work, with 42.5% and 46.13%, respectively, also for the full time or part time forms of activity, with 51.43% respectively 58.67% compared to 2010.

The only decrease registered value refers to the temporary work form in part time regime, which registers -27.56% compared to 2010.

Table 8. Dynamics of the rural forms of work

Dynamics of different forms of work, in rural areas	
forms of work	**2020 to 2010**
total	42.72%
permanent contracts	42.57%
temporary contracts	46.13%
full time	51.48%
permanent work	51.93%
temporary work	37.05%
part time	58.67%
permanent work	72.06%
temporary work	-27.56%

Source: author`s calculation, based on NIS data [8].

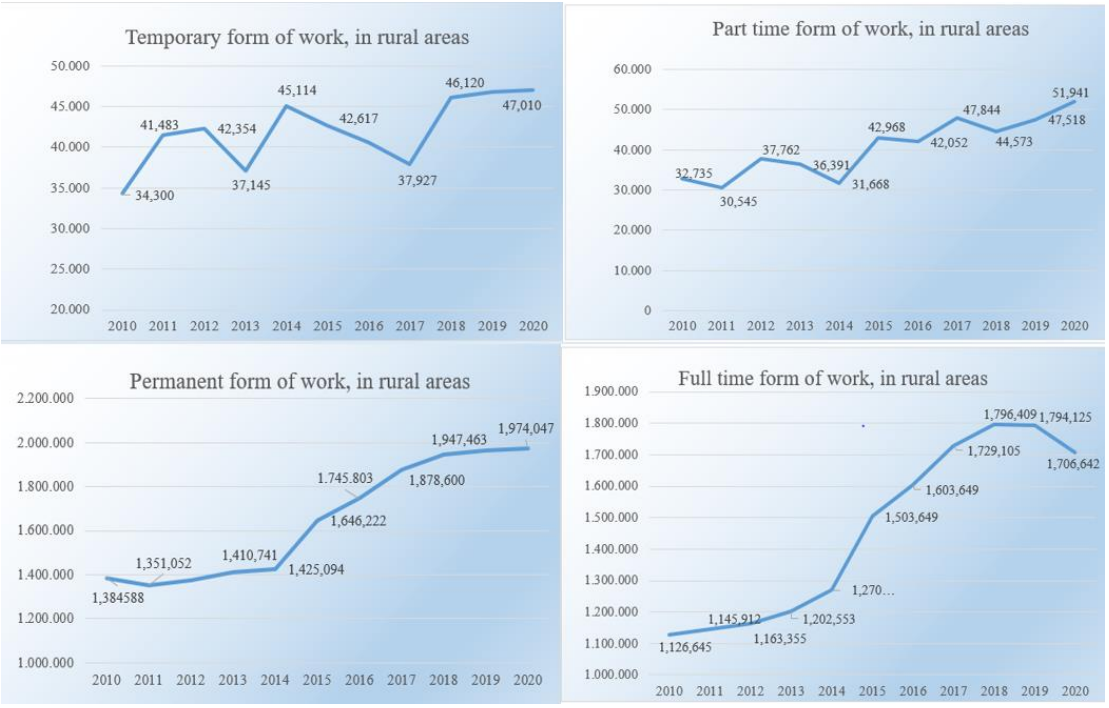

Fig. 4. Evolution of temporary (a), permanent (b), part time (c) and full time (d) forms of work, in rural areas
Source: author`s calculation, based on NIS data [8].

The described forms of work, permanent, temporary, in complete or partial activity regime, in the rural environment and their evolution are represented graphically in the Figure 4.

It can be observed that the temporary work model (GIG) and the partial form of activity (part time) have a similar trend of dynamics, permanent forms of work and those in full activity (full time) describing a similar trend. The dynamics of the number of temporary employment contracts show a significant increase in the period 2010 - 2012, with a relatively constant trend for the period 2012 - 2016, downwards between 2016 and 2019, and then their number to increase significantly in 2019. Compared to 2010, the number of temporary employment contracts increased by 46.13% (85,669 contracts in 2020, compared to 58,625 contracts in 2010). The fluctuations of the dynamics of the temporary forms of work are also defined by the moments of economic crisis, meaning a decrease of them in the period of onset and increase towards the end of the crisis [6].

The partial form of work as well as the temporary forms of work have an unpredictable evolution, with sudden increases and decreases during the reference period. There are a number of factors that would influence this trend, starting from seasonality (in which case the number of part time contracts increase or decrease, depending on the economic field analyzed). The works in agriculture or constructions, for example, make necessary a labour force surplus from spring to autumn, in winter period no labour force addition being necessary. Another determining factor of the dynamics of partial and temporary forms of work is the population migration phenomenon effect, from rural to urban or outside of the country. Another example is tourism field that also records different and fluctuating periods of staffing [2]. The phenomenon leads to the decrease of the able-bodied population, respectively to the closing of the existing labour contracts and obviously to the increase of the labour demand on the market.

CONCLUSIONS

From the analysis performed, it can be deduced observations and results that define the general framework of all forms of work in Romanian rural environment and the dynamic tendencies of the different forms of work commitment during the analyzed period.

Both dynamics of permanent contracts number and that of the contingent ones, register an ascending trend for the 2010 - 2020 reference period. Between 2015 and 2020 there is a significant increase in the total number of permanent full-time contracts, 2015 registering the highest value of dynamics, of approximately 40%.

Between 2011 and 2016, the volume of the contingent form of work increases, so that in 2019, its value reaches the maximum registration level.

Full time contracts, regardless of how they are registered, as a determined or indefinite period, have the largest share of the total number registered at national level in rural areas.

Part-time contracts register different dynamic trends, in the sense that the permanent ones have an ascending trend, and the contingent forms register a sudden collapse in the period 2017-2018, by approximately 400% compared to previous years. Part time permanent jobs increase with 67.43% in 2020 compared to 2010.

The number of people who have a second job has decreased by about 50% in the analyzed decade.

The highest share in the total number of people with secondary activity, depending on the level of education, has those who have finished or have a high school diploma, followed by professional and apprentice people.

Women and men participate in constant weights in the total number of contingent employment contracts and in terms of differentiation by categories of number of hours worked weekly it can be seen that men have mostly full-time contracts and women mostly occupy temporary jobs with a number weekly hour less than 40.

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WORK IN RURAL AREAS, AN ANALYSIS OF THE UNEMPLOYMENT RATE AND ITS EVOLUTION OVER THE LAST DECADE

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Abstract

The economic reality of the Romanian rural space describes a different unemployment rate than those registered in the urban areas or at national level. At the same time, the dynamics of the economic sectors belonging to the rural areas is different from its evolution in the urban environment. Forms of employment in rural areas tend to be predominantly of a permanent nature, to the detriment of temporary work or seasonal ones. Elements of influence on the individual, which affect the decision to work or the option to choose a satisfactory job are the financial and social conditions. Influencing factors such as the level of education and qualification, the level of income per person or household, the work seasonality phenomenon in different economic sectors, constantly change the employment work level, also the contractual form in which the work is performed. This article describes the interaction of some economic and social indicators on the unemployment rate in the Romanian rural areas and highlights its evolution in the economic and social context of the last decade. The analysis method used in this paper is the quantitative one. An important share of the total number of unemployed in rural areas, is represented by people who have never worked, who have never had a work experience, regardless of age or level of education. The highest values are registered for people aged between 15-24 years and for those who graduated high school and the lowest weight values are for people aged 55-64 years and those with university degrees. For the last decade, the highest number of rural unemployed are people who have finished or graduate the high school, and the unemployed with secondary school. The highest increasing value of unemployed people is recorded in 2015. The highest decreasing values of unemployed people are recorded between 2016 and 2019.

***Key words*:** *unemployment, rural areas, rural statistics*

INTRODUCTION

The phenomenon of unemployment, generally speaking, in urban or rural areas, is one of the topics intensely and constantly analyzed. The unemployment rate, together with the employment rate and the number of able-bodied populations, regardless of the analyzed environment, are all reference indicators in defining the labour market, the balance between labour demand and supply [5]. In this sense, the effect of the migration phenomenon of the labour force from the rural to the urban environment or outside Romania, must be also emphasized. Also, Romania in the last decade has been generally characterized by economic stability, except for the very first years after the global economic crisis in 2007 and for 2020, the year in which the global health crisis broke out. Its effects on the labour market were immediate: the demographic dynamics of enterprises changed significantly compared to 2019, with implicit impact in decreasing the volume of employed labour force, increasing the number of unemployed and obviously the unemployment rate.

There are distinct types of rural areas and their delimitation makes it easier to understand the

predominant factors that influence the unemployment phenomenon, for each area. Thus, there are (a) classical rural areas, geographically isolated from the urban ones, with economic activity based mainly on agriculture, (b) rural areas derived from former areas of extraction or production activity in which unemployment registers high values, (c) areas in the vicinity of cities, characterized by population mobility to urban areas and a higher population density than in the other areas described and (d) seasonal areas whose activity is based on tourism or agriculture [2].

Unemployment among young people is a particularly important phenomenon in rural areas, and the reasons for its persistent nature are due to lack of job alternatives or in building a career, poor access to vocational training in the proximity of the living area, the dynamics of architecture forms of work, respectively the transition to GIG types of work, partial or temporary models, in different rural economic sectors [2].

In the following we will refer to the characteristics of the unemployment phenomenon in the Romanian rural areas [1] and we will analyze the interdependence of some of the factors that influence the evolution of this indicator, in the last 10 years. As benchmarks of the analysis, we considered it necessary to lean towards the description of the unemployment rate dynamics in general, the way in which unemployment is affected depending on the level of education, the age categories of the population or the way in which the unemployment period affects the analyzed indicator.

Another factor that we considered necessary to follow is the category of unemployed who have never worked, as well, depending on the level of education or population age category, in order to highlight one of the important characteristics of the rural unemployment phenomenon, namely, that the category of people who have never worked, regardless of age or level of education, represents almost 50% of the total number of unemployed in rural areas. And last but not least, we have created a general framework for describing the income situation in rural areas, both for employees and the unemployed, in order to better understand the impact of this indicator on the rural unemployment dynamics.

The purpose of this paper is to highlight the characteristics of the rural unemployment phenomenon in 2010-2020 period, the way in which this indicator has evolved in this decade and to underline the key points of its dynamics.

MATERIALS AND METHODS

The reference period considered in this paper is 2010 - 2020. All statistical data used in this analysis belong to the National Institute of Statistics. Some data are available until 2019, but from the integrated analysis of the evolution of rural unemployment, we can say that this issue does not significantly influence the results obtained. Also, the statistical data for 2020 represent an arithmetic average of the first, second and the third quarterly values currently available. The analysis method used in this paper is the quantitative one. Calculations of dynamics and weight of indicators are used, in order to highlight the integrated evolution of the rural unemployment phenomenon in the analyzed period.

RESULTS AND DISCUSSIONS

The rural unemployment rate

The unemployment rate in rural areas, representing the total number of people looking for a job in the total active labour force, calculated as a percentage, registers during the last decade increasing values until the middle of the reference period, then a decreasing trend, starting with 2016 until in 2020. Compared to the indicator values in urban and national level, as it results from the statistical data included in Table 1 it can be seen that, at rural level, the values were lower than the other two comparison areas, up to 2015, the highest value being registered by the unemployment rate in the urban environment (7.00%). From 2015 till 2020, there is a change in the indicators dynamics on the 3 comparison areas, the unemployment rate in rural areas having a higher value than

the national average or the urban areas. Thus, the dynamics of the indicator in rural areas registers a relatively constant trend for the first half of the decade, with values close to 5% (4.80% in 2010 and 5.30% in 2015), then rising to 6.60 for 2015. For the rest of the period, there is a slightly decreasing trend, so that in 2020 the value is 5.63%. If we refer to the share of rural unemployed number in the national total, during the reference period we can see an absolutely upward trend in the parameter evolution, with values of 32.01% for 2010 and 51.33% in 2020, of the total national indicator. As a comparison between the areas described in the analysis, in Figure 1, it can be seen the differences in the evolution of the unemployment rate indicator, namely: the minimum values recorded in the analyzed period are those of 2019, with 4.50% in rural areas, 3.90% nationally and 3.40% in urban areas and the maximum are those registered in 2010 (4.80% in rural areas, 7.00% nationally and 8.80% in urban areas).

Table 1. Unemployment rate in rural areas

		period										
	residence	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
unemployment rate in rural area (unit: percentage)	**Total national**	7.00	7.20	6.80	7.10	6.80	6.80	5.90	4.90	4.20	3.90	4.97
	Urban	8.80	8.60	8.30	8.70	8.10	7.00	5.60	4.50	3.80	3.40	4.43
	Rural	4.80	5.50	5.00	5.20	5.30	6.60	6.30	5.40	4.70	4.50	5.63
unemployed in rural area (unit: no. of people)	**Total national**	651,695	659,426	627,209	652,984	628,682	623,910	529,869	449,331	379,678	353,370	445,672
	Rural	208,601	225,555	208,182	217,999	219,832	273,477	251,719	224,271	193,650	185,316	228,775
	% of national	32.01%	34.20%	33.19%	33.39%	34.97%	43.83%	47.51%	49.91%	51.00%	52.44%	51.33%

Source: author`s calculation based on NIS data [10].

Thus, the dynamics of the indicator in rural areas registers a relatively constant trend for the first half of the decade, with values close to 5% (4.80% in 2010 and 5.30% in 2015), then rising to 6.60 for 2015. For the rest of the period, there is a slightly decreasing trend, so that in 2020 the value is 5.63%. If we refer to the share of rural unemployed number in the national total, during the reference period we can see an absolutely upward trend in the parameter evolution, with values of 32.01% for 2010 and 51.33% in 2020, of the total national indicator.
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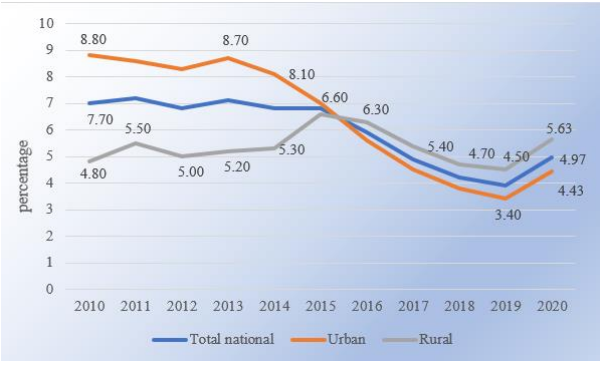

Fig. 1. Evolution of unemployment rates in rural areas compared to the national and urban levels (%)
Source: author`s calculation based on NIS data [10].

There is also an increase in the values of the unemployment rate on all 3 comparison averages, in 2020, the main motivation being the effects of the pandemic crisis on the labour market.
One of the present economic sectors in rural areas is agriculture [5], a sector for which statistical data show that unemployment is multidimensional and the predominant forms of work are seasonal and temporary. There is

also an increased mobility of people, given the seasonal or temporary movement in different rural areas, along with finding a job [4]. Precisely these characteristics of the labour dynamics in the agricultural sector, make employment and unemployment indicators not exactly easy to be quantified [7].

The rural unemployment by educational level

The level of education influences in finding a job, along with other factors such as: the specialty of studies, the level of national economic stability, the income level, the level and the wage differences between the rural and the urban environment, the balance between supply and demand on the labour market, etc [11].

If we refer to a higher education, for example, holding an academic diploma does not certify in finding a job, the basic conditions being rather defined by the level of labour demand at a given time and the level of economic stability. If the labour demand is high, in a stable economic environment, the occupancy rate is higher and vice versa [12].

Table 2. Rural unemployment by educational level

Unemployed in rural area (unit: no. of people) / period												
Level of education	**Residence**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Total	**national**	651,695	659,426	627,209	652,984	628,682	623,910	529,869	449,331	379,678	353,370	445,672
		208,601	225,555	208,182	217,999	219,832	273,477	251,719	224,271	193,650	185,316	228,775
% from national	**Rural**	32,01%	34,20%	33,19%	33,39%	34,97%	43,83%	47,51%	49,91%	51,00%	52,44%	51,33%
dynamics		:	8,13%	-7,70%	4,72%	0,84%	24,40%	-7,96%	-10,90%	-13,65%	-4,30%	23,45%
University	**national**	:	73,387	82,065	89,221	98,340	73,952	56,021	44,132	38,950	29,348	39,057
		:	11,056	9,609	11,941	13,565	13,525	9,038	7,932	8,768	7,334	11,279
% from total rural	**Rural**	:	4.90%	4.62%	5.48%	6.17%	4.95%	3.59%	3.54%	4.53%	3.96%	4.93%
dynamics		:	:	-13.09%	24.27%	13.60%	-0.29%	-33.18%	-12.24%	10.54%	-16.35%	53.79%
Postgraduate specialized or technical foreman	**national**	22,323	14,024	13,787	17,277	15,169	13,157	12,266	8,637	5,549	5,115	6,485
		3,338	2,032	2,513	3,291	2,958	3,314	2,155	1,325	796	895	923
% from total rural	**Rural**	1.60%	0.90%	1.21%	1.51%	1.35%	1.21%	0.86%	0.59%	0.41%	0.48%	0.40%
dynamics		:	-39.13%	23.67%	30.96%	-10.12%	12.04%	-34.97%	-38.52%	-39.92%	12.44%	3.13%
High school	**national**	215,370	225,431	220,280	237,585	257,228	265,985	232,534	201,355	178,781	162,482	204,130
		53,628	60,847	63,330	66,633	82,909	109,602	107,720	98,777	88,489	80,286	94,878
% from total rural	**Rural**	25.71%	26.98%	30.42%	30.57%	37.71%	40.08%	42.79%	44.04%	45.70%	43.32%	41.47%
dynamics		:	13.46%	4.08%	5.22%	24.43%	32.20%	-1.72%	-8.30%	-10.42%	-9.27%	18.18%
Professional, complementary or apprentice	**national**	185,132	167,129	149,019	149,398	102,100	102,018	85,894	71,426	54,149	49,922	72,376
		64,375	57,246	49,815	56,253	40,676	47,959	45,661	42,597	30,404	29,833	40,352
% from total rural	**Rural**	30.86%	25.38%	23.93%	25.80%	18.50%	17.54%	18.14%	18.99%	15.70%	16.10%	17.64%
dynamics		:	-11.07%	-12.98%	12.92%	-27.69%	17.90%	-4.79%	-6.71%	-28.62%	-1.88%	35.26%
Secondary	**national**	115,091	126,337	116,700	116,040	124,317	132,817	116,004	96,830	75,091	75,084	95,413
		58,364	66,003	60,892	59,517	64,025	80,295	72,193	57,590	48,187	47,948	60,961
% from total rural	**Rural**	27.98%	29.26%	29.25%	27.30%	29.12%	29.36%	28.68%	25.68%	24.88%	25.87%	26.65%
dynamics		:	13.09%	-7.74%	-2.26%	7.57%	25.41%	-10.09%	-20.23%	-16.33%	-0.50%	27.14%
Primary (1 - 4 classes)	**national**	18,050	24,805	22,900	20,693	25,060	29,213	20,818	21,239	20,310	22,278	18,711
		10,146	16,093	11,186	9,613	11,545	15,224	12,208	13,272	13,791	13,540	13,587
% from total rural	**Rural**	4.86%	7.13%	5.37%	4.41%	5.25%	5.57%	4.85%	5.92%	7.12%	7.31%	5.94%
dynamics		:	58.61%	-30.49%	-14.06%	20.10%	31.87%	-19.81%	8.72%	3.91%	-1.82%	0.35%
No graduate school	**national**	5,320	5,299	4,156	5,412	6,468	6,768	6,333	5,712	6,848	9,140	9,500
		3,089	2,913	2,758	3,162	4,153	3,558	2,744	2,778	3,216	5,479	6,794
% from total rural	**Rural**	1.48%	1.29%	1.32%	1.45%	1.89%	1.30%	1.09%	1.24%	1.66%	2.96%	2.97%
dynamics		:	-5.70%	-5.32%	14.65%	31.34%	-14.33%	-22.88%	1.24%	15.77%	70.37%	24.00%

Source: author`s calculation based on NIS data [10].

Regarding the share of different groups of people who do not have a job and their level of education, in the unemployed total number, the following observations can result, according with statistical data in Table 2: the highest shares of total unemployed is held by high school graduates (37.16%) and by the persons with primary school, gymnasium or without any education class (35.13%).

The category of persons with higher education has a diluted contribution in the total indicator (4.67%), the lowest value of the weight being registered for the persons qualified in professionals / apprentices (0.89% of the total number of rural unemployed and 0.21% of the national total value). Comparison of the above categories described in the rural unemployed

total value is represented graphically in Figure 2.

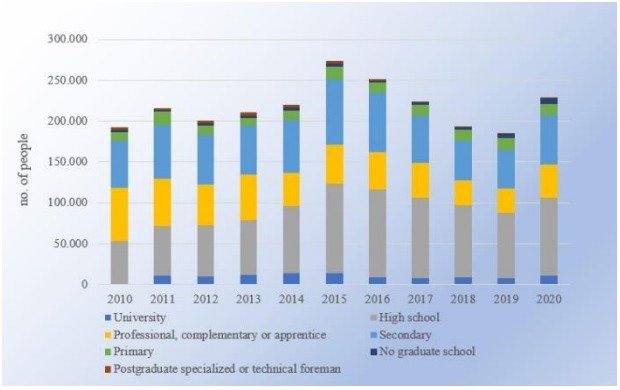

Fig. 2. Comparison of rural unemployed categories, by educational level, in total value indicator
Source: author`s calculation based on NIS data [10].

Analyzing the value differences of 2020 with those of 2010, we can see consistent increases or decreases on different analyzed groups. Thus, the number of unemployed people who did not graduate any class increased by 119% (and with 78.57% at national level), as well as the number of unemployed people who graduated high school, 76.92% in 2020 compared to 2010. In the other direction, there are significant decreases of the number of unemployed qualified professional/technical classes (-72.35%) and those with professional, complementary or apprentice qualification (-60.91%).

The effects of the current. pandemic crisis on the employment indicator led to the increase of all their values in 2020, compared to 2019. It can be seen increases of rural unemployed, for all analyzed groups, the average dynamics being 23.45%. Thus, the largest increase in the number of unemployed in rural areas is the category of people with university degrees (53.79%) and those with professional schools or apprentices (35.26%). Other registered values are: 27.14% for people with secondary school, 18.18% for people who finished or graduated high school, 24.00% for people without education and 0.35% for those with primary school.

The rural unemployed who never work by age and educational level

Another aspect of rural unemployment that needs to be analyzed is the differentiation of the categories of unemployed who have never worked, by age categories and according to the level of education. The first observation that emerges from the data contained in Table 3 is the significant share of people who have never had a job in the total number of unemployed in rural areas, with values between 1.04% in 2010 and 61.00% in 2019, the values throughout the analysis period being represented graphically in Figure 4. It can also be seen that young people aged 20-24 are the category most exposed to unemployment, with about 35,835 people in 2019, increasing throughout the analysis period (40,027 people in 2010). Other important registered values for the entire reference period is that of persons aged between 15-19 years, with 21.408 persons in 2019. The 25-29 years category register 15,989 persons registered in 2019, the 30-34 years group 11,366 persons. It can be seen that, once with the advancing age of the persons, the number of unemployed who have never worked decreases. The evolution of rural unemployed who never work before can be seen in Figure 3.

Also, in Figure 4 we can see the share of the categories of unemployed who have never worked and those who worked before the unemployment period, in the total number of unemployed in rural areas, during the analyzed period. The weights of the unemployed who have never worked are important, starting around 40% in 2010 and increasing to about 60% in 2020. Another interpretation of the values of these weights is made according to the level of education of the unemployed who never work, as can be seen from the statistical data included in Table 4 and represented graphically in Figure 5.

If we consider the differentiation of the rural population that has never had a job, depending on the level of education acquired, according to the statistical data included in Table 3, we can see that people who finished the high school are the highest category in the total number of unemployed who have never worked. The registered values are 47.33% in 2020 and 31.89% in 2010, the evolution trend being an absolutely increasing one for the analyzed period. In the other way, we observe

the category of qualified persons in professional schools or apprenticeships with decreasing values of approximately 50% in 2020 compared to 2010 (19,799 persons in 2010 compared to 10,692 in 2020).

Generally, the highest values of dynamics can be seen in 2015, when the total number of people in rural areas who never worked increased by 56.81% compared to the previous year, as seen in Figure 4.

The lowest values in the weight of the indicator are registered by the persons who have not graduated any class, by those who have finished primary school and by the category of persons with university studies. The evolution dynamics of the categories subject to attention indicate relatively constant trajectories for groups with primary education, university studies or vocational schools, while the dynamics trends for groups with high school and gymnasiums describe oscillating trajectories, increasing in 2010-2015 and decreasing for the other half of the reference period, as can be seen in Figure 5.

Table 3. Rural unemployed people who never worked, by age category

unemployed in rural area, who never worked (unit: no. of people)	Period									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total	85,613	89,058	88,497	89,266	96,355	151,097	139,102	132,555	123,202	113,051
dynamics	:	4.02%	-0.63%	0.87%	7.94%	56.81%	-7.94%	-4.71%	-7.06%	-8.24%
% from total rural	41.04%	39.48%	42.51%	40.95%	43.83%	55.25%	55.26%	59.10%	63.62%	61.00%
15 – 19 years	17,094	14,894	19,768	21,322	21,119	26,851	25,242	19,632	18,479	21,408
20 - 24 years	40,027	41,888	36,487	37,820	42,057	45,620	41,530	46,481	37,039	35,835
25 - 29 years	14,591	13,884	13,340	13,391	15,927	29,209	28,753	21,391	20,290	15,989
30 - 34 years	4,174	6,384	6,293	5,850	4,859	12,509	13,799	13,468	13,376	11,366
35 - 39 years	4,204	4,787	4,287	3,403	4,407	13,469	9,359	8,486	11,483	7,211
40 - 44 years	2,405	3,595	4,345	4,527	3,601	10,216	9,853	8,318	7,357	7,248
45 - 49 years	1,668	1,802	1,808	1,394	2,870	7,197	4,996	8,141	10,141	7,097
50 - 54 years	860	879	1,157	1,025	1,113	3,723	3,495	3,602	2,575	3,639
55 - 59 years	482	465	242	324	313	1,593	1,527	1,910	1,773	1,632
60 - 64 years	107	392	680	144	:	432	549	823	566	1,625

Source: author`s calculation based on NIS data [10].

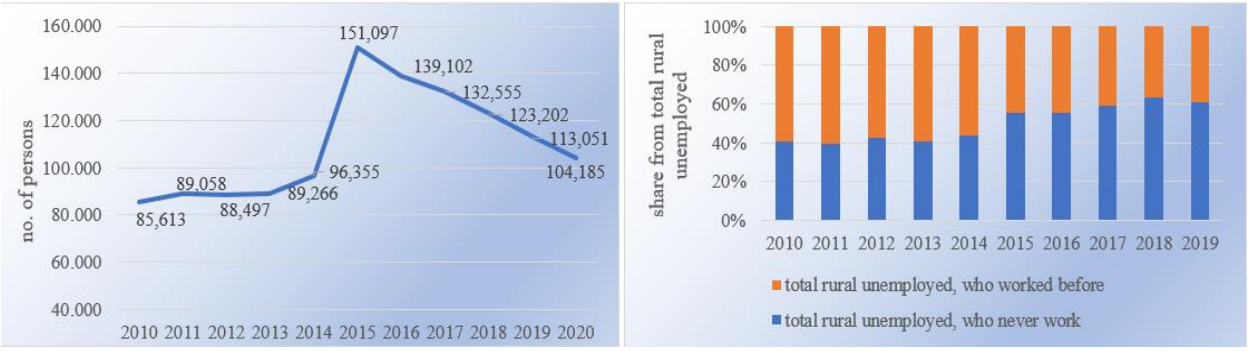

Fig. 3 and Fig. 4. Evolution of the unemployed who have never worked (rural araeas) (a) and their share in total number of enemployed (rural areas)(b)

Source: author`s calculation based on NIS data [10].

Table 4. Rural unemployed who never worked by educational level

Rural unemployed, who never worked, by educational level (unit: no. of people)	Period										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total rural	85,613	89,058	88,497	89,266	96,355	151,097	139,102	132,555	123,202	113,051	104,185
Universitary	:	7,180	5,749	6,872	7,605	10,735	6,386	5,166	5,977	4,792	5,668
% from total rural	:	8.06%	6.50%	7.70%	7.89%	7.10%	4.59%	3.90%	4.85%	4.24%	5.44%
Postgraduate specialized or technical foreman	1,470	1,419	980	838	1,100	1,835	1,553	1,246	692	422	405
% from total rural	1.72%	1.59%	1.11%	0.94%	1.14%	1.21%	1.12%	0.94%	0.56%	0.37%	0.39%
High school	27,306	32,647	36,902	37,733	42,672	66,415	67,116	68,304	63,572	55,603	49,312
% from total rural	31.89%	36.66%	41.70%	42.27%	44.29%	43.96%	48.25%	51.53%	51.60%	49.18%	47.33%
Professional, complementary or apprentice	19,799	14,483	11,725	11,467	11,025	15,514	13,944	15,676	12,277	10,839	10,692
% from total rural	23.13%	16.26%	13.25%	12.85%	11.44%	10.27%	10.02%	11.83%	9.96%	9.59%	10.26%
Secondary	22,630	24,667	25,791	24,615	26,731	44,644	41,482	32,652	28,993	28,702	28,202
% from total rural	26.43%	27.70%	29.14%	27.57%	27.74%	29.55%	29.82%	24.63%	23.53%	25.39%	27.07%
Primary (1 4 classes)	5,515	6,552	5,021	4,130	5,203	9,239	7,063	8,487	9,205	8,774	6,308
% from total rural	6.44%	7.36%	5.67%	4.63%	5.40%	6.11%	5.08%	6.40%	7.47%	7.76%	6.05%
No graduate school	2,780	1,358	2,100	2,424	2,018	2,715	1,557	1,025	2,487	3,919	3,598
% from total rural	3.25%	1.52%	2.37%	2.72%	2.09%	1.80%	1.12%	0.77%	2.02%	3.47%	3.45%

Source: author`s calculation based on NIS data [10].

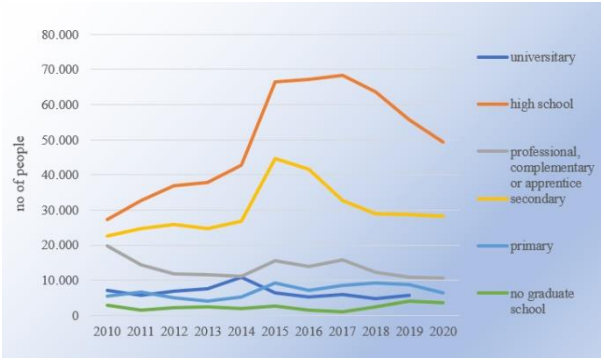

Fig. 5. Rural unemployed who never work, by educational level

Source: author`s calculation based on NIS data [10].

The rural unemployment by duration

Approximately 30% of the total unemployed in rural areas are people who do not have a job for more than 12 months according with statistical data shown in table no. Long-term unemployment has as possible influencing factors technological changes and automation, with the initial decrease of the workforce, lack of qualifications or an insufficient education, in accordance with the requirements of the labour market, the migration from rural to urban or foreign of qualified people or able-bodied population in general, the rural income level, age, individual demotivation, etc [8].

When we refer to the influencing factors on the two types of unemployment, short-term or long-term, we can also mention the dynamics of existing companies in the rural market, from the point of view of economic sectors of their activity and their life cycle.

An infusion of new companies appearing on the market, in the same economic sector, for example, causes an increase in labour demand and increase the employment rate, while, in the other direction, when companies start to end their activity, jobs start to disappear and the number of unemployed increases [6].

In another train of thoughts, there may be jobs in sectors for which the able-bodied population is not sufficiently educated or qualified, which can lead to a higher unemployment.

The most significant values recorded are those related to 2015, when the number of unemployed people for more than 12 months increased by 24.40% compared to the previous year, by 49.72% for unemployed for a period between 12 and 17 months, 27.45% for the unemployment period of 18-23 months and 41.18% for a period longer than 24 months. In the other way, the one of diminishing the number of unemployed in the rural area, the year 2017 registers values in this sense, on all the categories of the unemployment period. Thus, for the unemployment period between 12 and 17 months, the indicator takes the value of -33.02%, the one of 18-23 months is -20.89% and for the period 24+, -16.09% is registered compared to the previous year. Figure 6 graphically represents the comparison of rural unemployed categories, by duration, in total value indicator, for the analyzed period.

For 2020, the highest share of the number of unemployed people on the rural indicator it can been observed for an unemployment duration less than 1 month (21.74%), then for a period of 1-2 months (18.53%), the unemployment for 3 – 5 month (15.62%) and for a 12-17 months period (15.12%), the lowest proportions referring to the unemployment for periods between 6-8 months (8.37%), 9-11 months (5.70%) or for 18–23-month period (4.84%) (Table 5 and Fig. 6).

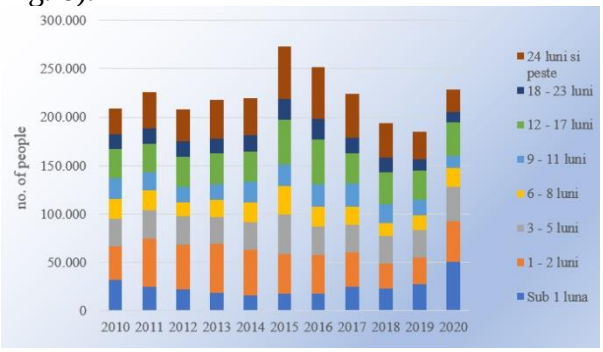

Fig. 6. Comparison of rural unemployed categories, by duration, in total value indicator

Source: author`s calculation based on NIS data [10].

Table 5. Rural unemployment by duration

Rural unemployment (unit: no, of people)	Period										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Total rural	208,601	225,555	208,182	217,999	219,832	273,477	251,719	224,271	193,650	185,316	228,775
under 1 month	31,650	24,485	21,433	18,188	15,585	17,502	17,122	24,072	22,455	27,418	49,727
% from total	15.17%	10.86%	10.30%	8.34%	7.09%	6.40%	6.80%	10.73%	11.60%	14.80%	21.74%
1 - 2 month	34,387	49,876	46,488	50,608	47,103	40,309	40,415	35,882	25,764	26,984	42,394
% from total	16.48%	22.11%	22.33%	23.21%	21.43%	14.74%	16.06%	16.00%	13.30%	14.56%	18.53%
3 - 5 month	28,577	29,736	29,177	27,375	28,820	41,577	28,953	28,239	28,780	28,695	35,732
% from total	13.70%	13.18%	14.02%	12.56%	13.11%	15.20%	11.50%	12.59%	14.86%	15.48%	15.62%
6 - 8 month	20,772	20,506	14,677	18,012	20,111	29,507	20,982	19,417	13,272	15,093	19,149
% from total	9.96%	9.09%	7.05%	8.26%	9.15%	10.79%	8.34%	8.66%	6.85%	8.14%	8.37%
9 - 11 month	21,608	18,072	15,663	16,351	21,934	22,486	23,207	23,916	19,642	16,572	13,044
% from total	10.36%	8.01%	7.52%	7.50%	9.98%	8.22%	9.22%	10.66%	10.14%	8.94%	5.70%
12 - 17 month	29,734	29,575	31,608	32,285	30,524	45,701	46,146	30,907	32,705	29,678	34,597
% from total	14.25%	13.11%	15.18%	14.81%	13.89%	16.71%	18.33%	13.78%	16.89%	16.01%	15.12%
18 - 23 month	15,035	16,038	16,222	14,819	16,930	21,578	20,990	16,606	15,603	12,276	11,072
% from total	7.21%	7.11%	7.79%	6.80%	7.70%	7.89%	8.34%	7.40%	8.06%	6.62%	4.84%
24 month and over	26,838	37,267	32,913	40,360	38,825	54,815	53,903	45,231	35,430	28,600	23,061
% from total	12.87%	16.52%	15.81%	18.51%	17.66%	20.04%	21.41%	20.17%	18.30%	15.43%	10.08%

Source: author`s calculation based on NIS data [10].

The average monthly income, as an impact factor on rural unemployment

The income level in rural areas is an influencing factor on the employment rate in the labour market. Romanian revenues in rural areas are lower than those in urban areas, as can be seen in Table 6, in which are included data regarding the level of income, for employees and unemployed, in urban and rural areas, as average monthly income. It can be seen that the parameter value in terms of employees is about 70.29% compared to urban, and for the unemployed the difference is about 63.33%. Another important aspect that comes to show the balance between incomes and expenses at rural level and that must be mentioned is the value of the minimum shopping cart in rural areas was set at the end of 2018 as 644 lei for an adult (National Agency for Consumer Protection, ANPC, Central Insolvency Commission, 2018, Decision 7/2018 Regarding the Approval of the General Criteria for Establishing a Reasonable Standard of Living [9].

Regardless of the relatively upward trend over the entire analyzed period of all categories subject to analysis, as seen in Figure 7, the differences between the value of the rural indicator compared to the urban one, makes the phenomenon of the working population migration from rural to urban or outside of the country to be accentuated. Another result of the total average income, as an impact factor in the employment rate is the decision to accept or not a form of work commitment under the given conditions.

The current rural reality is also characterized by a trend of rejection of job offers paid at legal minimum level and rather acceptance of forms of social assistance and unemployment benefits.

With the current health crisis, the number of jobs has decreased in rural areas and implicitly the number of unemployed has increased. A persistent and high level of unemployment is a significant negative impact on subsequent economic growth [3].

Table 6. Average monthly income in rural and urban areas

Average monthly income (unit: lei)	Residence	Period									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
employees	Total	981,58	1,016,00	1,056,30	1,115,55	1,173,68	1,255,09	1,410,30	1,607,07	2,152,20	2,436,49
	Urban	1,070,66	1,089,35	1,131,61	1,215,13	1,267,29	1,380,01	1,550,05	1,795,27	2,395,65	2,708,40
	Rural	743,17	816,09	860,76	848,19	937,41	988,30	1,114,81	1,250,39	1,689,35	1,903,73
unemployed	Total	471,17	497,71	488,01	499,06	527,87	476,37	584,05	653,62	656,20	828,47
	Urban	493,77	517,96	537,54	535,57	576,16	523,15	682,46	726,18	822,18	944,47
	Rural	426,58	457,73	400,56	425,97	436,86	412,92	454,72	567,41	509,19	696,73

Source: author`s calculation based on NIS data [10].

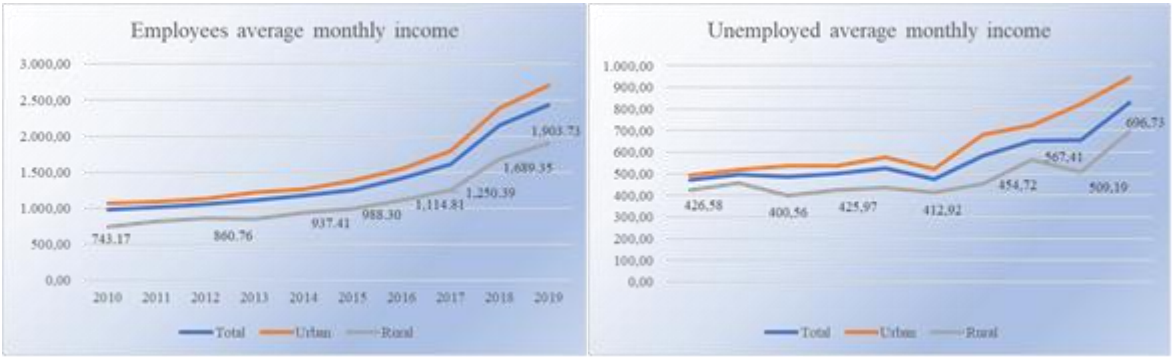

Fig. 7. The average monthly income (lei) for employees and unemployed
Source: author`s calculation based on NIS data [10].

And last, but not the least, drawing a parallel between European developing countries and those with developed economies, we can say that in developed countries, the income level in rural areas is almost similar to that in urban ones, given the heterogeneous level of economic development.
In developing countries, the indicator level in rural areas is lower than in urban ones, which is due to the factors mentioned above [13].

CONCLUSIONS

The unemployment rate in the Romanian rural area had the lowest values compared to those in the urban area or to the national average, between 2010 and 2015, and then to register higher values compared to the indicators on the other two mentioned areas (for 2016-2020 period). Unemployment rate in rural areas increases on the first half of decade, then falls in a downward trend until 2019. In 2020, the value of the unemployment rate starts to increase again, due to the effects of the global health crisis on the economy and implicitly of the labour market.
In 2020, the highest number of rural unemployed are people who have finished or graduate the high school, then the unemployed with secondary school, those with university studies, the, post graduated specialized persons or technical foreman having the lowest share in the total number of unemployed in rural areas. The highest increasing values of unemployed people are recorded in 2015, for all categories mentioned, except for people with university degrees. The highest decreasing values of unemployed people are recorded between 2016 and 2019.
An important share of the total number of unemployed in rural areas, there are people who have never worked, who have never had a work experience, regardless of age or level of education (from 41.4% in 2010 to 63.62% in 2018 and 61% in 2019). The highest values are registered for people aged between 15-24 years and for those who graduated high school and the lowest weight values are for people aged 55-64 years and those with university degrees.
In 2020, about 37.36% of the total number of unemployed in rural areas and the most important share is represented by people who cannot find a job for a period between 1-5 months. Unemployed persons for periods between 12 – 24 and over month represent 30.04% of the total of rural unemployed value. The share of weight, as an importance, remains the same throughout the analyzed period.
The rural level incomes are lower than the one registered in urban areas, for whole period 2010-2020. In 2019, the highest values of the average monthly income are registered, both for the unemployed and for the employees, in the rural area, respectively 693.73 lei (approx. 145 euro) and 1,903.73 lei (approx. 398 euro).

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LOCAL INITIATIVES FOR RURAL DEVELOPMENT

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Abstract

The article describes the LEADER instrument - concept and implementation in Romania's rural area, through Local Action Groups (LAGs), their role in the socio-economic development of local communities, the development path, from the beginning to the present, and how to implement a bottom-up approach - in response to the needs identified at the local level in order to increase the quality of life in rural areas by supporting local initiatives, thus specifically addressing the problems identified at the local community level, for periods programming period 2007-2013, and 2014-2020, when Romania received support from the European Fund for Agriculture and Rural Development (EAFRD).

Key words**:** *LEADER, Local Action Group, local initiatives, rural area, Romania*

INTRODUCTION

What is LEADER? The LEADER program (the title comes from the French "Liaison Entre Actions de Développement de l'Economie Rurale", - "Links between actions for the development of the rural economy") is an instrument of the European Union to support rural development projects initiated at local level, in order to support rural areas. At the level of the Member States of the European Union, the LEADER instrument has been implemented since 1991 and until 2006, three programs were developed: LEADER I, LEADER II and LEADER +. These programs are designed to encourage the implementation of new approaches to integrated and sustainable development in the community.

Since 2007, the LEADER initiative has reached a level of maturity that allows the competent authorities and local action groups in the Member States to allow the implementation of the LEADER approach on an extended basis in the national rural development program [1, 2, 3, 12, 17].

In Romania, according to the provisions of the Council Regulation no. 1698/2005 on the European Agricultural Fund for Rural Development (EAFRD) for the period 2007-2013 [4, 6], in the National Rural Development Program of Romania, a fourth axis was introduced called the LEADER Axis, through which the implementation of this concept was initiated.

In the 2014-2020 programming period, based on the provisions of Regulation (EU) no. 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development provided by the European Agricultural Fund for Rural Development (EAFRD) [5], Romania introduced in the National Rural Development Program of Romania, Measure 19 - LEADER Local Development. Many studies analyzed and assessed the impact of the implementation of LEADER instrument in Romania through the Local Action Groups [10, 11, 14, 15, 16].

In this context, the purpose of this study was to present the LEADER concept and the state of implementation in the rural area of Romania through Local Action Groups. Also, it aimed to emphasize the role of the local communities in indentifying their needs to grow the life quality and living standard sustaining the local initiatives in the periods 2007-2013, and 2014-2020.

MATERIALS AND METHODS

In order to present the stage of implementation of the LEADER instrument in

Romania, through the Local Action Groups, the following indicators were used:
-number of Local Action Groups,
-covered area,
-number of inhabitants who benefited from the interventions of the Local Action Groups,
-number of the implemented projects,
- value of the implemented projects.
The analysis covers the programming periods: 2007-2013 and 2014-2020, using the information provided by the Ministry of Agriculture and Rural Development.

RESULTS AND DISCUSSIONS

The LEADER axis in Romania, in the period 2007-2013 was based on the combination of characteristics regarding:
• territorial approach
• partnership approach
• bottom-up approach
• integrated and multisectorial approach
• innovation and experimentation
• implementation of cooperation projects
• interconnection of local partnerships.
The specifics of the LEADER implementation were given by the need for rural development of a certain territory (area) - by taking into account several types of partners (local public authorities, representatives of the private and social sector, individuals). Taking control of the development of rural areas in their own hands aimed to change the mentality of waiting for decisions at the central level, with decision-making at the local level, in which all representatives are consulted and also received the satisfaction of involvement in rural development of the respective territories. Innovative approaches based on seeking new answers to existing problems were supported, by promoting creative and innovative ways of exploiting human, natural and cultural, financial, logistical resources in compliance with environmental conditions and the principle of sustainability. The development of the communication capacity between the partners (public, social, private) has led to the improvement of the territorial coherence necessary for the development of the economy and the rural communities.
In the period 2011-2012, the territory was covered by 163 LAGs selected in two stages, based on eligibility and selection criteria, which ensured the authorization of homogeneous LAGs from a territorial, economic and social point of view and to implement a Local Development Plan that meets the needs identified at the local level. The 163 LAGs covered an area of approx. 142,000 km², representing approximately 63% of the eligible territory, consisting of communes and small towns with a maximum of 20,000 inhabitants and about 58% of the LEADER eligible population. The total financial allocation on Axis 4 was EUR 524,094,639, of which support was provided for the construction of public-private partnerships (Sub-measure 431.1), for the running costs of the LAG (sub-measure 431.2), for implementation of selected projects within the strategies (measure 4.1) and for the development of cooperation projects (measure 421) (Table 1).

Table 1. Financial allocation and number of projects contracted under the LEADER Axis

Sub-measure	Financial allocation EURO	Number of projects contracted
4.1	451,874,742	7,038
421	3,749,704	92
431.1	6,639,557	97
431.2	61,830,636	163

Source: Own data processing www.madr.ro [6].

In the territories covered by the Local Action Groups were implemented projects aimed at increasing the competitiveness of the agricultural and forestry sectors, with a financial allocation of 183,081,072 euros (of which 95,202,158 euros public expenditure and 87,878,914 euros private expenditure), projects which participated in the improvement of the environment and rural area, with a financial allocation of EUR 31,381 (of which Euro 29,498 in public expenditure and Euro 1,883 in private expenditure), as well as projects that supported the increase the quality of life and diversification of the rural economy, with a financial allocation of 268,762,289 euros (of which 220,385,078 euros public expenditure

and 48,377,211 euros from private expenditure).

Between 2014 and 2020, the aim was to cover the entire territory eligible for LEADER for a balanced territorial development, which would ensure the critical mass for the correct and efficient implementation of local development strategies and the efficiency of operating costs. Community Led Local Development (CLLD) is a way of implementation that allows local partners to develop the Local Development Strategy (LSD), based on the analysis of needs and priorities specific to the territory. In the LDS were coherently selected measures adapted to the specific priorities of the territory and capitalizing on the authentic local potential of the territory. LEADER contributes to the development of rural areas, including small towns with a maximum 20,000 inhabitants, and facilitates the implementation of projects with an innovative multisectorial and cross-cutting approach, to support the needs of the population in the LEADER eligible territory and meet the objectives of the Europe 2020 Strategy. The support provided under this measure will contribute to reducing the degree of poverty and the risk of social exclusion when developing infrastructure and services in rural areas, increasing and diversifying the number of jobs in rural areas, preserving local heritage, improving collaboration between rural actors and accessing modern ITC infrastructure.

In the current programming period 2014-2020, through measure 19 - Support for local development LEADER (CLLD - Local development placed under the responsibility of the community) in the National Rural Development Program 2014-2020, Managing Authority for the National Rural Development Program (MA NRDP) selected 239 Local Development Strategies (LDSs) that are implemented by 239 Local Action Groups (LAGs) authorized. LAGs include 2,735 communes and 142 cities with less than 20,000 inhabitants, covering 92% of the eligible area LEADER [7, 8, 9].

The LAG is an active private-public partnership, organized on the basis of Government Ordinance 26/2000 on associations and foundations, consisting of representatives of the public sector, the private sector and civil society [13], appointed from a continuous and homogeneous rural territory, who developed the Local Development Strategies (LDSs) based on the needs and priorities specific to the LAG territory. The LDS includes measures that meet local needs, contribute to EAFRD objectives and generate added value and / or economic, social, cultural and natural impact in the territory. The strategies elaborated by the LAGs are materialized in projects implemented in the territorial coverage area.

The potential beneficiaries of the financing of LEADER investment projects are private, public entities, from the territory of the LAG, established by the technical fiche of the measure described in the LDS in compliance with the provisions of the specific legislation. LAGs are also eligible beneficiaries for certain public interest operations for the community and territory identified in the SDL.

As an element of novelty, in the 2014-2020 programming period, the complementarity of the LEADER approach from NRDP 2014-2020 with the Human Capital Operational Program (HCOP) 2014-2020 regarding the social infrastructure was ensured.

Thus, LEADER finances the infrastructure component for social services "hard component", and through HCOP - Priority Axis 5 "Local development under the responsibility of the community" - Specific objective 5.2 "Reducing the number of people at risk of poverty and social exclusion from marginalized communities in rural areas and cities with a population of up to 20,000 inhabitants ", the“ soft component” services are financed, aiming at the operationalization of the social infrastructure projects financed by LEADER. The potential beneficiaries of the projects supported by HCOP, are the local authorities with responsibilities in the field, in partnership with the relevant social actors or LAGs, providers of social services under the law.

Within these integrated projects, social service providers will operate in the

infrastructure financed for this purpose by PNDR - LEADER measure.

Measure 19 has a total allocation of 637,631,674 euros, distributed to Sub-measure 19.1 "Preparatory support for the development of local development strategies", Sub-measure 19.2 "Support for the implementation of actions within the local development strategy", Sub-measure 19.3 "Preparation and implementation of activities Cooperation Group "- Component A" Preparatory Technical Assistance for LAG Cooperation Projects "and Component B" Implementation of Cooperation Activities of Selected LAGs "and Sub-Measure 19.4" Support for running costs". There is currently a contracting rate of about 80% of the total allocation (Table 2).

Table 2. Financial allocation/sub-measures, number and value of projects contracted under measure 19

sub-measure	Financial allocation NRDP 2014-2020 EURO	Projects contracted	Value Euro
Sub-measure 19.1	1,990,183	162	2,209,131
Sub-measure 19.2	495,641,759	7.181	400,199,704
Sub-measure 19.3	16,986,768	62 – Component A 65 – Component B	222,783 – Component A 3,835,586 – Component B
Sub-measure 19.4	123,013,163	478	100,298,715

Source: Own data processing www.madr.ro [7].

The number of Local Action Groups has increased compared to the previous programming period, and the area targeted by local development strategies is about 92% of the total eligible area (total communes and cities up to 20,000 inhabitants) and about 86% of the LEADER eligible population, with a positive impact on the development of local communities and rural areas in Romania. Also, in the current programming period, LAGs benefit from an increased allocation [6, 8]. (Table 3)

Table 3. The comparative situation of the allocation and number of LAGs between the programming periods

	NRDP 2007-2013	**NRDP 2014-2020**
	EURO	**EURO**
Financial allocation	524,094,639	637,631,873
No. LAG	163	239

Source: Own comparison based on the data from [6, 8].

CONCLUSIONS

LEADER is an important instrument for Romania in increasing the economic and social development of rural areas, reducing urban-rural disparities and promoting social inclusion.

The current situation reflects a capacity for development at local level that does not fully meet local needs, especially in terms of collaboration between public and private partners.

The strategic approach must be encouraged and developed by placing it under the responsibility of the community.

Compared to the previous programming period, the number of Local Action Groups has grown, and about 92% of the eligible area is destined for the implementation of the local development strategies.

Also, a positive impact on the local communities and rural areas is going to have 86% of the LEADER eligible population.

All these aspects prove the effectiveness of the implementation of LEADER for assuring the development of the rural areas.

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This analysis was based on data available from the Ministry of Agriculture and Rural Development, as well as those available on the website of the National Rural Development Network and the European Commission.

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THE ROLE OF LOCAL ACTION GROUPS IN RURAL ROMANIA IN THE PERIOD 2011-2021

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Abstract

The paper aims to present the role of Local Action Groups in rural Romania in the period between 2011 and 2021. It is based on data available at the MADR level and the following indicators were used: no. of LAGs, area and population covered by LAGs, types of investments, number and value of investments. During the examined period there was an increase in the number of LAGs, investments made locally from non-reimbursable European funds which led to improved living conditions in rural areas through quality infrastructure and basic services and job creation LAGs participate in developing and strengthening the role of local governance through the involvement of public authorities, the private sector and civil society in community-based decision-making.

Key words**:** *Local Action Group, rural development, local governance*

INTRODUCTION

LAGs are non-governmental organizations working at the level of local communities. These partnerships are legally established as associations based on Government Ordinance 26/2000 on associations and foundations and have as their main purpose the socio-economic development of a delimited territory consisting of communes and small towns with up to 20,000 inhabitants. LAGs can be financed from various sources at local level, there is also the possibility to use European non-reimbursable funds from the EAFRD [10, 12, 16].

To be eligible for financial support, these organizations must consist of at least 51% representatives of the private environment and civil society, urban organizations must represent a maximum of 25% at the decision-making level, to develop and implement a Local Development. This strategy must target a homogeneous territory, with a population between 10,000 and 100,000 inhabitants. Considering the low population density in the Danube Delta area, a minimum threshold of 5,000 inhabitants is accepted for this area [7, 8].

Since Romania's entry into the EU, in 2007, the LEADER instrument has been applied at the local level. The role of LAGs in implementing the bottom-up approach has been the subject of several studies, being a new concept for Romania [1, 2, 3, 4, 9, 11, 13, 16].

In this context, the paper aimed to present the role of Local Action Groups in rural Romania in the period between 2011 and 2021.

MATERIALS AND METHODS

In order to present the role of LAGs at the level of local communities in rural areas, the following indicators were used:

-number of LAGs,
-area and population covered by LAGs,
-types of investments,
-number and value of investments.

The reference period was 2007-2021.

The data available at the level of the Ministry of Agriculture and Rural Development were taken over and processed to demonstrate the role of LAGs in rural areas.

RESULTS AND DISCUSSIONS

In Romania, the LAGs were created starting with 2011, when through PNDR 2007-2013 - Axis IV LEADER, 163 partnerships were selected. They elaborated and implemented

local development strategies that targeted an area of approx. 142,000 km², representing approximately 63% of the eligible territory and approx. 58% of the LEADER eligible population. Between 2011 and 2015, through the LAGs, approximately EUR 454 million was spent from the EAFRD for the benefit of local communities [5, 14, 15].

Each LAG had at its disposal approximately 2,850,000 euros. Some of these resources (20%) were used for the LAG's running costs, strengthening the administrative capacity of the LAG team and for territorial animation. The rest was directed to investments in the territory, being implemented 7,038 projects with a public value of 355,289,430 Euro.

The main investments were:

- increasing the competitiveness of the agricultural and forestry sectors: projects contracted with a value of 115,722,910 Euro, of which 52.51% (62,039,220 Euro) were for the installation of young farmers.
- quality of life in rural areas and diversification of the rural economy: projects contracted with a value of 239,566,520 Euro, of which 70.76% (172,566.94 Euro) were for renovation, development of villages, improvement of basic services for the economy and population rural development and the enhancement of rural heritage. [5, 8, 14, 15] (Figure 1).

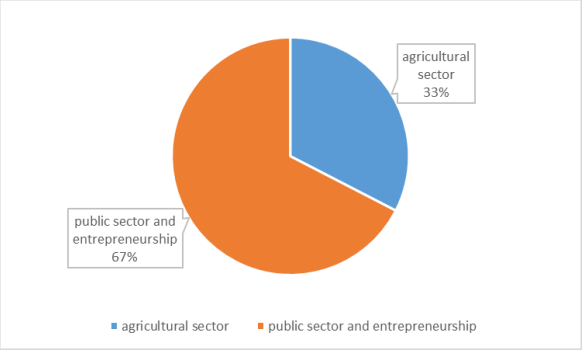

Fig. 1. Distribution of funds used by LAGs 2007-2013
Source: Own data processing www.madr.ro [5].

In the 2014-2020 programming period, through measure 19 - LEADER local development - NRDP, 239 LAGs were selected that implement local development strategies on a territory covering 92.25% of the LEADER eligible area and 86.18% of the population targeted by LEADER. The LAGs have 637,631,674 euros at their disposal to cover operating costs, cooperation projects and local investments [6, 7, 8, 14, 15] (Table 1).

Table 1. Distribution of the allocation of measure 19 NRDP 2014-2020

Type of expenses	**Financial allocation NRDP 2014-2020 EURO**
Preparation of strategies	1,990,183
Local investments	495,641,759
Cooperation projects	16,986,768
Operating expenses	123,013,163

Source: Own data processing based on the data from MARD, www.madr.ro [7].

The investments were mainly pointed at developing non-agricultural activities, improving the economic performance of all agricultural holdings, and facilitating farm restructuring and modernization, in particular with a view to increasing market share and market orientation, as well as diversifying agricultural activities and promoting social inclusion, poverty reduction and economic development in rural areas.

Considering the results obtained at the local level in the 2007-2013 programming period, for the current period the allocation for the LEADER Measure has been supplemented. Thus, LAGs have a generous source of funding to cover the needs identified in the territory (Table 2).

Table 2. Comparative allocation situation for LEADER programming period

Type of expenses	**Financial allocation NRDP 2007-2013 (Euro)**	**Financial allocation NRDP 2014-2020 (Euro)**
Preparation of strategies	6,639,557	1,990,183
Local investments	451,874,742	495,641,759
Cooperation projects	3,749,704	16,986,768
Operating expenses	61,830,636	123,013,163
TOTAL	524,094,639	637,631,873

Source: Own data processing based on the data from MARD, www.madr.ro [6].

LAGs are responsible for developing and implementing a local development strategy

that includes a coherent set of operations in order to meet local objectives and needs and that leads to smart, sustainable and inclusive growth.

To address local needs LAGs must meet the following tasks as mentioned by the EU regulations, EU Parliament legislation and National Rural Development Program 2014-2020 [3, 4, 6]:

-"building the capacity of local actors to develop and implement operations including fostering their project management capabilities.

-drawing up a non-discriminatory and transparent selection procedure and objective criteria for the selection of operations, which avoid conflicts of interest, ensure that at least 50 % of the votes in selection decisions are cast by partners which are not public authorities, and allow selection by written procedure;

-ensuring coherence with the community-led local development strategy when selecting operations, by prioritising those operations according to their contribution to meeting that strategy's objectives and targets;

-preparing and publishing calls for proposals or an ongoing project submission procedure, including defining selection criteria;

-receiving and assessing applications for support;

-selecting operations and fixing the amount of support and, where relevant, presenting the proposals to the body responsible for final verification of eligibility before approval;

-monitoring the implementation of the community-led local development strategy and the operations supported and carrying out specific evaluation activities linked to that strategy.

-drawing up a non-discriminatory and transparent selection procedure and objective criteria for the selection of operations, which avoid conflicts of interest, ensure that at least 50 % of the votes in selection decisions are cast by partners which are not public authorities, and allow selection by written procedure;

-ensuring coherence with the community-led local development strategy when selecting operations, by prioritising those operations according to their contribution to meeting that strategy's objectives and targets;

-preparing and publishing calls for proposals or an ongoing project submission procedure, including defining selection criteria;

-receiving and assessing applications for support;

-selecting operations and fixing the amount of support and, where relevant, presenting the proposals to the body responsible for final verification of eligibility before approval;

-monitoring the implementation of the community-led local development strategy and the operations supported and carrying out specific evaluation activities linked to that strategy" [3, 4, 6].

CONCLUSIONS

The LAG is a coagulation factor between local actors: public authorities, entrepreneurs, farmers and civil society, strengthening local governance. Applying the bottom-up approach, it manages to identify the common problems of a territory and to find solutions for them, by involving the population. Access to non-reimbursable funding is an advantage that the LAG leverages for the benefit of the community.

The LAG has an important role in highlighting the local, traditional potential, facilitates for rural residents' access to new information and ideas, exchange of experience and learning from the experience of other regions or countries, to stimulate and support innovation, to acquire skills and improving them.

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ASSESSMENT OF ECONOMIC ACTIVITY OF THE RURAL POPULATION BY AGE AND GENDER GROUPS: A CASE STUDY OF UKRAINE

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Abstract

In the article we proved that the transformations taking place in the labour market lead to radical changes in the economic activity and inactivity of the rural population, which requires additional analysis and finding ways to address existing disparities. In the research we grouped the regions of Ukraine by the level of economic activity of the rural population in 2019 at the age of 15-70 years and in working age, the results of which are presented in the form of cartograms The results of the analysis revealed that the level of education has a stronger positive impact on the level of economic activity of women. This means that education is more important for women in terms of improving their position in the labor market. The article has proven that currently, the level of economic activity of the rural population and the rural labour market in Ukraine remain underdeveloped, need constant change and adaptation to world standards. In modern conditions, the main factors influencing the processes taking place in the rural labour market are: structural adjustment of the economy, in particular the predominant development of agriculture; accelerated economic growth; building the potential of entrepreneurship; scientific and technological progress, digitalization of society; state regulation of labour potential development, labour market, and employment.

Key words**:** *rural population, economic activity, rural development, economically inactive rural population, gender groups, working age*

INTRODUCTION

Indicators of economic activity occupy an important place in the system of criteria for the effectiveness of economic development of the rural population and reflect the general economic situation at the level of the agricultural sector. In Ukraine, the situation in the field of economic activity of the rural population is quite problematic. The difficult situation with the efficient use of labour is due not only to the growth of agricultural efficiency but also to the formation of the labour market. The prolonged economic crisis in the field of agricultural production has led to significant changes in the living standards of the rural population of Ukraine, which has manifested itself in declining incomes and increasing informal employment. The crisis has led to a reduction in the number of employees. On the other hand, the intensive development of large agricultural holdings, which has been observed since 2019, also does not contribute to the growth of employment. On the contrary, the growth of incomes of large agricultural enterprises stimulates them to make large investments in equipment upgrades and the introduction of innovative technologies, which on the one hand significantly reduces the overall need for labour, and on the other – increases the demand for highly skilled workers.

In general, in the agricultural sector, there is a reduction in the number of people employed directly in agriculture, which significantly affects the lifestyle of people living in rural areas. Thus, the problems of adaptation of the rural population to changes in external conditions are accompanied by a significant transformation in the field of economic activity, in particular - when the age structure of those employed in agriculture changes. Accordingly, the solution of current problems in the field of economic activity of the rural

population of Ukraine is quite relevant, which necessitates the study and analysis of its specifics.

Many works and specific scientific researches are devoted to the research of problems of economic activity and employment in the agrarian sphere. Their results are widely covered in the works of such leading scientists as O. Agres [1], O. Apostolyuk [2], S. I. Bandur [3], D. Bohynia [4], O. Bugutskyi [5], V. S. Diiesperov [7-8], M. Dziamulych [9-12], Yu. Ya. Luzan [17], P. M. Makarenko [18], L. O. Marmul [19], V. M. Oliinyk [21], A. Popescu [22-33], M. S. Riabukha [34], T. Shmatkovska [36-38], R. Sodoma [39], O. Stashchuk [40-41], I. N. Tofan [42], I. Tsymbaliuk [43], V. Yakubiv [44], Ya. Yanyshyn [45], O. Yu. Yermakov [46], I. Zhurakovska [47] and others.

Despite the complex set of problems considered in the works of leading economists, it should be noted that much of this work is devoted to the problems of income and unemployment of the rural population. At the same time, the transformations taking place in the labour market lead to radical changes in the economic activity and inactivity of the rural population, which requires additional analysis and finding ways to address existing disparities.

Given the scientific achievements of these scientists, it should be noted that identifying problems of economic activity or inactivity of rural residents, their distribution by appropriate groups, analysis of factors affecting the level of unemployment and working capacity of peasants requires further research. All this requires a detailed analysis of the situation and the development of recommendations for improving the efficiency of the economically active population of rural areas.

MATERIALS AND METHODS

To select the most effective methods of managing such socio-economic phenomena as economic activity of the population, its employment, and unemployment, as well as for their correct characterization, it is important to adequately assess them. Unemployment and employment are very complex and multifaceted phenomena, so they need to be characterized from different angles and by various indicators [16].

According to the recommendations of the International Labour Organization (ILO), the entire population aged 15-70 is divided into three mutually exclusive and exhaustive categories: employed, unemployed, economically inactive (Fig. 1).

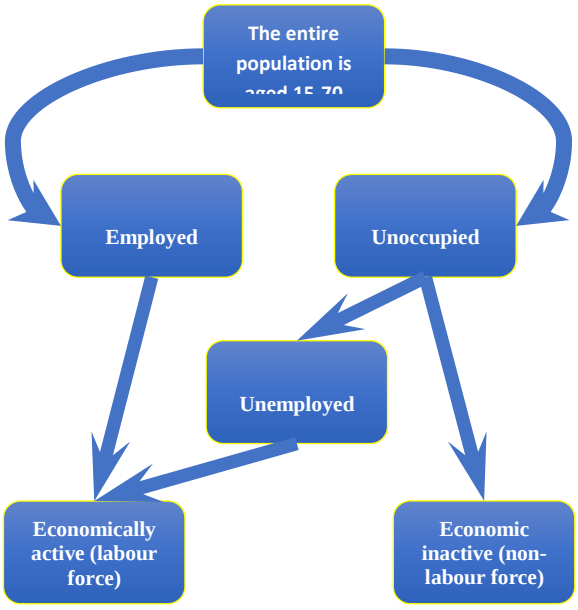

Fig. 1. The structure of the economically active rural population according to the methodology of the International Labour Organization

Source: generalized and systematized based on [15].

The number of the economically active rural populations is an absolute indicator of economic activity, which reflects its size. This indicator quantitatively reflects the labor potential of the country`s population. However, little can be said about the economic activity of the country`s population, operating on only one indicator. To assess economic activity, it is important to know how this indicator changes in dynamics, how large or small it is for the entire population. Relative indicators are used for this purpose [16].

The economically inactive rural population (persons who are not part of the labor force) are persons aged 15-70 who did not belong to the employed or unemployed population during the surveyed week [13].

The economically inactive population includes pupils and students, pensioners, persons receiving disability pensions, persons engaged in housekeeping; persons who have stopped looking for a job, having exhausted all possibilities of obtaining it, but who can and are ready to work; other persons who do not need to work regardless of the source of income [19]. However, it should be noted that the labor market has a highly dynamic nature, so we should consider not only the number of each group for a certain period of time but also the movement (flows) of people between different groups [8].

The level of economic activity of the rural population is its relative indicator, which reflects its "popularity" compared to other types of activity (inactivity). It is calculated as the ratio of the economically active population (P_{ea}) to the total population aged 15-70 years ($P_{15\text{-}70}$):

$$L_{ea} = \frac{P_{ea}}{P_{15-70}} \times 100$$

The economically active population of rural areas can be divided into two categories - employed and unemployed. Employees include persons of both sexes between the ages of 15 and 70 who, during the period under review, performed hired work for remuneration (money or payment in kind), as well as other work that brought income; were temporarily absent from work due to illness or injury, days off, annual leave, leave both with and without maintenance, time off, leave at the initiative of the administration, strike and other reasons; performed work without pay at the family business [14].

The employment rate is a relative indicator of it, which shows its prevalence among adults. It is calculated as the ratio of the employed population (P_{ea}) to the total population aged 15-70 years:

$$R_e = \frac{P_e}{P_{15-70}} \times 100,$$

The number of unemployed (P_{ue}) is an absolute indicator of unemployment, which reflects its size. To assess unemployment, it is also very important to know how this indicator changes in relation to past periods, as well as how widespread this negative phenomenon is in society. Relative unemployment rates are used for this purpose.

The unemployment rate (R_{ue}) is a relative unemployment rate that shows its prevalence among the economically active population. It is calculated as the ratio of the number of unemployed to the number of the economically active population (P_{ea}):

$$R_{ue} = \frac{P_{ue}}{P_{ea}} \times 100,$$

The analysis of the given economic indicators provides an opportunity to estimate losses from the incomplete use of labour resources due to unemployment [16].

The distribution of the employed population by types of economic activity is carried out on the basis of a comprehensive assessment by integrating data from a sample survey of the population, state statistical surveys of enterprises, institutions, organizations, and administrative reporting.

RESULTS AND DISCUSSIONS

Note that the agricultural population directly related to agriculture, which provides the economically active, and those who are dependent on them, can be considered only 2.6 billion people, or 38% of the world`s population. Of these, about 2 billion people lived in Asia, 0.5 billion – in Africa. The share of economically active (employed and job seekers) in agriculture is about 40% of the total number of economically active. In developed countries, the share of the population whose livelihoods are directly related to agriculture is 4%, in developing countries – 45%, and in the least developed countries - 66%. The share of economically active in agriculture is 4%, 48%, and 65%, respectively [16].

The rural population in Ukraine is the basis for the formation of the labour force in the agricultural sector of the economy, the number of which is significantly reduced due to negative socio-economic and demographic

processes. According to official statistics, the total population of Ukraine is 42.1 million permanent residents. Note that of the rural residents – about a third. If we estimate the indicators of 2018, the rural population in Ukraine for 10 years decreased by about 16%. Economically active rural population – about 16%. The employment rate of the rural population in 2019 in Ukraine was 62.2%, urban – 68.2%. The total number of people employed in agriculture is 2.9 million. The unemployment rate among the rural population in Ukraine is currently 10.9%.

Note that agriculture in Ukraine employs about 16.7% of the economically active population. For comparison: in US agriculture, in the G7 countries and in Japan, 2.5, 4.7 and 7.2% of the population are employed, respectively.

It should be noted that only employment, the income from which allows not only the basic reproduction of the workforce but also provide an opportunity for the educational, professional, cultural, and spiritual development of the employee at a cost that is acceptable to the employer from the standpoint of effective activity, can be considered productive. In Ukraine, the level of social capital is extremely low, unsatisfactory condition with the access of the rural population to social infrastructure and social services, there is a demographic crisis, increasing migration of rural population to cities and abroad in search of proper work and wages, living conditions. According to official data, the number of migrant workers in Ukraine is about 7% of the socially active population. Thus, according to unofficial estimates, the number of migrant workers from rural areas reaches 2 million people.

According to the results of the analysis of official data obtained from the State Statistical Service of Ukraine, we analysed the dynamics of indicators on the economically active rural population by gender groups and the level of economic activity in 2017-2019 (Table 1).

According to the results of the study, the economically active rural population in Ukraine is declining every year, namely – in 2018 the female rural population aged 15-70 years compared to 2017 decreased by 863.7 thousand people, and the male rural population – by 959.3 thousand people. In 2018-2019, the economically active female rural population aged 15-70 decreased by 85.2 thousand people and the male rural population – by 57.6 thousand people.

Table 1. Dynamics of the economically active rural population in Ukraine by the level of economic activity and gender groups in 2017-2019

Indexes	2017		2018		2019		Absolute deviation (women)		Absolute deviation (men)	
	Women	Men	Women	Men	Women	Men	2017-2018	2018-2019	2017-2018	2018-2019
Economically active rural population (thousand people):										
At the age of 15-70 years	9,428.3	10,492.6	8,564.6	9,533.3	8,479.4	9,475.7	863.7	-85.2	959.3	57.6
Working age	8,878.4	10,156.8	8,180.9	9,215.1	8,142.9	9,160.7	697.5	-38.0	941.7	54.4
The level of economic activity of the rural population (%):										
At the age of 15-70 years	56.1	69.3	56.2	69.2	55.9	69.1	0.1	-0.3	-0.1	-0.1
Working age	66.5	76.4	66.5	76.7	65.4	77.0	0.0	-1.1	0.3	0.3

Source: Built and systematized based on [13].

The level of economic activity of the rural population of Ukraine in the studied period fluctuates. In particular, in 2018, for the rural female population aged 15-70, the studied indicator increased by 0.1%, and for men – decreased by 0.1%. In 2019, compared to the previous year, the level of economic activity of the rural population in Ukraine aged 15-70 decreased by 0.3% for women and by 0.1% for men.

It should be noted that the level of economic activity of the rural population is influenced by a set of factors, among which it is expedient to highlight the reduction in the number of small and medium-sized businesses, reducing the level of social support at the state level as a whole.

In general, for rural residents in Ukraine, the indicator of economic activity is not high enough, which indicates a lack of activity of the population in search of work.

A decrease in such categories of the population as the number of the economically active and employed population (as well as the level of economic activity and employment) means a decrease in resources for labour, i.e. this is an undesirable trend for the economy of any country.

We analysed the level of economic activity of the rural population of Ukraine and one of the countries closest to the territory and borders with Ukraine (namely Poland) by age and gender groups in 2019 (Figs. 2, 3).

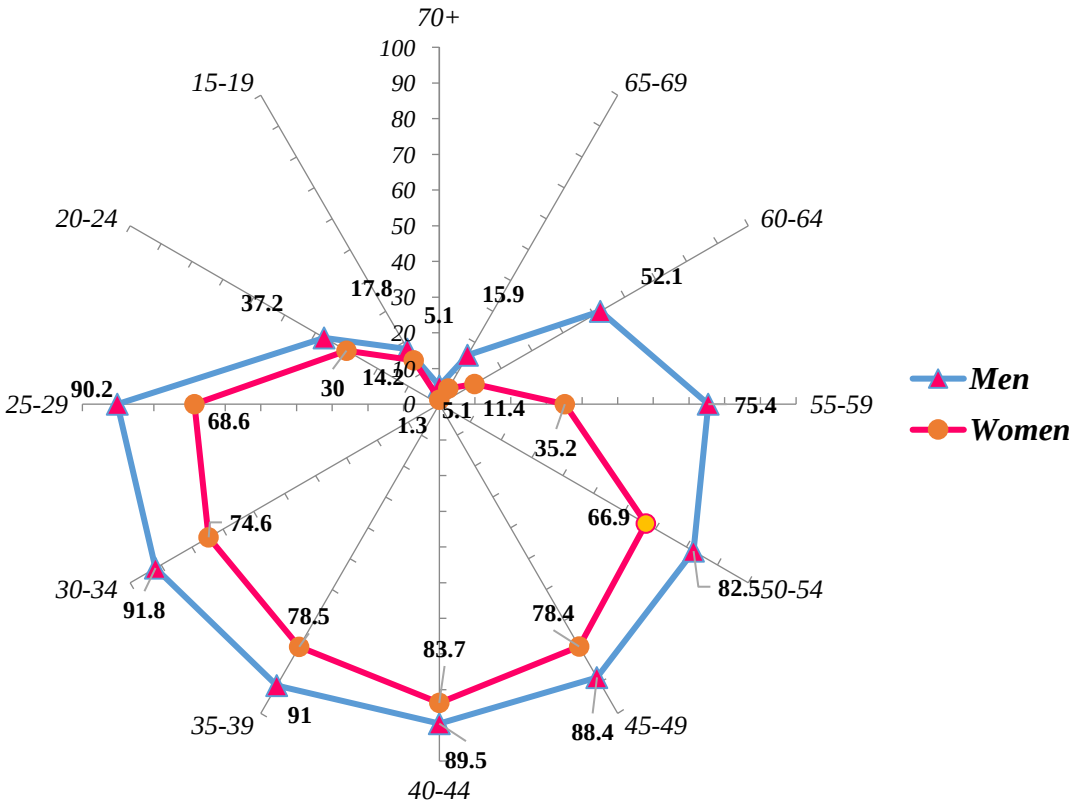

Fig. 2. The level of economic activity of the rural population of Ukraine by age and gender groups in 2019, %
Source: Own development based on [13].

According to the analysis, the lowest level of economic activity of the rural population in Ukraine is typical for people aged 15-19, in particular for rural women of this age group it was – 14.2%, and for rural men – 17.8%.

The most active in the search for work in Ukraine is the male rural population aged 30-34 years and aged 35 to 39 years. The highest level of economic activity of the rural population of women is in the age group of 40-44 years – 83.7% (Fig. 2).

The analysis of the factors influencing the level of economic activity of the rural population by gender groups showed that the growth of economic activity of the female population, in contrast to the male population, is negatively affected by the number of children. This result is explained by the fact that it is the rural women who bear the main burden associated with raising children.

To compare and contrast the identified dependencies, we analysed the level of economic activity of the rural population by

age and gender groups in 2019 in one of the countries closest to the territory and bordering Ukraine, namely Poland (Fig. 3).

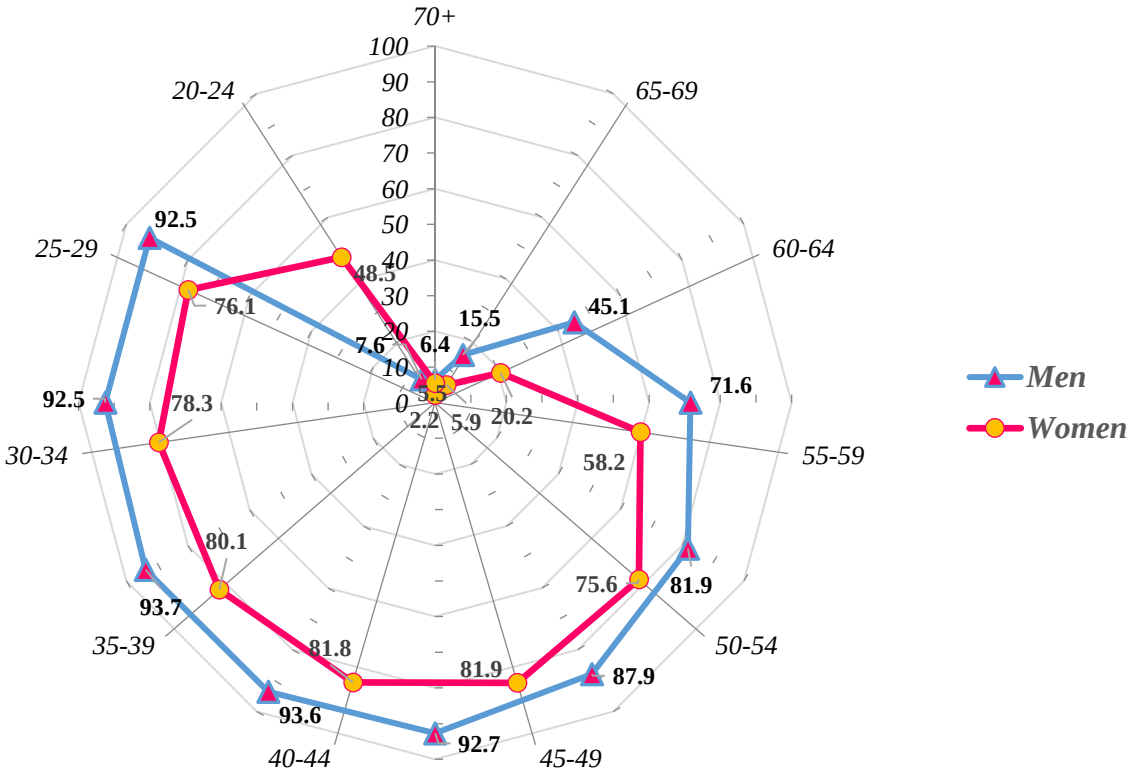

Fig. 3. The level of economic activity of the rural population of Poland by age and gender groups in 2019, %
Source: Own development based on [13].

In particular, it was found that the highest level of economic activity of the rural male population in Poland falls on the age groups of 30-34 and 35-39 years (93.7% and 93.6%, respectively). The lowest level of economic activity of the male rural population is in Poland for the age groups 15-19 years and 70+ years (6.4%).

It was found that the level of economic activity of the rural female population in Poland is slightly different from that in Ukraine, namely - the highest level of economic activity of the rural female population in Ukraine falls on the age group 40-44, and in Poland, the age group with the highest economic activity rural population is extended to 49 years (Fig. 3).

The study suggests that the positive impact of age and the negative impact of the status of pensioner and pupil (student) is observed for both men and women. This indicates that the structures of factors influencing economic activity in men and women are similar in both Ukraine and Poland.

The high level of female employment has led women to behave in the same way as men when making decisions about economic activity. According to the results of the study, the activity of men in the labour market depends to a greater extent on economic factors, and women - on socio-demographic.

According to the results of the study, a larger share of rural residents in Ukraine in the absence of paid work relies solely on personal farming. These are mostly people between the ages of 50 and 59. On average, 56.7% of men and 44.6% of unemployed women in all age groups participate in farming. Young people under the age of 24 consider employment in the peasant economy to be a help to the older generation; 78% of young people participate in farming only in their spare time. However, people in this age group, who consider employment in farms to be their main activity, spend an average of 29 hours a week running such farms. Given that 63% of men and 64% of women in the relevant categories have paid work, it can be concluded that personal

farming provides the bulk of employment in the rural population.

59.6% of the rural population of Ukraine combines the main work with participation in the peasant economy [46].

We compared the level of economic activity in Ukraine and countries with developed economic systems and a high level of social protection of the rural population (on the example of Great Britain) (Fig. 4, 5).

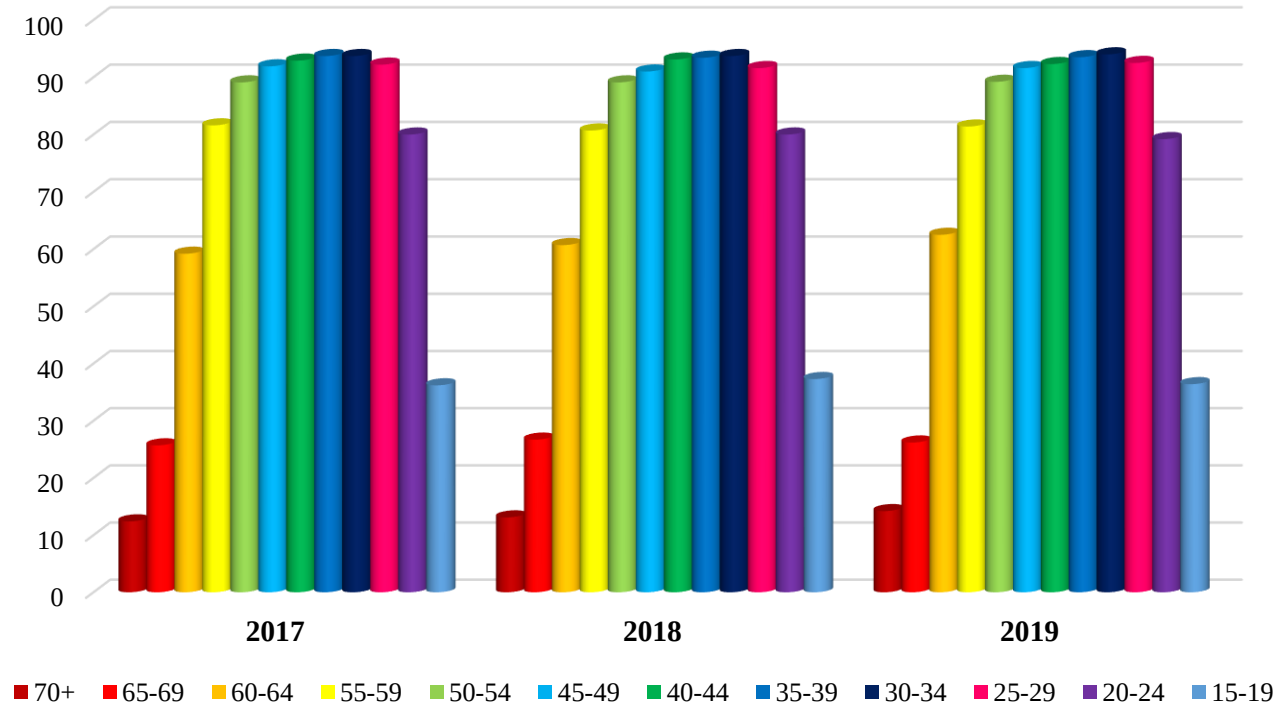

Fig. 4. Dynamics of the level of economic activity of the rural population by age groups in the UK for 2017-2019, men, (%)

Source: Built and systematized based on [13].

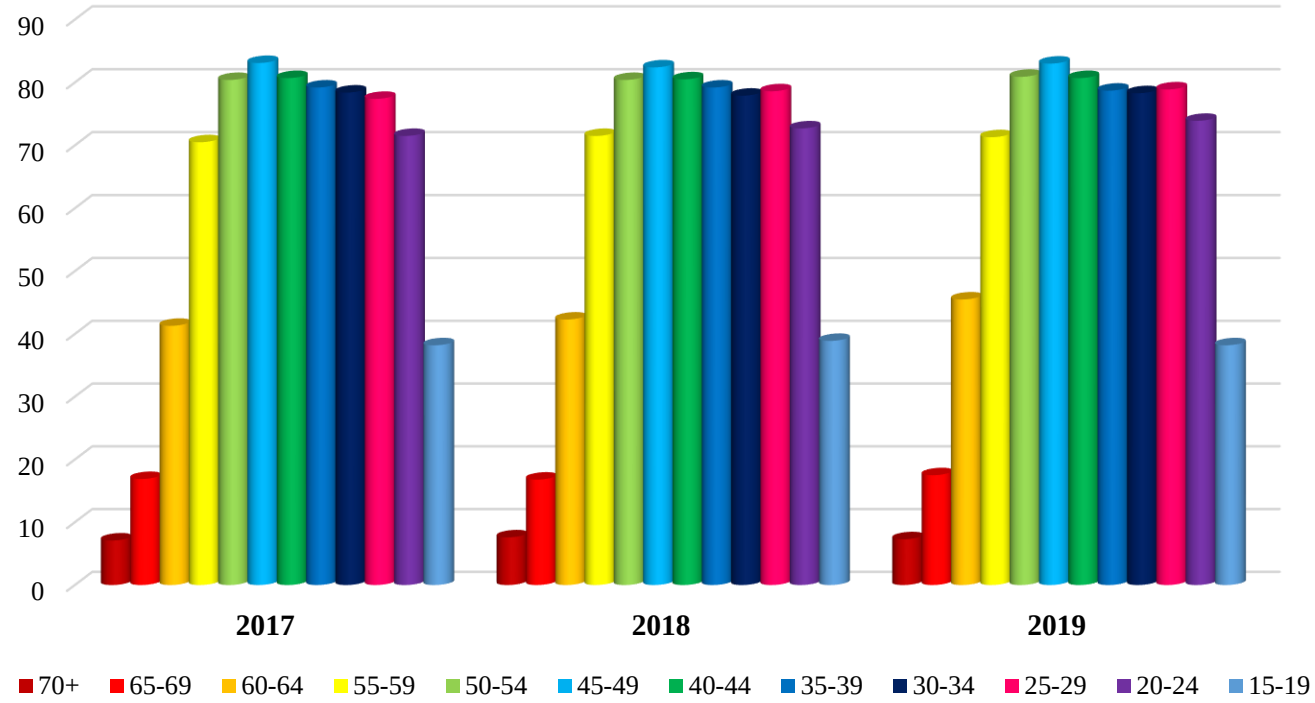

Fig. 5. Dynamics of the level of economic activity of the rural population by age groups in the UK for 2017-2019, women, (%)

Source: Built and systematized based on [13].

According to the results of the study, the highest level of economic activity among the male rural population in 2017-2019 in the UK is observed in the age groups of 30-34 and 35-39 years and in the dynamics – increases slightly (Fig. 4).

Regarding the female rural population in the UK for 2017-2019, it was found that the highest level of economic activity in the study period is observed for the age groups 45-49 years and 50-54 years (Fig. 5). Thus, we found a differentiation by gender and age groups in terms of economic activity of the rural population in Ukraine and the United Kingdom. Particularly significant differentiation is observed for the age group 50-54 years in both men and women. In Ukraine, the level of economic activity of the rural population of this age group is significantly lower compared to the same period in the UK and slightly lower compared to Poland (Fig. 2, 3, 4, 5).

In conclusion, it should be noted that the high level of social protection in the UK allows showing a significant level of economic activity of the rural population in the age group 50-54 years. In Ukraine, social standards do not allow the rural population of this age group to show the same high economic activity, which causes and causes additional economic losses from insufficient use of labour potential of the rural population. Such a negative situation in Ukraine requires the development of measures to improve it and special attention from specialized scientific structures and relevant government agencies.

We grouped the regions of Ukraine by the level of economic activity of the rural population in 2019 at the age of 15-70 years and in working age (Figs. 6, 7).

According to the results of the analysis of our cartogram, a high level of economic activity of the rural population in Ukraine in 2019 is observed in agricultural regions with quality soils and good climatic conditions (Kherson, Mykolaiv region), which significantly contributes to agricultural development in this area and in regions with large urban centres, where pendulum labour migration of the rural population has become quite high (Lugar, Kharkiv, Zhytomyr regions) (Fig. 6. 7).

Fig. 6. Cartogram of the grouping of regions of Ukraine by the level of economic activity of the rural population in 2019 at the age of 15-70 years, %

Source: Built and systematized based on [13].

Thus, and the results of the study, it should be noted that the economic system of Ukraine due to high openness is strongly influenced by global development trends. In the field of rural employment, the key features are deagrarization and diversification of the rural economy, multi-vector migration of labour flows. Identified domestic trends in the development of the rural labour market indicate the preservation of these features in the future.

Fig. 7. Cartogram of the grouping of regions of Ukraine by the level of economic activity of the rural population of working age in 2019, %
Source: Built and systematized based on [13].

Universal recommendations for effective employment for different rural settlements are quite difficult to identify. However, if those located near large urban centres benefit significantly from such a neighbourhood through pendulum labour migration and diversification of their economies, remote rural settlements are exposed to significant risks, leading to the gradual decline of the economy of such rural settlements.

We believe that the raster polarization of the development of the economy of rural settlements in Ukraine will increase in the future, so it is the latter (remote areas) that should become the object of state influence aimed at solving the problem of rural employment. In our opinion, the best solution to this problem may be to support the development of local economic systems that unite several rural settlements. The advantage of such a scenario is, first of all, the reduction of dependence on the urban economy of highly urbanized centres, as well as the expansion of opportunities by combining the potential of individual rural settlements, which allows more fully and quickly implement a diversified rural development scenario.

At the same time, there will be a strengthening of intra-village communications and connections, including pendulum labour migration between different rural settlements, which creates not only certain challenges (due to the need to improve the quality of transport) but new opportunities, additional employment in transport services,

maintenance of transport networks, etc.). Separately, we note the need to create a favourable environment for the employment of rural women in remote rural areas, which can be implemented by supporting the development of crafts, handicrafts, rural tourism, and more.

Indicators of employment and unemployment are the main characteristics of the socio-economic situation of the country and the state of the labour market. Unemployment is the most acute problem in rural areas, which significantly suppresses the economic activity of the rural population. Although compared to the unstable dynamics of the unemployed population in cities, the number of unemployed peasants in the last three years in Ukraine remains almost unchanged. The registered unemployment rates do not fully reflect its real size. The group of persons belonging to the unemployed according to the criteria of the International Labour Organization is much broader and extremely heterogeneous in terms of the economic interests of its members. Among them may be both those who are desperate to find a job and those who only theoretically intend to find a permanent job [7].

At the next stage of the analysis, we consider it appropriate to investigate in more detail the structure of the economically inactive rural population in Ukraine, in particular women due to unemployment in 2019 (Fig. 8).

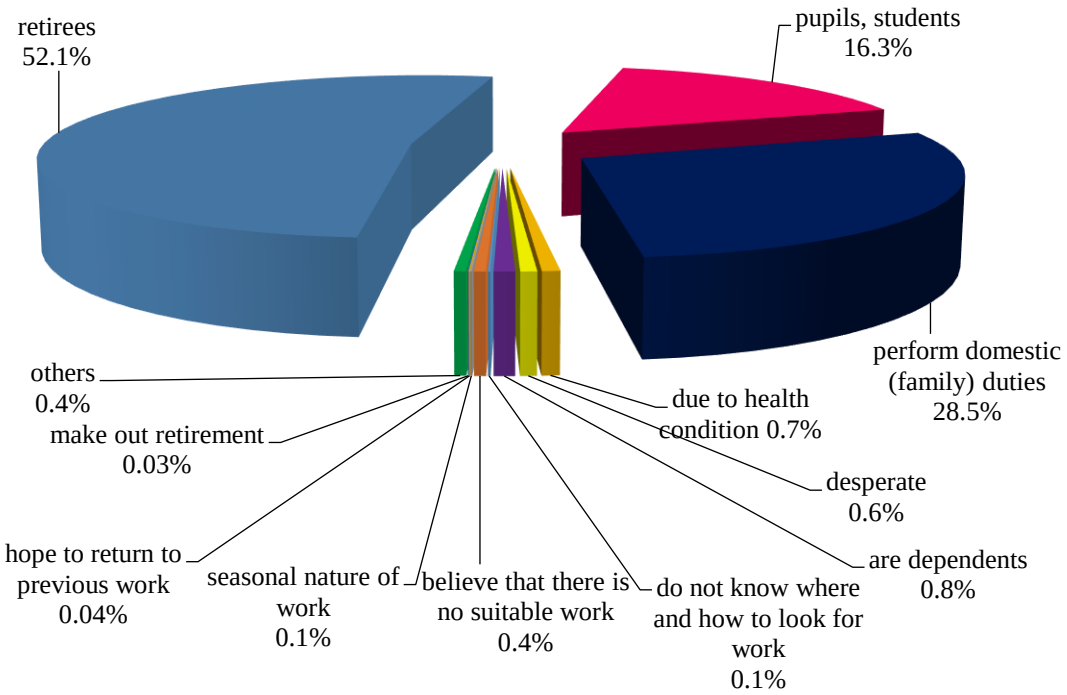

Fig. 8. Structure of economically inactive rural population in Ukraine by reasons of unemployment in 2019, women (%)

Source: Generalized and built on the basis of systematization of sources [6; 13]

According to the results of the study, the largest share in the structure of the economically inactive female population in rural areas due to unemployment is occupied by persons of retirement age – 52.1%, as well as women who perform domestic (family) duties – 28.5% and students and students – 16.3%. This situation is due to the fact that these age groups of the rural population are the least competitive in the rural labour market. The share of the economically inactive female population in rural areas for other reasons of unemployment is quite low and does not exceed 1%, therefore, their role in shaping the total number of the

economically inactive female rural population is not significant enough.

Thus, the results of the analysis revealed that the need to expand opportunities for the formation of conditions for employment of the rural female population, which largely performs domestic (family) responsibilities (in particular, to a greater extent than the male rural population), as well as those who study at the same time and want to get a job in order to earn extra income.

To get an idea of the economic activity of rural residents in Ukraine, it is also necessary to assess their ability to show labour, economic and entrepreneurial activity. Ukraine's labour potential is characterized not only by the degree of activity of the population in search of work. In a competitive market economy, it is especially important to take into account the quality of labour resources, which is primarily due to the level of education of the population.

For a more thorough analysis of the economically active population by gender, it is necessary to pay attention to another major factor in the formation of the active population of Ukraine, this factor is education. The analysis of the economically active rural population in Ukraine by the level of education is presented in Table 2.

Table 2. Dynamics of economically active rural population aged 15-70 by education and gender groups in Ukraine in 2017-2019, %

Researched indicators	Economically active rural population aged 15-70 years. %							
	Research period. years	By education level						
		full higher	basic higher	incomplete higher	professional and technical	complete secondary	basic secondary	initially general or have no education
The entire rural population	2017	30.8	1.2	20.1	26.5	19.3	2.1	0.08
	2018	31.6	1.3	19.5	26.2	19.3	2.0	0.08
	2019	31.8	1.2	19.5	26.6	18.9	1.9	0.07
including from the entire rural population, %:								
Women	2017	16.4	0.6	11.7	8.9	8.7	0.9	0.04
	2018	16.8	0.7	11.4	8.8	8.7	0.9	0.04
	2019	16.7	0.6	11.5	9.1	8.5	0.8	0.03
including from the entire rural population, %:								
Men	2017	14.4	0.6	8.3	17.5	10.6	1.2	0.04
	2018	14.8	0.6	8.1	17.4	10.6	1.2	0.04
	2019	15.1	0.6	8.1	17.5	10.3	1.1	0.04

Source: Systematized and built based on [13].

The results of the survey show that starting from the age group of 25–29 years, the share of people with secondary vocational education predominates in the structure of education of rural residents. In second place – general secondary education, but among the inhabitants of villages aged 50 to 59 years and older, the share of those who do not have general secondary education is increasing.

Thus, the results of the analysis revealed that the level of education has a stronger positive impact on the level of economic activity of women [20]. This means that education is more important for women in terms of improving their position in the labor market. Trends in the impact of health on participation in the labor force are the same for both men and women, but with the deterioration of

health, the level of economic activity of men decreases more [35].

It was found that for the younger generation of rural residents there is a tendency to increase the proportion of people with higher education. Obviously, higher education is becoming not only more popular but also more accessible to rural people. At the same time, both young people (13% of them have incomplete higher education) and mature people aged 40 to 49 receive higher education. For workers of this age, the incentive to pursue higher education is to extend their employment and possibly increase their wages before retirement. Among those with higher professional education, the age group from 30 to 39 years predominates, their share is 32.1% [34]. Among people with different levels of education, differences in employment are insignificant. Even those who have a high professional qualification do not show increased activity in organizing their own business but prefer to work for hire.

CONCLUSIONS

Currently, the level of economic activity of the rural population and the rural labour market in Ukraine remain underdeveloped, need constant change and adaptation to world standards. In modern conditions, the main factors influencing the processes taking place in the rural labour market are: structural adjustment of the economy, in particular the predominant development of agriculture; accelerated economic growth; building the potential of entrepreneurship; scientific and technological progress, digitalization of society; state regulation of labour potential development, labour market, and employment. Among the tools for regulating the rural labour market, the most promising are those that take into account the objective impact of global trends and are aimed at boosting innovative employment, entrepreneurial activity, ensuring a balanced market of educational services and the rural labour market, forecasting the volume and structure of supply and demand labour, increasing the competitiveness of professionals and expanding the range of decent jobs with a sufficient level of wages for the rural population.

At the same time, a comprehensive state and regional policy in Ukraine to ensure the implementation of economic activity of the rural population at a sufficient level should include the implementation of measures to create additional jobs in rural areas, improve tax legislation to develop entrepreneurship in agricultural and non-agricultural activities, increasing the actual level of employment of the rural population.

According to the results of the study, the development of organic agriculture in the world has shown a number of benefits for increasing economic activity of the rural population, which can be implemented in Ukraine, including job creation in rural areas; increasing the efficiency of small farms through the diversification of agricultural products; increase in incomes of agricultural enterprises and, as a consequence, increase in budgets of rural communities, other positive socio-economic changes that are extremely relevant for Ukraine.

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DEVELOPMENT OF AGRO-TOURISM IN DOBROGEA REGION, ROMANIA, IN THE CONTEXT OF EUROPEAN INTEGRATION

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Abstract

The objective of the present paper is to make an analysis of agro-tourism activity development in Dobrogea – a historical province from Romania's South-East extremity, in order to identify the main trends and changes in the period after Romania's accession to the European Union, using official empirical data and specific indicators: agro-tourism offer in terms of number of agro-tourism boarding houses (they refer only to accommodation in standardized tourist units) and number of places/beds in use (number places-days) in this type of accommodation units; agro-tourism demand in terms of number of tourist overnight stays in the agro-tourism boarding houses; the net utilization index of the agro-tourism boarding houses capacity. The whole volume of information presented in this paper was obtained from national statistics, from governmental and non-governmental sources, as well as from articles and studies published in specialized journals. The results showed that the agro-tourism offers were among the most preferred destination, as most tourists feel safer here and agro-tourism boarding houses services are more and more attractive. However, the agro-tourism potential in Dobrogea should be much better exploited, the demand/offer ratio should be in balance, the agro-tourism boarding houses destinations should be more intensively promoted and service quality should be improved in order to increase the agro-tourism flow and attractiveness of this region.

Key words**:** *rural area, agro-tourism activities, agro-tourist boarding houses, development strategy, Dobrogea*

INTRODUCTION

There is a significantly growing global demand for agro-tourism, as a form of rural tourism, emerged as an alternative to the classic tourism [4, 17, 25].

The free flow of information on the internet and different media, the growing transportation industry, and the decreasing communication costs are all factors supporting the new emerging form of tourism, where accommodation and other hospitality services take place in tourist boarding houses that are integrated in the local farms [3, 15, 16].

In Romania, in the last few years, the analysis of agro-tourism flow has proved that our country becomes more and more attractive as agro-tourism destination, both for the residents and non-residents, with a constant expansion, and a number of arrivals in agro-tourist boarding houses that exceeded for the first time 1 million in the year 2018 [3, 12, 17].

At the same time, in the opinion of many specialists [14, 16, 22, 24, 25] for those who live in the rural area, developing the local tourism activity means improving their social, cultural and economic situation.

Having in view the positive role played by the promotion and development of agro-tourism activity as a complementary activity to farming, organically integrated in the farm economy, the present paper intends to analyse the main trends and changes in the agro-tourism activity in Dobrogea (a historical province from Romania's south-eastern extremity) in the period after Romania's accession to the European Union.

MATERIALS AND METHODS

For the purpose of this paper, data were collected from the National Institute of Statistics, more exactly from Tempo Online Data base, for the period 2007-2020.

The main indicators taken into consideration were the following: (i) *the agro-tourism offer*

in terms of number of agro-tourist boarding houses (therefore, they refer only to accommodation in standardized tourist units) and number of places/beds in use (number places-days) on this type of accommodation units; (ii) *the agro-tourism demand* in terms of number of tourist overnight stays in the agro-tourist boarding houses; (iii) the net utilization index of the agro-tourism boarding houses capacity in operation, calculated according to the following formula:

$$I_n = (N / C_f) \times 100,$$

where: I_n is the net utilization index of the agro-tourist accommodation capacity in operation; N is the number of beds in a certain period; C_f is the tourist accommodation capacity in operation.

In the paper we present the results of the statistical data series for the agro-tourism boarding houses. From the statistical point of view, the urban boarding houses were redefined into tourist boarding houses, and the rural and agro-tourist boarding houses into agro-tourist boarding houses [13].

The agro-tourist boarding house is a independent buildings for tourism destination These structures ensure, also, in specially designed spaces, the preparation and serving of meals, as well the possibility of tourist participation in household [13, 22].

The methods used in this research were the following: the documented study, the descriptive statistical analysis and logical synthesis of information. This type of documentation aimed to identify and review the main trends and challenges related to the resources involved in agro-tourism activity. The results were tabled and graphically represented and correspondingly commented and the statistical data were completed by information from articles, studies, reports and governmental and non-governmental documents.

RESULTS AND DISCUSSIONS

Located in the south-eastern part of Romania, between the Danube and the Black Sea, Dobrogea's territory benefits from a diversified tourism patrimony, with natural and anthropic resources distributed on a total area of 15,570 km^2, divided between two counties: Constanta (the most urbanized county in Romania) and Tulcea (with 40.55% of its area covered by water: the Danube Delta and the lagoon complex Razim-Sinoe) [5, 6, 23].

In Dobrogea region, agro-tourism is a form of tourism emerged from the need to find solutions for increasing the rural farm incomes by putting into value their economic potential. This potential refers both to the existing accommodation potential, prepared and arranged mainly for tourists' receival, and to the goods and services supplied for consumption to persons coming to the rural area for recreation, rest and leisure. Depending on the natural, cultural, folklore conditions of the region, the agro-tourism services supplied range from the serving of meals, accompanying and guiding tourists on certain tracks or initiation in certain traditional crafts, to practicing some sports or assistance to a series of traditional habits in the locality or region (poems sessions, village dances, carols, religious holidays, traditional fairs, folklore shows, etc) [7, 21].

In Dobrogea, ***the natural agro-tourism resource*** is determined by:

- The *Danube Delta (the newest land of Europe) and the lagoon complex Razim-Sinoe*, locate in the north-eastern part of the county Tulcea, with a great diversity of water and terrestrial ecosystems [2, 6, 23];
- The *Măcin Mountains*, the oldest relief of the Romanian territory, located in the north-western part of the county Tulcea, maximum 467 m high (Greci-Ţuţuiatul peak), fascinating through its unique geo-morphology and bio-geography [6, 9, 23];
- The *Romanian Black Sea coastline* is stretching on 245 km (152 miles) between the northern border with Ukraine and the boarder with Bulgaria in the south, where there are excellent beaches facing the east, with lots of sunshine in the summer season [5, 18, 23];
- The *Northern and Southern Dobrogea Plateau,* with agro-tourism potential, yet fully unexplored, with large forests and a rich hunting fund, vineyards, fisheries, bee-

keeping, local agro-pastoral resources, traditional cuisine or horse riding [5, 18, 23].
Analysing the Dobrogea rural space, we will find that this is the keeper and preserver of a priceless treasure of art and architecture, with historical artefacts, vestiges and monuments, as well as a genuine ethno-folklore heritage of unique value and purity, which "*makes out of Dobrogea a genuine museum in open air*" [14, 21].
The ***rural settlements with potential for agro-tourism activity development*** in Dobrudgea are located in a compact area located in the wet regions and in a hilly and plateau area. The tourism potential is used for the gastronomic, ethnographic, historical, religious and scientific tourism practice [7].
The rural settlements with agro-tourism function identified on Dobrogea's territory can be classified by main natural resources (Table 1).

Table 1. The main rural settlements with agro-tourism potential identified on Dobrogeaa's territory

Rural settlements	**Area for tourism practice**
Crișan, Jurilovca, Mahmudia, Maliuc, Murighiol, Nufăru, Sfântu Gheorghe,	Danube Delta and the lagoon complex Razim-Sinoe
Greci, Luncavița	Măcin Mountains
Corbu, Tuzla, Costinești, Limanu with 2 villages: 2 Mai and Vama Veche	Romanian Black Sea Coastline
Niculițel, Babadag	Northern Dobrogea Plateau
Ostrov, Oltina	Sourhern Dobrogea Plateau

Source: own processing [5, 6, 7, 8, 9, 21, 23].

In Dobrogea, ***the main activities*** developed by the tourists accommodated in the agro-tourist boarding houses are the following:
- *Recreation and summer heliotherapy treatment*: Corbu, Agigea, Tuzla, Vama Veche, 2 Mai, 23 August;
- *Recreation and fishing purpose or nautical sports* for amateurs and professionals, practiced in the Black Sea or in the Danube Delta: Crişan, Caraorman, Mila 23, Maliuc, Murighiol, Mahmudia;
- C*ultural, religious or historical trips*: Adamclisi, Enisala, Istria, Slava Cercheză;
- *Wine tasting trip*: Murfatlar, Măcin, Niculiţel, Ostrov;
- *Gastronomic trip* for tasting a range of appetizing and delicious food products: Sfântu Gheorghe, Costineşti etc. [2, 5, 6, 8, 21, 23].
Most of these activities require an animator to coordinate the spare time of tourists. The animator of the agro-tourist boarding houses is a person responsible for the group of tourists to whom he proposes an active agro-tourism activities which exploit the natural landscape and opportunities in rural areas, facilitating relationships between members of a group [26].
In the rural area of Dobrogea, ***the agro-tourism offer*** is growing and the quality of agro-tourist boarding houses and services has steadily improved after Romania's accession to the European Union [8, 14].
According to the National Rural Development Programme (NRDP), co-financed by the European Agricultural Fund for Rural Development (EAFRD), *the main operational programmes* with financing possibilities in the agro-tourism activities are the following:
- NRDP 2007-2013 by Axis 3 "Improvement of life quality in the rural areas and rural economy diversification" with Measure 313, as well as the LEADER Axis providing diversification of economic activities for creating alternative jobs and new income opportunities for farmers [10];
- NRDP 2014-2020, which provides financial support to private investments for tourism supply diversification in the rural area [11].
Moreover, *the indirect effects* for agro-tourism activity development come from the following structural programmes:
- The Regional Operational Programme known as REGIO with finances projects in three fields of intervention: restoration and lasting capitalisation of the cultural and historical patrimony, as well as creation/modernisation of the related infrastructures; creation, development, modernisation of specific infrastructure for lasting capitalisation of natural resources and for the increase of the quality of tourist services, and promotion of the tourist potential, and creation of the necessary infrastructure with the purpose of increasing

Romania's attractiveness as a tourist destination [19, 20].

The *eligible investments* for agro-tourism activity development supported by the European funds targeted:

- increasing, improving and diversifying the small-scale tourism accommodation facilities (agro-tourism boarding houses and private investments in the leisure tourism infrastructure);
- developing and promoting the agro-tourism services;
- guiding and training in agro-tourism services provided to the rural inhabitants;
- developing the local on-line biking systems for the rural tourism accommodation facilities in the rural area connected to regional and national systems [1, 10, 11].

The *direct beneficiaries* of the financial support are the following:

- natural persons (with the commitment that by the date of signing the financial contract they will get the certification of authorized natural persons);
- farmers or members of certain agricultural enterprises who wish to diversify their basic farm activity by developing a non-agricultural activity in the rural area in the already existing enterprise that falls under the category of micro-enterprises and small-sized enterprises, except for the non-authorized natural persons;
- existing and newly established micro- and small-sized enterprises in the rural area;
- local communities, local public authorities, non-governmental organizations and professional associations [1, 10, 11].

The *indirect beneficiaries* are tourists staying overnight and visitors who love to combine the pleasure to live outdoors far from the civilization of the cities, to enjoy learning about traditional occupations of the people from Dobrogea, tasting traditional food, meeting folk customs, but also having contact and taking part in agricultural works and playing with farm animals etc. [1, 10, 11].

There is a multitude of actors involved in agro-tourism development in Dobrudgea. Some of them play a more important role than others. At the moment, by close collaboration at ministerial level the non-governmental organizations with tourism profile can play a very important contribution on education and the agro-tourism can become an alternative for the local economy [22, 23].

In the period 2007-2020, the share of the number of Dobrogea agro-tourism boarding houses in the total number of agro-tourism boarding houses existing in Romania were different throughout the years, from 4.3% in 2007 to 4.3% in 2020, with the highest share of 5% in the year 2018 and the lowest share of 0.7% in the year 2017 (Fig. 1).

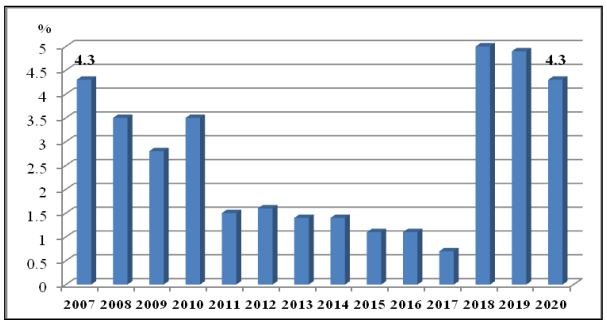

Fig. 1. Share of Dobrogea agro-tourist boarding houses in total number of agro-tourist boarding houses in Romania, 2007-2020 (%)
Source: NIS, Tempo-online, 2021 [13].

The share of the number of agro-tourism boarding houses in total number of tourism structures in Dobrogea fluctuated in the analysed period, from 5.1% in 2007 to 11.1% in 2020, with the highest share of 12% in the year 2018 and the lowest share of 1.9% in the year 2017 (Fig.2).

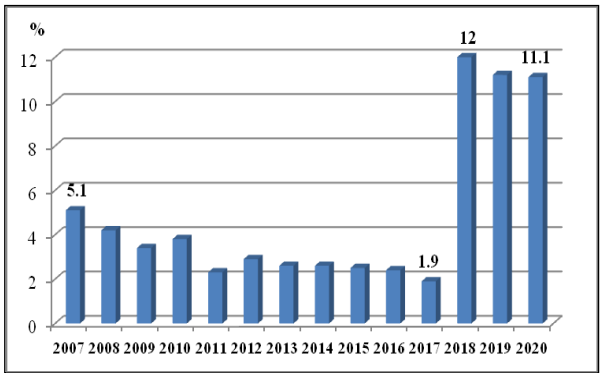

Fig. 2. Share of agrotourist boarding houses in total number of accommodation structures in Dobrogea, 2007-2020 (%)
Source: NIS, Tempo-online, 2021 [13]

The number of agro-tourist boarding houses had a diferent trend in Constanta county compared to Tulcea county (Fig.3).

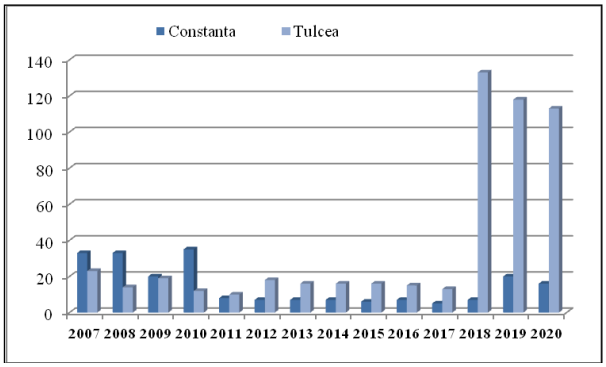

Fig. 3. Evolution of the number of agrotourist boarding houses in Constanta and Tulcea counties, 2007-2020
Source: NIS, Tempo-online, 2021 [13].

In the case of Constanta county, there was a declinig trend from 33 agro-tourist boarding houses in the year 2007 to 16 agro-tourist boarding houses in the year 2020, with the highest number 35 in the year 2010 and the lowest number 5 in the year 2017. In the case of Tulcea county, the trend fluctuated each year, from 23 agro-tourist boarding houses in 2007 to 113 agro-tourist boarding houses in 2020, with an abvious increase in the year 2018 to 133 agro-tourist boarding houses.
The number of beds in the agro-tourist boarding houses increased in the last three years of the analysed period, because farmers were interested in increasing their incomes by tourists' accommodation and also by traditional meals (Fig. 4).

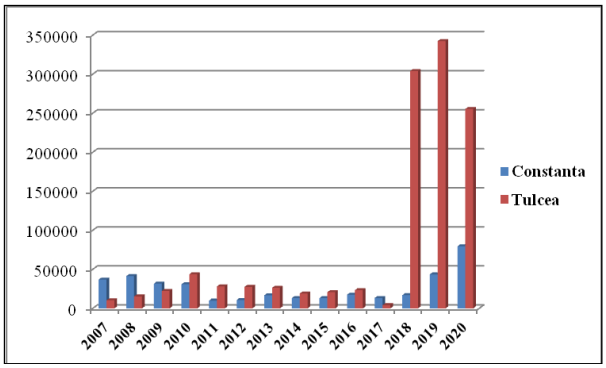

Fig. 4. Evolution of the accommodation capacity in use on agro-tourist boarding houses in Constanta and Tulcea counties, 2007-2020 (number places-days)
Source: NIS, Tempo-online, 2021 [13].

The numbers of overnight stays in agro-tourist boarding houses have a similar trend with the evolution of number of beds used in the agro-tourist boarding houses (Fig.5).

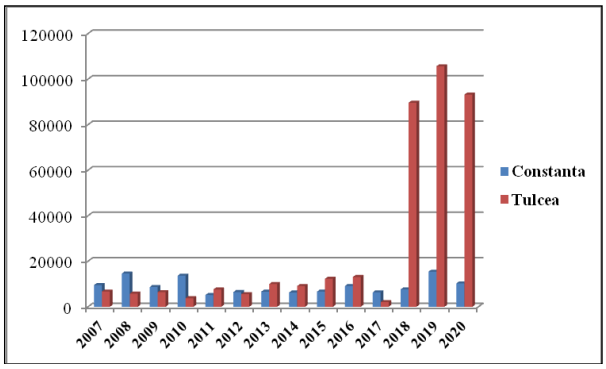

Fig. 5. Evolution of the overnight stays in the agrotourist boarding houses in Constanta and Tulcea counties, 2007-2020 (number)
Source: NIS, Tempo-online, 2021 [13].

In Tulcea County, after 2017, the number of beds on agro-tourist boarding houses had a more dynamic trend in the last three years of the analysed period, as the number of overnight stays on agro-tourism boarding houses increased. This is explained by the attractive accommodation in a rustic style and leisure services at lower prices compared to other accommodation units, and also by the promotion of the beauty of the scenery from the Danube Delta Biosphere Reserve or from the National Park Macinului Mountains.
In the analysed period, there was a very small number of foreign tourists who stayed overnight in the agro-tourist boarding houses in Dobrogea, with a slight increasing tendency in the year 2019 (Fig.6).

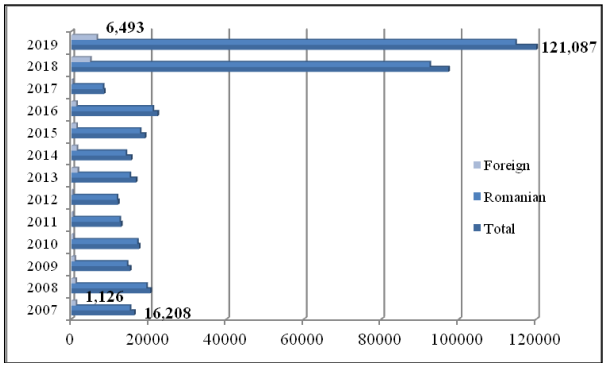

Fig. 6. Evolution of the number of tourists' overnight stays on the agrotourist boarding houses in Dobrogea
Source: NIS, Tempo-online, 2021 [13].

The flows of tourists are characterized by seasonality along the year and have a deep influence on the net use of the accommodation capacity and tourism receipts. In the Dobrogea agro-tourist boarding houses, these indices varied year by year (Fig.7).

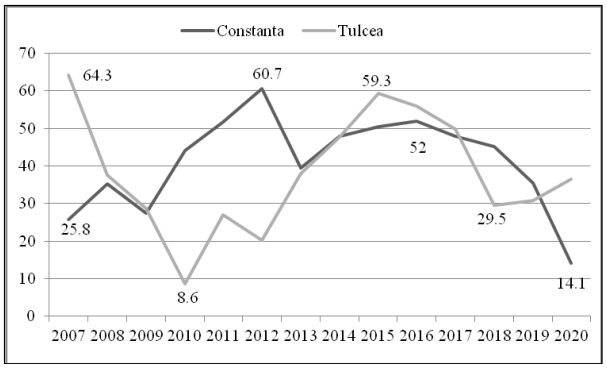

Fig. 7. Evolution of the net utilization index of the agro-tourist boarding houses capacity in Constanta and Tulcea counties
Source: NIS, Tempo-online, 2021 [13].

This is explained by planning the holidays mainly in the middle of the year, the desire of tourists to shorten the period of stay and the limited money allocated to holidays in close relation to the family budget. In this way, the managers of agro-tourist boarding houses cannot cover the entire capacity.

CONCLUSIONS

For most of us, Dobrogea means the Black Sea shore with its resorts or the Danube Delta with its priceless biodiversity. Between the Danube River and the Black Sea coastline there is more reason for a travel.

In Tulcea County, the Danube Delta was and remains an important tourism objective, and the Măcin Mountains are not very well-known. The best-known tourism rural settlements in Danube Delta are: Crişan, Maliuc, Mahmudia and Murighiol, and the locality Jurilovca, on the bank of lake Razim; the localities with most tourist circulation are Jurilovca and Murighiol.

In Constanţa County, the agro-tourism management focuses on the coastal area, the localities along the Danube and the localities with archaeological sites and religious objectives. The highest variety of tourism receival structures and most of the seasonal tourism activity is found in the commune Costineşti, with the villages Schitu and Costineşti, and in the commune Limanu, with the villages 2 Mai and Vama Veche.

Summing up the main characteristics of agro-tourism activity in Dobrogea, during the period 2007-2020, we can draw the following conclusions:

- The number of agro-tourist boarding houses had a diferent trend in Constanta county compared to Tulcea county;
- The number of places on agro-tourist boarding houses increased in the last three years of the analysed period;
- The number of overnight stays on agro-tourist boarding houses has a similar trend with the evolution of number of places on agro-tourist boarding houses;
- The net use of the accommodation capacity and tourist receipts varied year by year;
- The tourist accommodation facilities and public food catering are less developed, which limits the number of tourists in the region.

This variation registered by agro-tourist boarding houses activity is explained by the desire of tourists' who planning holiday mainly in the middle of the year, with an average duration of stay of one day limited by the money allocated for spending the vacation which is in close relation to the family budget. In this way, the managers of agro-tourist boarding houses cannot cover the whole capacity.

Also, the insufficient promotion of agro-tourism potential, the limited collaboration between the most important actors, the lack of coherence and absence of a strategy at central authorities level, the lack of a coherent vision for the development of agro-tourism, the lack of State interest in the development and promotion of agro-tourism, the lack of funding programs and special offers organized by the employers' associations in agro-tourism, represent the reasons out of which the agro-tourism activity in the area of Danube Delta, Northern and Southern Dobrudgean Plateau, and the Black Sea coastline is not considered a representative tourism product.

Therefore, the agro-tourism potential in Dobrogea should be much better exploited, the demand/offer ratio should be in balance, the agro-tourism boarding houses as a tourism destination should be more intensively promoted and service quality should be improved in order to increase the agro-tourism flow and attractiveness of this region.

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ECONOMIC EFFICIENCY OF THE LAND RESOURCE MANAGEMENT BY AGRICULTURAL PRODUCERS IN THE SYSTEM OF THEIR NON–CURRENT ASSETS ANALYSIS: A CASE STUDY OF THE AGRICULTURAL SECTOR OF UKRAINE

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Abstract

To assess the effectiveness of the management of land resources for agricultural enterprises suggested factors affecting the market for agricultural products, which integrates a system of environmental, economic and social indicators in this area. The paper highlights main theoretical aspects of the land resource management of the agricultural enterprises. The essence of land resource management is shown based on the definition of the objects of management, which are land resources of agricultural enterprises, subjects of management, which are landowners and employees of such agricultural enterprises, and objective of management, which is providing and maintaining the efficiency of land resources usage as a key factor of agricultural production. The land market and its structure are presented in detail. Described prospects management of land resources of agricultural enterprises. A complete analysis of mortgage lending secured by agricultural lands has been carried out. A decrease in the number of agricultural enterprises, which is mostly connected with imperfections of land governance, formed in the state, has been identified. Relationships between strengths and weaknesses of agricultural enterprises, opportunities, and threats of efficient land use have been identified. Scenarios of economic development have been considered, which should be taken into account while developing a strategy.

Key words**:** *agricultural sector, agricultural management, agricultural producers, efficiency, land use strategic goals*

INTRODUCTION

Economic instability in the country, increased competition, and saturation of the domestic market imported agricultural products, changing climate conditions that increase the risk of crop failure, lack of financial resources to ensure quality cultivation and opportunities for its recovery, lack of qualified personnel - a major obstacle to the organization effective land use domestic agricultural enterprises.

Land relations in the agricultural sector should focus on their effective use in the long term.

In modern terms the share of those wishing to transfer land to rent because of the lack of opportunities for doing her own agricultural production.

The system of land administration affects the development of legal security (which is the main requirement for the investors), the access to the credit (the mortgage), spatial planning (to support economic and ecological development) and the efficient and effective land taxation [36].

The main problem in the use of agricultural land in Ukraine is viewed as a discrepancy between ownership and use [23]. An

excessive lease of agricultural land by agroholdings (big agricultural enterprises) made it possible to form a good structure of land use (fields). Based on the analysis of scientific sources revealed that determining the efficiency of land use of agricultural enterprises should take into account not only the economic effect of management but the level of satisfaction of people's needs in food, preservation and restoration of soil fertility, yield owners of land and farmworkers.

Land, as a basis of living space for human societies, has always played a special role in history. Besides, the land is the main source of providing humanity with food necessities and therefore a key factor in maintaining social stability. Thus, it is possible to conclude, that land is a unique strategic asset, inseparable from history, present and future of societies, which inhabited particular territories at different times. Therefore, it isn't correct to consider land as an ordinary commodity or raw material. At the same time land, and agricultural land in particular, as the object of human economic activity, has its own economic aspects. This raises the questions about the settlement of legal issues, connected to land use and ownership. Intensive agricultural land use leads to a decrease in soil fertility through compaction, in particular of black soil.

The relevance of the selected study is due to environmental, economic and social problems that exist in Ukraine regarding the adoption of the goal of sustainable development by 2030, in particular, the rational use of land-resource potential, and in particular agricultural land.

The problem of land administration in the scientific literature paid much attention in research O. Agres [1], O. Apostolyuk [3], O. Atamaniuk [2], M. Dziamulych [6-9], H. Hreshchuk [10], G. Pasakarnis [13], A. Popescu [14-22], T. Shmatkovska [25-27], O. Stashchuk [29], R. Stupen [30], I. Tofan [31], A. Tretiak [32], I. Tsymbaliuk [33], Ya. Yanyshyn [35], I. Zhurakovska [37], etc. However, the problem in the agricultural domain so far is not resolved and requires further in-depth scientific research in this area. A necessary condition for effective development of land relations, strategies and evaluation of effective land use of agricultural enterprises is to develop effective land management tools.

Given the value of the results should indicate that some aspects of the outlined topics require further study. The research scientists O. Atamaniuk and H. Hreshchuk have theoretical and practical importance for the agricultural sector because it allowed us to estimate the long-term development of land relations [2]. However, rangeland resources were not fully covered.

MATERIALS AND METHODS

The theoretical and methodological basis of the research is the basic provisions of modern economic theory, the work of leading domestic and foreign scientists on the issues of land use. In the article, all materials are worked out by means of a complex of methods of scientific research, in particular the direct description of the studied phenomenon, processing of statistical information by means of economic methods of research, representation of the received results by means of a graphic method.

Research uses common scientific methods, namely: a monographic analysis, which is a study of scientific publications on the effective use of land resources and, in particular, rational use of agricultural lands; grouping – for grouping forms of property by social, economic, environmental interests of the major land groups.

RESULTS AND DISCUSSIONS

Land reform and the ongoing process of improving land relations, especially in the field of agriculture in Ukraine, have shown a number of problems related to the use of agricultural land resources. At the present stage of economic management, the efficient use of land resources of agricultural enterprises is one of the most important problems of the agrarian policy of our country. This is due to the dominance of not very effective agricultural lease relations, which has a significant impact on the performance of farms in general.

At the present stage, the role of the state in the land market in Ukraine is increasing. First of all, this is due to the need of forming a wide legal field and adoption of a number of legislations. Besides, the need for state regulation is explained by:
- the existence of a shadow market in which land transactions are concluded underground and remain uncontrolled;
- the need to develop economic programs for the development of the agricultural sector in order to provide financial and organizational support to economic subjects;
- the need to ensure proper protection of land through rational use, conservation of land and improvement of their properties in the process of use (in most developed countries of the world there are sets of environmental and technological requirements, standards and restrictions for landowners to improve the ecological condition of agricultural land, termination of degradation processes, improvement of soil quality);
- the need to develop the infrastructure of the land market;
- the need of strict control over compliance with all landowners and land users of the provisions of the Land Code and other legal acts on land and to prevent speculation with the land, the need to control the transfer of land and sells on a competitive basis;
- strengthening of the state control over the process of parcellation of productive lands, which has become uncontrolled in Ukraine.

Table 1 shows an estimation of providing of the system of land resources administration in Ukraine with a description of the condition of each sector of land administration.

Table 1. Evaluation of institutional support for the land administration system in Ukraine

Sector of land administration	Current condition	Rating, %
Land policy in the field of land relations	Fair	49
including lease relationship	Good	34
Land policy in the field of use and conservation	Fair	43
including economic promotion of rational land use and conservation	Very poor	23
Mechanisms of implementation of land policy	Poor	27
including land conservation policy	Very poor	20
Regulation and administration of land relations	Poor	37
including the protection of land rights	Fair	20
Regulation and administration of the organization of land use and protection	Poor	33
including economic incentives for land use	Very poor	25

Source: Own results.

Results have shown that the current condition of lands in Ukraine requires improvement of law support for monitoring of the state of lands. The monitoring of agricultural land should be carried out twice a year (on the local level). The first time – before sowing, the second – after the harvest. The results of such monitoring are characteristics of changes in soil properties, which makes it possible to assess the degree of agricultural impact on their condition.

Fig. 1 shows a cartogram based on the results of grouping the regions of Ukraine by the area of land on which in 2019 operations in the field of market turnover took place.

According to the results of the analysis of the cartogram developed by authors (Fig. 1), it can be stated that the activity of the agricultural land market functioning in Ukraine is determined by the frequency of their market turnover. In particular, the largest area of land plots on which market operations took place in 2019 can be traced in the Vinnytsia, Poltava, Cherkasy, Kirovohrad regions of Ukraine. The smallest area of land plots on which market operations took place in 2019 is typical for the Rivne and Zakarpattia regions of Ukraine. Thus, we summarize that the results of our analysis revealed that in the border western regions of Ukraine the studied indicators are the lowest.

Multifunctional land use defines land management and land use as one of the main factors for the balanced development of rural and urban territories and the country as a whole, which should aim to ensure cost-

effective and environmentally friendly land use to achieve public welfare.

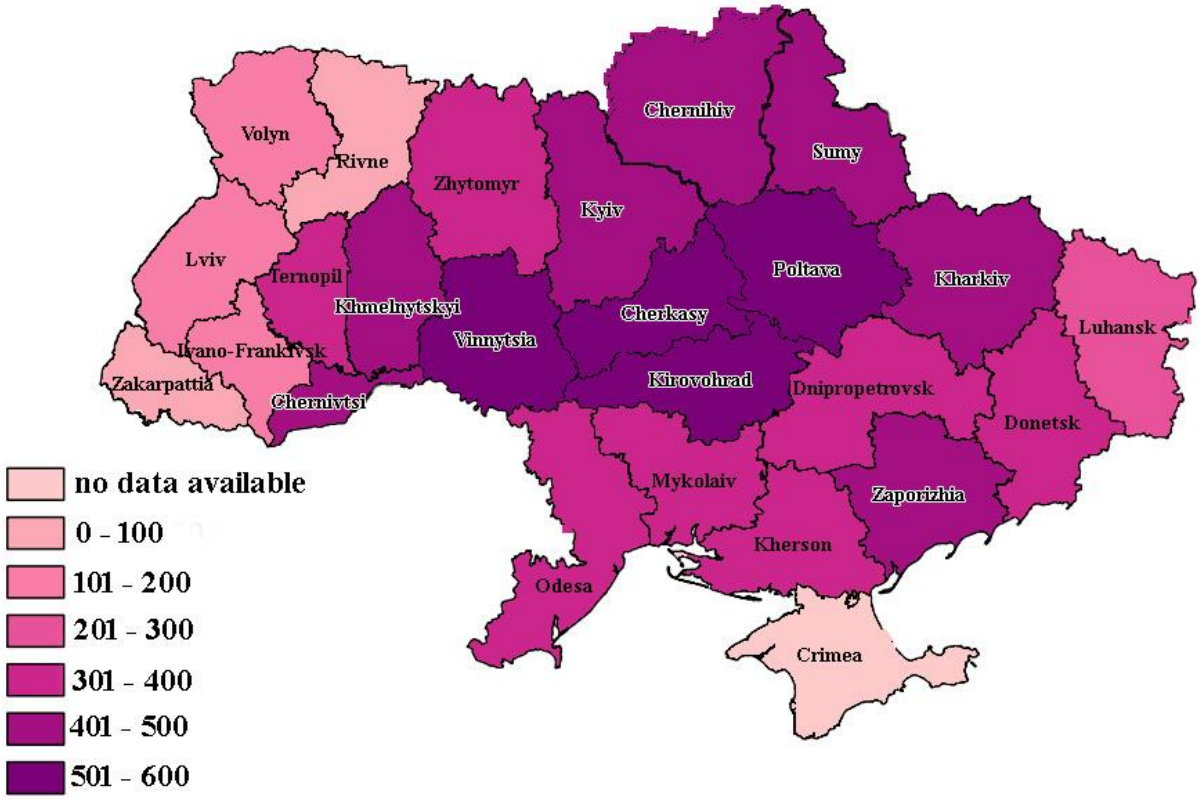

Fig. 1. Cartogram of the grouping of the regions of Ukraine by the area of land plots on which market turnover operations took place in 2019, ha
*Note: Data on the Autonomous Republic of Crimea is not available due to the occupation of this territory.
Own design based on the sources: [4, 5].

Analyzing the specificity of land as an aggregate natural resource, it should be noted that it is considered in the following main ways [32]:
- the land is the territory of the country, the main state-forming component (national security);
- the land is a universal spatial basis that is constantly supported by a certain correlation of land categories and land use types (spatial security) [28];
- the land is the main means of production in agriculture and forestry (food security) [11];
- the land is a major component of nature (environmental safety);
- the land is a stockpot of water, mineral, forest, recreational and other resources (economic security).
The basis of balanced use of land resources is the choice of the most effective option for their use, in terms of solving certain environmental and economic priorities [10].

Management of land resources is carried out at the national, regional and within farms. The scheme management of land resources of agricultural enterprises is shown in Figure 2.
The main strategic directions of improving the efficiency of land use at the micro-level are: maintaining and improving soil fertility; introduction of new cultivation technologies; maximizing profit; improve productivity and increase agricultural production; meet the interests of all participants in land relations. At the territorial level is advisable first to provide support for the priority areas of the territory of agricultural production, sustainable land use, and environmental friendliness. At the national level is necessary to improve the institutional framework and environmental policies on agricultural production systems, establish effective programs to support its investment support.

The cartogram of the grouping of districts of the Lviv region of Ukraine by the area of agricultural lands in 2019 is given in Fig. 3.

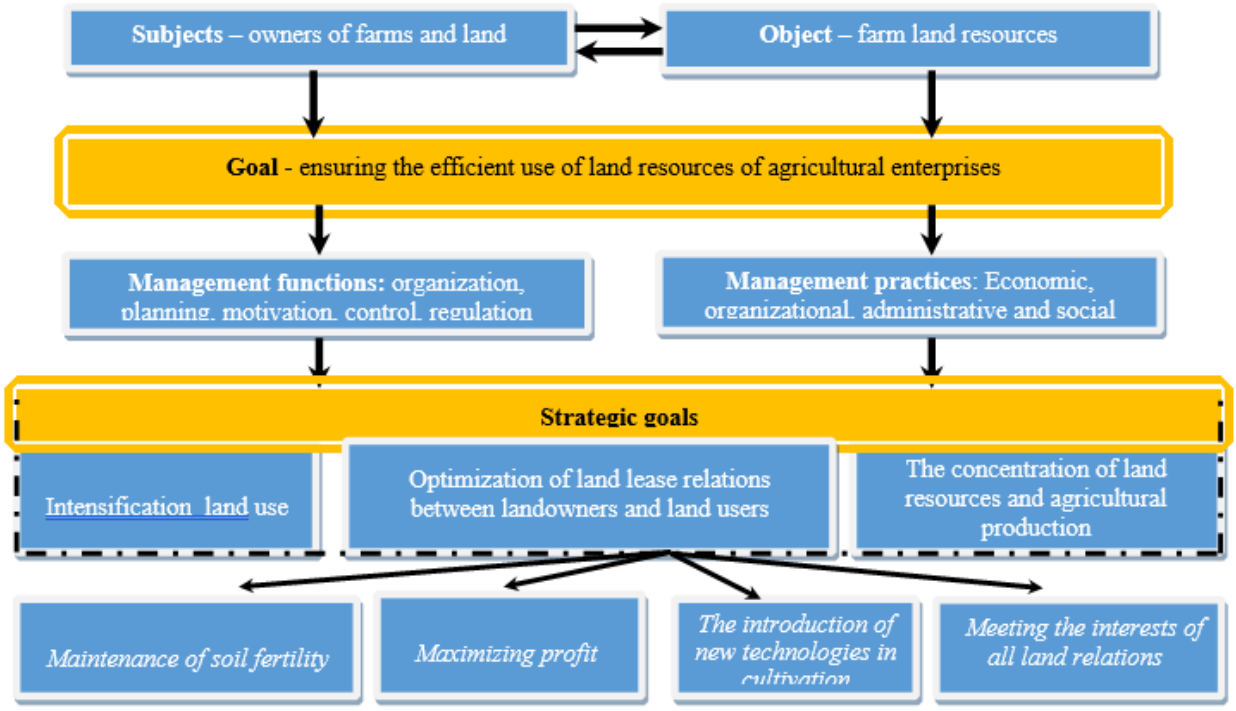

Fig. 2. Scheme of the management of land resources of the agricultural enterprises.
Source: Own design.

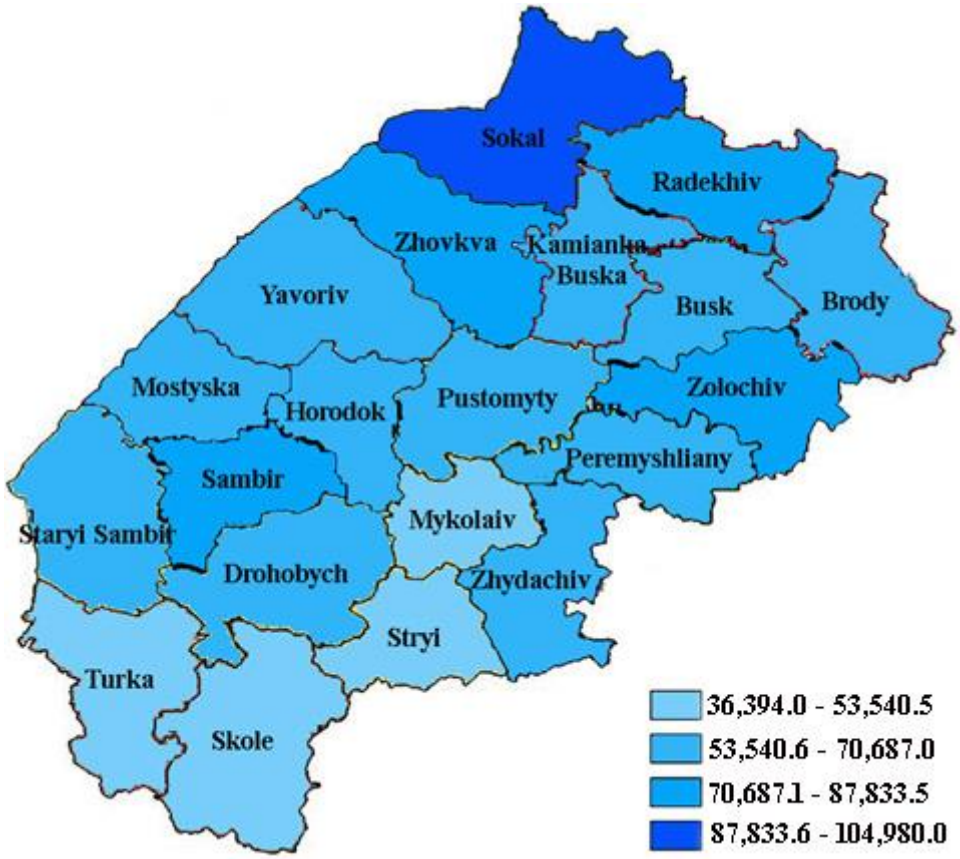

Fig. 3. Cartogram grouping of districts of the Lviv region of Ukraine by area of agricultural land in 2019, ha
Own design based on the sources: [4].

According to the results of the analysis of the grouping, we found that the largest area of agricultural land as of 2019 is available in the Sokal district of Lviv region of Ukraine. In addition, the area of agricultural land is also high in Zhovkva, Zolochiv, Sambir, and Radekhiv districts of the Lviv region of Ukraine. The lowest indicators on the size of agricultural land in 2019 are typical for mountainous areas of the Lviv region of Ukraine, included in the first group, namely - Turkiv, Skoliv, Stryi, Mykolaiv districts of Lviv region.

We believe that the results of the analysis of the grouping of districts of the Lviv region of Ukraine by area of agricultural land will provide an opportunity to justify our trends and features of economic efficiency of land use in the studied region of Ukraine.

In our opinion, it is advisable to structure the factors within each study group and detail them in order to determine the impact on agricultural land use, the ability to achieve and increase the efficiency of such use.

In order to study the effect of environmental factors on the activities of agricultural enterprises and their efficient use of land resources held a questionnaire survey of a number of enterprises in the agricultural sector. Respondents depicted in Fig. 4.

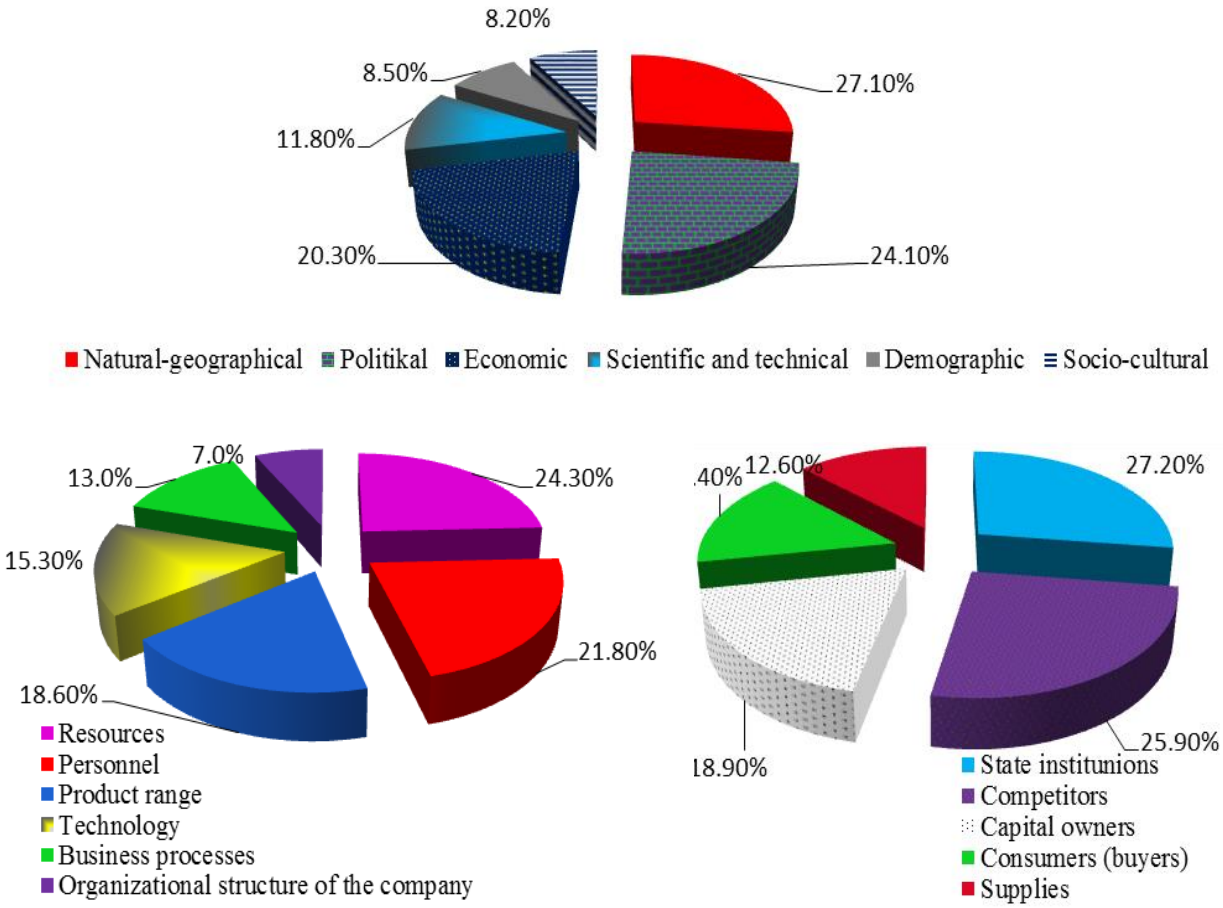

Fig. 4. The results of a questionnaire survey (questionnaire) of managers of the agricultural enterprises regarding the factors influencing the use of land resources in Ukraine (factors of the internal environment, macro-environmental and micro-environmental factors)

Source: Own design based on the sources: [5, 12, 24].

It is established that the greatest influence on the use of land resources of enterprises is made by natural-geographical (27.1%) and political (24.1%) factors, further, in the order of decline of influence – economic (20.3%), scientific and technical (11.8%), demographic (8.5%) and socio-cultural (8.2%). Among the factors, micro-level of influence divided as follows: state institutions (27.2%), competitors (25.9%), capital owners (18.9%),

consumers (buyers) (15.4%), suppliers (12.6%). Factors of the internal environment, according to respondents, affecting land use of agricultural enterprises as resources – 24.3% personnel – 21.8% product range – 18.6%, technology – 15.3%, business processes – 13.0% and the organizational structure of the company – 3.0%.

According to the financial and economic reporting, we conduct correlation-regression analysis for a sample set of agricultural enterprises of Lviv region of Ukraine. To construct the regression equation, the value of commodity output per 100 ha of agricultural land (Y) was selected as the dependent variable, and the following indicators were selected as independent variables: area of agricultural land (X_1); costs per 1 ha of agricultural land (X_2); rate of return (X_3) (Table 2).

Table 2. Correlation matrix of relationships formation of individual indicators of economic activity of agricultural enterprises of Lviv region of Ukraine for 2019

Indicator	Commodity production per 100 ha of agricultural land	Area of agricultural land	Production costs per 1 ha of agricultural land	The rate of return
Commodity production per 100 ha of agricultural land	1	X	X	X
Area of agricultural land	-0.192	1	X	X
Production costs per 1 ha of agricultural land	0.981	-0.219	1	X
The rate of return	-0.689	0.135	-0.775	1

Source: Own research and calculations.

According to the data in Table 1, it can be argued that the relationship between commodity values per 100 ha of agricultural land and production costs per 1 ha of agricultural land is very strong (pair correlation coefficient is 0.981), and between commodity production and the area weak – inverted (correlation coefficient -0,192), between commodity products and the rate of return – also inverted, but moderate enough (even correlation coefficient is -0,689). The corresponding regression equation is:

$$Y= -918.31+0.27X_1+142.64X_2+21.51X_3$$

The coefficient of determination is quite high (0.976). Therefore, the 97 % variation in commodity output per 100 ha of agricultural land can be explained by a change in the model factors selected, and the remaining 3% (100–97) is the influence of factors not included in the model. It should be noted that the values of the regression coefficients have a very important economic interpretation and can be used to calculate the predicted values of the volume of commodity products.

In Ukraine, after the moratorium on the sale and purchase of agricultural land has ceased, it is advisable to introduce a legislative mechanism of increased responsibility for land use. It is important to anticipate the intended use of agricultural land without the right to sell the land within five years from the date of acquiring the ownership of the land (while introducing an exemption from land tax for a period of five years), as well as to introduce a high level of taxation on land sales income for short-term use and a regressive tax scale depending on tenure (to encourage long-term land use).

Foreign land management experience should be taken into account when addressing problems of improving land use in Ukraine. Particular attention should be paid to the organization of regular land monitoring as a basis for effective land management (Table 3).

Table 3. Comparative characteristics of land use status in European countries and Ukraine

Characteristic	Ukraine	%	EU countries	%
Land area, million hectares	60.4	100	437.4	100
Area of black soil, million hectares	28	46.36	18	4.12
Area of agricultural land, million hectares	42.7	70.70	177.7	40.63
Area of agricultural land per capita, ha/person	0.7	1.16	0.4	0.09
Area of leased agricultural land, %	41.4	68.54	94.2	21.54
Investment price, thousand USD / ha	1	1.66	5.5	1.26

Source: Own design based on the sources: [32].

This table shows that in spite of the considerable land area in the EU countries, in percentage terms the area of black soil in Ukraine is much higher and 70% occupy the

area of agricultural land (the largest share is occupied by arable land).

The argument in favor of securing land as a source of financial support for agricultural economic growth is that in the world, loans secured by land make up 95 % of farmers' investment resources, and only 5 % is money from the sale of land. According to experts, the use of a mortgage will allow agricultural companies to increase the volume of received loans by 6-9 times, to extend loans by 7-11 times - up to 35 years with significantly lower interest rates on loans (up to 9%) and substantially secure (up to 100 %) lending.

There are about 1.7 million hectares of land, which is 4 % of all agricultural land.

Experts estimate that if only 10 % of the agricultural land is included in the mortgage lending system, with a loan level of 60 % of the value of the collateral, this would increase the potential of the agricultural sector by $ 2.4 billion [34].

Accordingly, in the process of land use development, the first group of state land interests (social) focuses on the size of property for different social groups and land use forms. An important task for Ukraine is the transfer of land policy into a group of environmental and social interests and improving the well-being of rural and urban populations in Ukraine.

The purpose of land management regulation is the establishment of obligatory qualitative and quantitative indicators aimed at ensuring the sustainable use, protection and reproduction of land, as well as ensuring environmental safety in land relations [13].

First of all, we must consider all external and internal factors affecting the development of the market of agricultural lands in order to fulfill our task. In our opinion, it is appropriate to systematize these factors into four large groups: environmental, economic, social and legal. Factors that influence the development of agricultural lands market in Ukraine (Table 4).

Table 4. Assessment of Ukrainian land use trends according to economic interests, social interests, environmental interests, 2019

Ownership	Number of land owners and land users	Total area of land, ha	Agricultural land, ha	Forests and other wooded areas, ha	Land under buildings, ha	Water, ha	Other, ha
Economic interests							
Citizens	2,932,217	9,994.6	10,309.2	3.2	24.9	89.7	9.9
Legal entities	161,457	45,206.7	48,436.1	1,464.9	988.7	814.8	997.1
Total	3,093,674	55,201.3	58,745.3	1,467.9	1,012.79	904.5	45,080.1
Social interests							
Citizens	23,376,584	6,857.2	6,425.2	2.9	524.8	0.4	5.1
Legal entities	192,014	7,002.2	2,928.6	933.8	1,128.5	1,472.2	539.1
Total	23,568,598	13,859.4	9,353.8	45,009.8	1,653.3	1,472.6	44,374.1
Environmental interests							
Citizens	48,132	4.7	2.5	0.0	2.6	0.0	0.0
Legal entities	13,533.0	11,173.8	959.2	9,547.7	64.9	318.2	614.9
Total	61,665	55,189.8	44,912.2	9,547.7	44,048.9	318.2	614.9

Source: Own design based on the data from [28].

Ecological factors

This group includes all factors that have an ecological component. The composition and type of soil, the level of contamination and the environmental policy of the land user influence the level of demand and supply according to a particular land plot.

Economic factors

We consider that it is appropriate one can include those factors that directly affect the price of the land plot as one of the most important factors of influence on demand and supply to this group.

Social factors

This group includes all factors that are in some ways connected with the social sphere, which supports economic activity with two

most important components: labor resources and consumers of the final product [30].

Economic interests in the field of distribution and redistribution of land are aimed at the structure of land ownership in the composition, combined with the proposal, which forms its economic form. At the same time, the interests of society are focused not only on maintaining under state control the necessary part of land resources to solve the general problem of land development and territorial resources, but also on the fact that this vital factor usually belongs to private owners, because they can skillfully and most efficiently use land resources. In addition, environmental interests are focused on the parameters of the functional and economic structure of the land fund, namely the size, proportion, and priorities of its distribution, types, and categories (hayfields, pastures, areas under construction, forests, shrubs, swamps, etc.), exploitation intensity and anthropogenic effects.

The process of managing and using land resources. Comparative evaluation of Land Resources of Ukraine and foreign countries is shown in Table 5.

Table 5. Comparative evaluation of Land Resources of Ukraine and foreign countries in 2019

The structure of land resources	Categories of land	Ukraine,%	USA, France, Sweden, Germany, %
The economic component	Agricultural lands	70	55
	plowed land	54	33
	Forestry purposes	17	30
	reforestation area	0.7	15
	Water Facility	4	1
	Industry and other lands	2	2
Ecological component	A nature reserve and other purposes	5	15
The social component	Housing and other buildings	2	3
	Health purpose	0.3	5
	Historical and cultural	0.3	3
	Reserve land	0.6	3

Own design based on the sources: [28].

From this table shows that in our country there are problems in the distribution of land, affecting their effective use. The issue of state regulation of the land market in the aspect of environmental regulation cannot be overlooked. In general terms, world experience submits three possible mechanisms for achieving economic goals, including environmental and economic goals.

Land interests that arise in society can be divided into three groups: Social – to meet the physical, psychological, intellectual and other needs, both rural and urban;

Economic – regarding the commodity and monetary parameters of land ownership;

Ecological – refers to the effective development of the land resource and the nature of the property.

In the presence of high debt dependence of the economy and hostilities in the country, the implementation of unfavorable agrarian reforms for agricultural producers must independently, without much support of the state try to increase production volumes, enter foreign markets, ensure the efficiency of land use.

Because only with the unity of all three groups of social, economic and environmental interests that we can achieve the social well-being of rural and urban populations and overcoming threats, especially environmental ones, in nature.

The lease of hundreds, and in some cases thousands, of land parcels, requires large financial (about USD 11.20 per one hectare) and time costs (from 3 months or more) on registration of the lease rights. The availability of the unofficial payments leads to an increase in the registration costs of lease rights by 50 % [26].

The implementation of the agricultural land market model will have the following positive socio-economic consequences:

- the full realization of the right of private ownership of agricultural land by the citizens of Ukraine, when the landowner will independently choose one of three directions: production of agricultural products on their own land using both their own capital and obtaining loans secured by the land; transfer of land for rent to another agricultural producer for rent; sale of land for the purpose of obtaining money;
- increasing the investment attractiveness of the agricultural sector, in particular through the development of mortgage loans secured by agricultural land;

- establishing the objective market value of agricultural land in the course of their economic circulation and increasing the capitalization of land;
- rational redistribution of agricultural lands and optimization of their use;
- increasing the amount of rent for agricultural land, which will become one of the main sources of replenishment of local budgets;
- creation of middle-class farmers;
- a guaranteed minimum level of employment of the rural population in the agricultural sector;
- creating a strong fiscal framework for the activity of local communities sufficient to support the socio-economic development of rural areas;
- improving the demographic situation in rural areas and revitalizing the Ukrainian countryside;
- increase of the level of motivation of work through the combination in the person of the citizen of Ukraine the landowner and the producer of agricultural products;
- increasing the efficiency of the use of the land's natural resource potential and ensuring the strategic food security of the state;
- full legalization of land ownership and land use, elimination of «shadow» schemes of agricultural land transfer, prevention of raider schemes of agricultural land capture;
- ensuring transparency of land operations;
- preventing the purchase of agricultural land by «figurehead».

CONCLUSIONS

The intensification of agricultural production aimed at more efficient use of land and other resources through additional investment, the use of advanced technology, modern forms of production and labor.

The main role of inefficient land-use policy plays a land formed within the agricultural enterprise. More efficient use of land resources due to the achievement of strategic objectives, which are: optimization of land lease relations between landowners and land users, concentration and intensification of agricultural production. Achieving these goals is possible for the implementation of the strategic imperatives of environmental, economic and social issues. Specifically, the main strategic imperatives improve the efficiency of land use of agricultural enterprises are: ensuring soil fertility; introduction of new cultivation technologies; maximizing profit; improving productivity and increasing the volume of agricultural production; meet the interests of all participants in land relations.

Controlling the work of the land market, the state should create programs for economic regulation of agricultural land use.

We believe that the main objectives of land reform should be:

- provision of employment and job creation in rural areas;
- creation of a new mass class of wealthy hosts- landowners, the so-called «new peasantry», which should become the economic and military support of the Ukrainian State (priority category of landowners);
- economic development, GDP growth, and increased tax revenues;
- protecting the interests of current small landowners by guaranteeing a minimum fair land price.

Summarizing the above, it can be stated that the further development of land reform consists of stimulation of cooperation, improving lease relations and expanding mortgage operations. Provided that elements of a full-fledged land market are formed, this will ensure removing the moratorium and introduce a state-controlled agricultural land market in Ukraine with certain restrictions. The functioning of such market is an important step for the further socio-economic development of Ukraine, including rural areas on an ecological basis.

The use of a mortgage of land will allow agricultural enterprises to increase the volume of received loans, extend the term of long-term lending for significantly lower interest rates and considerably increase the availability of lending.

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INTEGRATED ASSESSMENT, ANALYSIS AND MANAGEMENT OF FINANCIAL SECURITY AND STABILITY OF JOINT-STOCK COMPANIES OPERATING IN THE AGRICULTURAL SECTOR: A CASE STUDY OF UKRAINE

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Abstract

The study substantiates that the issue of assessing the state of financial security of joint-stock companies in the agricultural sector became relevant with the growth of their number in the dynamics, as well as with the further development of the agricultural market in Ukraine. The article proves the need to identify and calculate the general indicator of the integrated state of financial security of JSC, which will allow us to identify trends in its change in general, compare the levels of different JSCs operating in the agriculture and identify relevant factors of their financial security. The study proves the feasibility of integrated assessment of the financial security of the JSC are confirmed by the fact that the basis of such a scientific and methodological approach creates conditions for reflecting the effectiveness of formation and use of financial resources in the financial and economic activities of agricultural JSCs in the most generalized form. identify the rank of efficiency of financial activity of the JSC, operating in the agricultural sector. In our opinion, this helps the JSC, operating in the agricultural sector to choose the most effective source of financing its financial and economic activities and helps to maximize the market value of the JSC itself by ensuring a sufficient level of its financial security.

Key words**:** *agricultural sector, integrated assessment, stability, investor uncertainty, joint-stock companies.*

INTRODUCTION

Each business entity has a state of financial security, as it carries out its financial and economic activities in such circumstances, which are characterized by a high level of dynamism, a variety of factors, strengthening the relationship between all types of financial processes in the economy. The issue of assessing the state of financial security of joint-stock companies in the agricultural sector became relevant with the growth of their number in the dynamics, as well as with the further development of the agricultural market in Ukraine. As such entities are a significant part of the country's economic system as a whole, the need to address the problems of ensuring the proper state of their financial security is a priority in the context of increasing the investment attractiveness of joint-stock companies (JSC) in the agricultural sector.

The identified issues are not new in financial science; to this day we can observe attempts to conduct independent research on the choice of a method of assessing the state of financial security of business structures. In practice, various theoretical and methodological approaches are used to assess the state of financial security of the JSC in the agricultural sector. However, some of these techniques can be combined into a separate approach, which is called integrated and is based on the calculation of relevant criteria, which will be included in the integrated indicator based on expert assessments. Therefore, there is a need to identify and calculate the general indicator of the

integrated state of financial security of JSC, which will allow us to identify trends in its change in general, compare the levels of different JSCs and identify relevant factors of their financial security. Using this indicator creates the conditions for corrective action in the long run to achieve optimal financial performance of the JSC.

Many researchers of scientists and practitioners are devoted to researches questions of the maintenance of financial safety of the enterprises of the agricultural sector. Various approaches to its provision were considered, which were based not only on the financial aspects of the agricultural sector but also took into account the objective specifics of management in the agricultural sector. Among the important works in this aspect are the studies of such specialists as O. Agres [1], O. Apostolyuk [2], M. Dziamulych [3-5], H. Haken [6], D. Lewis [8], I. Parvutoiu [9], Y. Peter [10], A. Popescu [11-19], G. Schinasi [21], T. Shmatkovska [22-24], R. Sodoma [25], I. Tofan [27], I. Tsymbaliuk [28], V. Yakubiv [29], Ya. Yanyshyn [30], I. Zhurakovska [32].

The relevance and feasibility of integrated assessment of the financial security of the JSC are confirmed by the fact that the basis of such a scientific and methodological approach creates conditions for reflecting the effectiveness of formation and use of financial resources in the financial and economic activities of agricultural JSCs in the most generalized form. identify the rank of efficiency of financial activity of the JSC. In our opinion, this helps the JSC to choose the most effective source of financing its financial and economic activities and helps to maximize the market value of the JSC itself by ensuring a sufficient level of its financial security. Given the above, we consider it necessary to systematize the proposals developed by scientists on methods of integrated assessment of financial security of agricultural entities and identify those features that can be used in the process of integrated assessment of financial security of JSC, operating in the agricultural sector.

MATERIALS AND METHODS

An integrated method of evaluation, as shown by the analysis of the scientific literature, arises from the use of indicators proposed in the indicator, resource-functional, or another approach with adjusting their set according to the type of economic activity, scale, or organizational and legal form of business entity. At the same time, the application of the integrated method to the assessment of financial security of the JSC is due to the fact that the above approaches have certain shortcomings, which reduces the level of objectivity of the assessment. This method is more accurate and suitable for use for multiplicative, multiple, and combined models [7]. In our opinion, the definition of an integrated indicator of financial security of the JSC of the agricultural sector has the following features:

1) combination of the action of all the most important indicators of efficiency of financial activity of joint-stock company of agrarian sphere;
2) solving the problem of assessing the state of financial security of the JSC by determining a single performance indicator that simplifies the interpretation of partial and summary indicators;
3) possibility of identification of exogenous and endogenous threats and dominants of financial security of JSC.

Integrated evaluation expands and introduces new capabilities to classical analysis, as well as based on the use of previously proposed methods of evaluation and a set of indicators, as well as allows you to compare indicators with different dimensions and characteristics. Integral indicators can be composed based on various prerequisites for their construction and depend on the following factors: the direction of evaluation and the available information base [20]. In particular, T. O. Telna in the process of studying scientific and methodological approaches to assessing the financial security of agricultural enterprises concluded that the assessment on the basis of indicators does not give a reliable result, because such an approach is not systemic. The level of financial security of enterprises should be assessed using an

integrated indicator, which is obtained by using multidimensional statistical methods [26].

In our opinion, to assess the state of financial security of the JSC it is necessary to use the integrated method given its advantages. However, the indicators proposed for inclusion in the methodology of calculation of the summary indicator should have such selection criteria as informativeness, comparability of results, availability of primary information, strategic direction, universality, complexity, and systematization. We consider it expedient to conduct an integrated assessment of the state of financial security on the basis of a combination of such scientific and methodological approaches as an indicator and expert assessment, which will, on the one hand, improve the quality of information and take into account the most important indicators of their financial and economic activity. reduce the level of subjectivity inherent in each of these approaches autonomously. At the same time, the symbiosis of these assessment methods to determine the integrated indicator of financial security of the JSC, in our opinion, will identify threats and dominants of financial security and assess their impact on the integrated indicator and conduct a strategic analysis of financial security of the JSC.

Given that the studied JSCs operate in the field of agro-industrial production, we justify our own approach to the integrated assessment of financial security of such JSCs. For this purpose, we will use the tools of indicator and rank methods in symbiosis. In general, the algorithm for determining the integrated indicator contains 4 stages: 1) selection of coefficients that best reflect the features of financial and economic activities of JSC agricultural sector and their calculation; 2) determination of the safety margin for each indicator; 3) assigning weight to each partial indicator in the model of calculation of the integrated indicator; 4) calculation of the integrated value of the indicator of financial security agrarian JSC (Fig. 1).

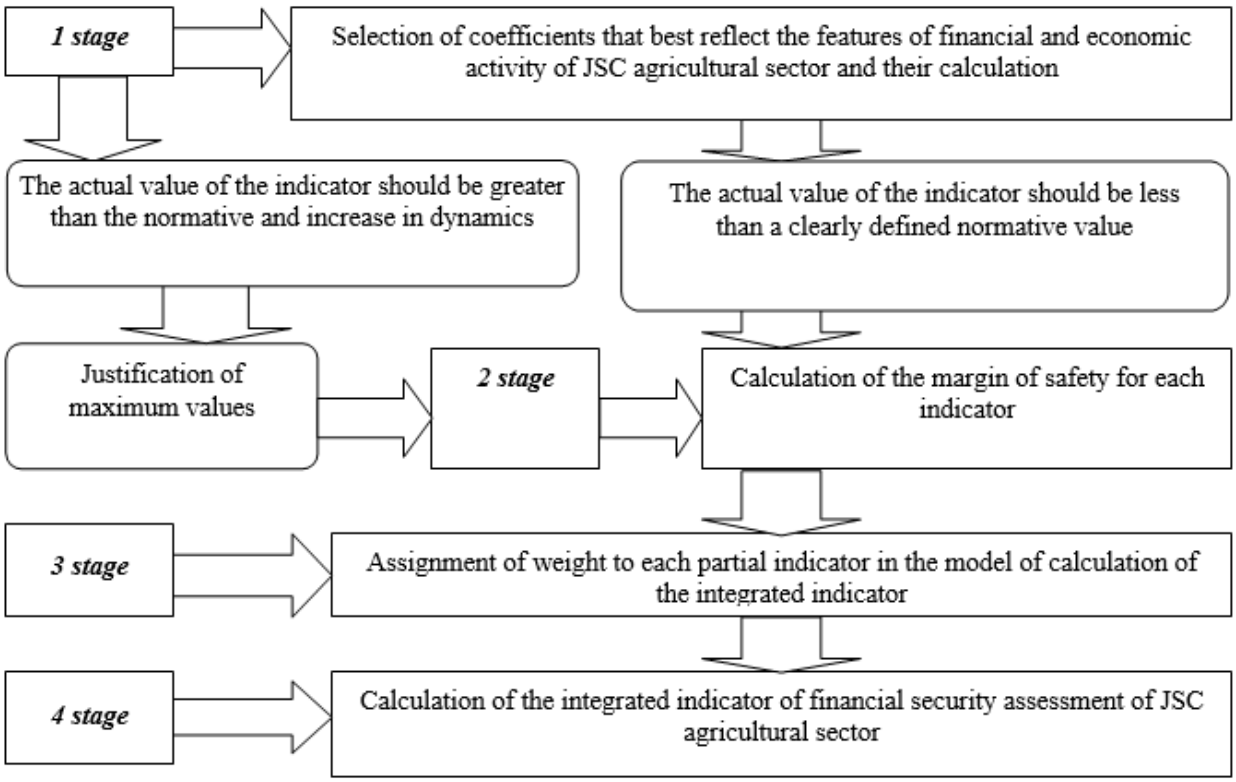

Fig. 1. Algorithm for calculating the integrated indicator of the state of financial security of JSCs operating in the agricultural sector.
Source: own development.

We propose to determine the integrated indicator of the state of financial security of the JSC on the basis of indicators of property status, profitability, financial stability, liquidity, business and market activity, defined. Given that most of them reflect the same characteristics of financial and economic activities of the JSC, we consider it necessary to reduce their list, limited to those indicators that characterize the level of financial security to the greatest extent, as they reflect the features of organizational and legal form, the specifics of life. the cycle of agricultural products, the formation and use of fixed and working capital. At the same time, despite the great importance of market activity indicators, on the basis of which it is possible to characterize the efficiency of the JSC, we take into account only the indicator of reinvestment and return on equity (calculated on the basis of the book value of shares).

Thus, the initial indicators on the basis of which we will form an integral include the coefficient of depreciation of fixed assets; return on assets; profitability of sales; return on equity; coverage ratio; coefficient of autonomy (solvency); funding ratio; asset turnover ratio; inventory turnover ratio; the turnover ratio of fixed assets (return on assets); receivables turnover ratio; accounts payable turnover ratio; reinvestment ratio; return on equity (shares).

Incidentally, for the purpose of further analysis, each of these indicators will be assigned a designation with the appropriate serial number, which will correspond to its actual value. (k_1, k_2, k_3, k_4, k_5, k_6, k_7, k_8, k_9, k_{10}, k_{11}, k_{12}, k_{13}, k_{14}).

RESULTS AND DISCUSSIONS

Indicators of their property status are extremely important for enterprises in the agricultural sector, as the specifics of the activity require the capitalization of a significant share of their own financial resources in the form of non-current assets, in particular, fixed assets. After all, this indicator characterizes the degree of suitability of fixed assets, the need to update existing and disposal of worn-out, the level of which reflects the other three coefficients of the property. Therefore, in order to conduct a general assessment of the property status of the JSC, it is sufficient to calculate the depreciation rate of fixed assets.

In order to assess the profitability of agricultural JSCs, it is enough to analyze their financial and economic profitability. From the indicators of profitability, we believe that the most important indicators are the return on assets (to assess the efficiency of financial resources) and capital (to assess the effectiveness of the most important source of their formation) because capital adequacy reduces the need for borrowed funds, and lack - on the contrary, necessitates in credit resources and this is perhaps the most important in ensuring the effective operation of agricultural enterprises. The return on operating activities will be reflected in the return on assets and equity, as they are calculated on the basis of indicators that directly proportionally affect the amount of net income, assets, and equity, on the basis of which the return on assets and equity is calculated.

However, in order to form more reliable conclusions, avoid collisions when calculating the return on equity, when the amount of losses exceeds the size of the latter (mathematically giving a positive result of financial profitability), as well as, given the specifics of agricultural JSC, we consider it necessary to take into account integrated indicator of financial security of JSC indicator of the profitability of sales. The fact is that in light of the current realities of the Ukrainian economy, agricultural JSCs, for the most part, do not use the potential to increase resources in the financial market, which is typical for JSCs - they do not place their shares on the stock market, do not carry out any operations in order to increase their profits, do not invest in the joint activities of other enterprises, do not make financial investments, etc. The list of operations that are not conducted by Ukrainian JSCs in the agricultural sector is very wide and this is mainly due to the lack of free financial resources, experience, and the necessary specialists in this field. Thus, due to

the negative impact of exogenous and endogenous factors on agricultural JSCs, all their profits are generated from income from the main activity, which is sometimes insufficient to maintain their own funds, so they use borrowed resources.

In addition, it is quite normal for unprofitable blood vessels to function, despite the fact that the magnitude of their losses is significant or permanently increasing. At the same time, they bear the costs of production and receive income from its sale, assessing the relationship between which you can analyse the profitability of their core business, which is often supported by the state, given the priority of agriculture for the national economy. Therefore, the profitability of sales can be used to assess the profitability of the main activity.

From all relative indicators of financial stability, we consider it appropriate to choose two indicators that best reflect the level of financial stability of the JSC in the agricultural sector, and a decrease in values below the recommended signals the risk of reducing their solvency. This is the ratio of autonomy and funding. The first can assess the effectiveness of the use of own financial resources and determine whether the assets of the JSC are financed by equity and what part of it is invested in assets, and the funding ratio allows you to assess the level of dependence of the JSC on borrowed resources.

We believe that the main feature of the liquidity of agricultural JSCs is the presence of net working capital, which indicates the ability of enterprises to pay their short-term liabilities, and its negative value signals the threat of liquidity loss. Since indicator coefficients are used to calculate the integrated indicator, we will use a coverage ratio to determine the level of security for this group of indicators of financial condition, which allows us to assess the extent to which the company's assets cover its current liabilities.

The successful operation of JSCs and their stable position in the market is manifested in excellent indicators of business activity. In this group of indicators for the JSC agricultural sector, the most important, in our opinion, is the indicator of turnover of assets, inventories, fixed assets, receivables, and payables. While the first of them testifies to the efficiency of use of all financial resources, including operating activities, the second - characterizes the policy of sales, which for agricultural JSCs is a prerequisite for creating competitive advantages in a market that can meet the needs of buyers in any a period of time that is beneficial for them. The turnover ratio of fixed assets indicates the efficiency of their use, which against the background of a significant share in the structure of assets (the range of its fluctuation in the studied enterprises is about 7-76% (Table 1) increases the level of financial and economic profitability in general.

Table 1. The share of fixed assets in the assets of joint-stock companies operating in the agricultural sector of Ukraine (at fair value) in 2016-2019, %

Business entities	2016	2017	2018	2019	2017 /2016	2018 /2017	2019 /2018	2019 /2016
PJSC “Mykolaiv Agricultural Company”	34.3	31.5	28.0	25.7	91.7	89.0	91.5	74.7
PJSC “Blok Agrosvit”	8.9	8.5	7.0	6.5	96.0	82.1	93.3	73.6
PJSC “Bakhmut Agricultural Union”	9.5	12.1	10.4	10.5	127.3	85.7	100.8	110.0
PJSC Agricultural firm “Verbivske”	47.5	30.9	26.7	25.7	65.0	86.5	96.3	54.1
PJSC Agricultural PJSC “Ukraine”	37.6	41.8	38.0	24.0	111.1	90.9	63.1	63.7
PJSC “Vinnytsiaagrotransservis”	61.1	62.3	55.1	58.5	102.1	88.4	106.1	95.7
PJSC “Technological agrarian company united”	48.6	52.6	75.6	72.7	108.3	143.7	96.2	149.6

Source: compiled according to the financial statements of joint-stock companies operating in the agricultural sector of Ukraine.

As for the receivables turnover ratio, it is very important to assess the impact of settlements with customers on the level of financial security of the JSC agricultural sector, as often the delay in payment of shipped products by counterparties in the form of deferred advances or breach of payment discipline reduces working capital required

for financing. other production costs. Given that the share of material costs of agricultural joint-stock companies in the operating structure is on average about 50% and they are carried out throughout the production cycle, this ultimately leads to a slowdown in business activity of JSC, and outstanding overdue receivables can turn into and reduce the profitability of JSC in general.

Given the lack of most indicators of the market activity of the JSC, we consider it necessary when calculating the integrated indicator of financial condition to take into account the reinvestment indicator, which allows assessing the financial growth potential of share capital and, accordingly, the level of owners' profits. The greater its value, the more promising is the development of blood pressure in the future. This indicator is, first of all, interesting for potential investors and contractors who are more willing to deal with a successful company. Given that this indicator is not calculated in the case of JSC losses in the relevant periods, in order to conduct an integrated assessment, we will consider its value equal to zero.

Another indicator of market activity is the return on equity of the agricultural sector. However, we will calculate it on the basis of the book value of shares, due to the lack of information about their market price and the lack of shares in circulation on the secondary securities market. This indicator shows how much profit per unit of the book value of a share and, accordingly, allows you to estimate the scale of return on equity, which is extremely important for corporate entities.

In contrast to existing methods, the calculation of the margin of safety is based on the idea of determining the potential financial stability, which indicates the presence of financial potential or the threat of its lack to ensure a certain level of financial security. To this end, and to avoid significant differences between the performance of different agricultural entities due to the peculiarities of settlements with debtors and creditors, inventory management policy, stage of the product life cycle, etc., we consider it necessary to calculate the relative margin of safety. To implement this, we use the theory of properties of solids, namely the method of calculating the coefficient of the strength of parts and machines, which is calculated as the ratio of the maximum (limit) stress characteristic of a particular material to its actual value when the actual stress value must be less than clear a certain value, which is normative (determination of the margin of safety by the stress) [31].

We extrapolate what is indicated on the features of the calculation of the coefficients of financial condition, the values of which must be less than a clearly established regulatory value. However, among these indicators there are those whose values, on the contrary, should increase in dynamics, crossing the threshold. For them, we calculate the margin of safety by the inverse formula, taking as a basis, again, the algorithm for calculating the margin of safety of solids at the allowable stress - the ratio of the actual (or regulatory, other than 0 limits) their value to the maximum allowable.

In other words, provided that the recommended value of the indicator should be less than a certain number, which is the strength threshold, it is calculated as follows:

$$Z_i = K_0 / K_n \quad (1)$$

If the normative value of the indicator moves in the direction of increase in a certain or in the absence of a clearly defined limit, the margin of safety is determined by the formula:

$$Z_i = K_n / K_0 \quad (2)$$

where: K_n – the actual value of the indicator;
K_0 – limit (normative) value of the indicator (known or defined not clearly).

The integrated indicator of financial security of JSC in the agricultural sector is the sum of the values of the margin of safety for each indicator, entered into the set of those on the basis of which it is calculated in a particular period. The value of the margin of safety for each partial indicator (introduced into the model of the integrated indicator) is adjusted to its assigned weight in the specified sample of coefficients:

$$Z = \sum_{i=1}^{n} Z_i \times q_i \quad (3)$$

where: Z – integrated indicator of financial security of JSC in a certain period;

Z_i – the margin of safety on the i-th indicator;
n – the number of indicators that are part of the integrated indicator (14);
q_i – the weight of each indicator in the value of the integral value of the margin of safety (from 2 to 5).
It should be noted that the assignment of weight to each coefficient is designed to equalize the indicators of the margin of safety, which will (sometimes significantly) differ in the studied joint-stock companies of the agricultural sector under the influence of the previously mentioned factors. In general, the composition of the input indicators and the algorithm for calculating the margin of safety on such indicators are shown in table 2.

Table 2. System of indicators for integrated assessment of financial security of JSC agricultural sector and algorithm for calculating their safety margin

Nr	Indicator	Normative value of the indicator, K	The actual value of the indicator, K_n	Safety margin		Wages, q_i
				Strength threshold, K_0	Calculation formula, Z_i	
1.	Wear coefficient	<0.5, reduction	k_1	0.5	$0.5/k_1$	3
2.	Return on assets ratio	>0, amplification	k_2	0.5	$k_2/0.5$	5
3.	Profitability of sales	>0, amplification	k_3	0.7	$k_3/0.7$	4
4.	Return on equity	>0, amplification	k_4	0.7	$k_4/0.7$	5
5.	Coverage ratio	>1, amplification	k_5	1	$k_5/1$	4
6.	Coefficient of autonomy (solvency)	>0.5, amplification	k_6	0.5	$k_6/0.5$	4
7.	Funding ratio	<1, reduction	k_7	1	$1/k_7$	5
8.	Asset turnover ratio	>0, amplification	k_8	2	$k_8/2$	3
9.	Inventory turnover ratio	>0, amplification	k_9	5	$k_9/5$	2
10.	Fixed assets turnover ratio	>1, amplification	k_{10}	1	$k_{10}/1$	3
11.	Receivables turnover ratio	>0, amplification	k_{11}	43	$k_{11}/43$	2
12.	Accounts payable turnover ratio	>0, amplification	k_{12}	14	$k_{12}/14$	2
13.	Reinvestment ratio	>0, amplification	k_{13}	3	$k_{13}/3$	4
14.	Return on equity ratio	>0, amplification	k_{14}	16	$k_{14}/16$	4

Source: systematized independently.

Let us explain in more detail the mechanism of calculating the value of the margin of safety, which is actually a reserve for increasing or decreasing the corresponding indicator by determining the limit value of the deviation of the actual value of the indicator from the normative (recommended). In this case, for each of these indicators, the margin of safety will be calculated differently. Thus, the threshold value of the depreciation factor, the excess of which is a threat to reduce the level of financial security, is taken to increase its threshold - 0.5, so for it, the margin of safety will be calculated by the formula (1), i.e. $z_1=0.5/k_1$
Indicators of return on assets, sales, and equity should be greater than zero and grow in dynamics. Therefore, the margin of safety for them will be determined by the formula (2). Given that the upper limit of the increase in these indicators has not been determined, these limit values have been set expertly, taking into account the potential for their development. For a return on assets, this limit will be 50%, assuming that corporate companies are likely to make a profit of half the value of all assets. Based on the same principle of determining the upper limit, for the return on sales and equity - it will be 0.7. Therefore, the margin of safety for these indicators will be determined by formula (2), i.e. $z_2=k_2/0.5$, $z_3= k_3/0.7$, $z_4=k_4/0.7$.
The limit value of the coverage ratio is a unit, the excess of which indicates the efficiency of the formation and use of financial resources of the JSC, which timely repays its financial obligations. If this value is less than 1, then the company is illiquid. The margin of safety by this coefficient is determined by formula (2), i.e. $z_5=k_5/1$.

The same formula is used to calculate the margin of safety for the coefficient of autonomy, which will be $k_6/0.5$ because its value must be> 0.5 (at the threshold of strength – 0.5), and for the funding factor - according to formula (1), substituting the data in which we have $z_7=1/k_7$ (at $k_0=1$).

In the same way, we will calculate the margin of safety according to the turnover ratios of assets and stocks, which we introduced in the calculation of the integrated indicator, and the values of which must be greater than zero and increase in dynamics. However, for the purposes of conducting the necessary calculations, we will set the maximum (threshold) values for them at levels 2 and 5, again by the expert method, taking into account their growth potential. That is, the margin of safety on the turnover of assets – $z_8=k_8/2$, on the turnover of inventories – $z_9=k_9/5$. The same formula (2) calculates the margin of safety for the return on assets – $z_{10}=k_{10}/1$, given that its value must be > 1 (for $k_0=1$).

Once again, the hypothetical limit values of the mentioned coefficients are substantiated by the results of the synectics method in view of their external maximum values obtained in the process of analysis of the corresponding coefficients of BP of the agricultural sector taking into account the potential increase of indicators. Thus, the threshold value of the turnover of receivables can be considered 43, the limit value of the indicator of turnover of accounts payable – 14. The margin of safety for the turnover ratios of receivables and payables is calculated by the formula (2), according to which we have: for the first indicator $z_{11}=k_{11}/43$, for the second – $z_{12}=k_{12}/14$.

Regarding the coefficients of market activity, which we take into account when calculating the integrated indicator of financial security of agricultural JSCs, the margin of their strength is also calculated by the formula (2). In the absence of normative values of these indicators, we consider it necessary to set it at level 3 for the reinvestment ratio (taking into account the value of this ratio at PJSC Agricultural firm "Verbivske" in 2016 – 2.46) and 16 – for return on shares (based on return on equity), at PJSC "Bakhmut Agricultural Union" in 2018 – 15.44) given the already mentioned mechanism for calculating the threshold values of the strength reserve. The latter is established by selecting the largest exterior value of a certain indicator, calculated for all studied blood pressure, taking into account the potential for their increase. We consider it necessary in this way to emphasize the need for the development of JSC in the agricultural sector, which, accordingly, will help increase their level of financial security. Therefore, for the reinvestment indicator, formula (2) is transformed into $z_{13}=k_{13}/3$, for the return on equity ratio – into $z_{14}=k_{14}/16$. It should be noted that for unprofitable enterprises the reinvestment ratio will be considered equal to 0, since in terms of losses it is not calculated, and therefore their margin of safety is also equal to 0.

To increase the reliability of the conclusions, we consider it appropriate to introduce a weight for each indicator, which will reflect its place in the integrated indicator of financial security and smooth the difference between the values of safety margins given the differences in scale, management, and life cycle of agricultural products. To do this, again, we will use the method of expert assessments, namely the survey of employees of the JSC in the agricultural sector, which are related to financial security.

The proposed structure of the questionnaires provided for the number of indicators of financial condition, the probable number of points that can be assigned to each indicator (from 1 to 5), and justification. According to the results of the questionnaires, the largest number of experts agreed that the ratios of the return on assets, equity, and financing should be assigned the highest score - 5. These indicators, according to experts, are sufficient to assess the level of financial security of the JSC, distinguishing dominants (threats) of profitable (unprofitable) activity, low (high) financial dependence.

Indicators of return on sales, stocks, autonomy, current liquidity, and reinvestment of profits will be assigned a weight of 4 points. The vast majority of experts believe that the analysis of these ratios allows

systematizing such dominants (threats) as profitability (loss) of the main activity, ability (inability) to meet their short-term financial obligations, the presence (absence) of sufficient funds to finance current activities and reinvestment. Complementary to these are indicators of depreciation of fixed assets, asset turnover, receivables, and return on assets, which allow assessing the efficiency of use of JSC assets. However, even in the conditions of unprofitability, they can be positive and fall into the range of recommended values, so in order to avoid distorted results of the calculation of the integral value of financial security, they are given less weight in the integrated indicator - 3. Given that in the JSC of the agricultural sector the indicator of inventory turnover and receivables at unprofitable enterprises may be higher than at profitable ones, the ratios of inventory turnover and receivables are given a weight of 2 points. The faster the product is sold and paid for, the faster the entity settles its liabilities, which, of course, affects the acceleration of accounts payable. Assuming the turnover ratio of accounts payable in addition to the above indicators of business activity, we assign it the same weight - 2 points (Table 2). Therefore, we calculate the margin of safety for each indicator on the basis of already determined actual values of the relevant indicators for assessing the state of financial security of joint-stock companies, which are taken into account when calculating the integrated indicator and grouped in Table 3-9.

Table 3. Indicators of financial security assessment of PJSC «Mykolaiv Agricultural Company» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.27	0.30	0.33	0.38
The return on assets	0.11	0.10	0.18	0.09
Profitability of sales	0.15	0.15	0.25	0.19
Return on equity	0.15	0.16	0.27	0.13
Coverage ratio	3.26	2.82	2.79	3.21
Coefficient of autonomy (solvency)	0.70	0.65	0.69	0.65
Funding ratio	0.43	0.54	0.46	0.55
Asset turnover ratio	0.69	0.72	0.74	0.46
Inventory turnover ratio	0.98	0.87	0.55	0.36
Fixed assets turnover ratio (return on assets)	1.49	1.57	1.71	1.11
Receivables turnover ratio	5.83	5.70	6.13	4.90
Accounts payable turnover ratio	4.25	3.91	3.45	2.53
Reinvestment ratio	1.16	0.98	1.01	1.04
Return on equity ratio	4.70	5.56	12.12	7.00

Source: calculated and systematized according to the annual financial statements of PJSC «Mykolaiv Agricultural Company».

Table 4. Indicators of financial security assessment of PJSC Agricultural firm «Verbivske» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.20	0.32	0.36	0.39
The return on assets	0.07	0.23	0.34	0.24
Profitability of sales	0.06	0.16	0.22	0.16
Return on equity	0.10	0.33	0.43	0.28
Coverage ratio	1.88	2.39	6.71	6.08
Coefficient of autonomy (solvency)	0.70	0.70	0.87	0.84
Funding ratio	0.42	0.43	0.15	0.19
Asset turnover ratio	1.25	1.47	1.56	1.49
Inventory turnover ratio	4.50	4.40	3.88	3.84
Fixed assets turnover ratio (return on assets)	2.11	2.89	3.60	3.53
Receivables turnover ratio	7.27	8.50	10.02	9.75
Accounts payable turnover ratio	4.98	5.73	9.00	13.65
Reinvestment ratio	2.46	0.99	1.02	0.29
Return on equity ratio	0.12	0.52	1.04	0.84

Source: calculated and systematized according to the annual financial statements of PJSC Agricultural firm «Verbivske».

Table 5. Indicators of financial security assessment of PJSC «Bakhmut Agricultural Union» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.67	0.60	0.62	0.63
The return on assets	0.17	0.16	0.37	0.22
Profitability of sales	0.33	0.35	0.61	0.49
Return on equity	0.31	0.27	0.51	0.30
Coverage ratio	2.00	2.62	4.21	2.35
Coefficient of autonomy (solvency)	0.58	0.64	0.78	0.71
Funding ratio	0.72	0.56	0.28	0.40
Asset turnover ratio	0.50	0.48	0.61	0.45
Inventory turnover ratio	0.70	0.73	0.74	0.79
Fixed assets turnover ratio (return on assets)	1.70	1.61	2.13	1.63
Receivables turnover ratio	2.90	3.41	7.47	5.77
Accounts payable turnover ratio	1.13	1.34	2.47	1.91
Reinvestment ratio	1.31	0.66	0.73	-0.38
Return on equity ratio	5.48	6.00	15.44	10.08

Source: calculated and systematized according to the annual financial statements of PJSC «Bakhmut Agricultural Union».

Table 6. Indicators for assessing the state of financial security Agricultural PJSC «Ukraine»

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.63	0.65	0.67	0.68
The return on assets	-0.03	-0.10	-0.19	0.06
Profitability of sales	-0.03	-0.11	-0.23	0.07
Return on equity	-0.07	-0.24	-0.69	0.23
Coverage ratio	1.08	0.96	0.83	1.37
Coefficient of autonomy (solvency)	0.42	0.38	0.18	0.34
Funding ratio	1.38	1.63	4.67	1.94
Asset turnover ratio	0.88	0.87	0.83	0.96
Inventory turnover ratio	1.87	2.03	1.94	1.88
Fixed assets turnover ratio (return on assets)	0.91	0.80	0.71	1.06
Receivables turnover ratio	3.82	3.80	3.79	3.70
Accounts payable turnover ratio	1.90	2.13	1.88	2.01
Reinvestment ratio	0	0	0	1.00
Return on equity ratio	-0.56	-1.597	-3.05	0.383

Source: calculated and systematized according to the annual financial statements of Agricultural PJSC «Ukraine».

Table 7. Indicators of assessment of the state of financial security of PJSC «Vinnytsiaagrotransservis» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.66	0.68	0.70	0.72
The return on assets	-0.06	-0.10	0.02	-0.11
Profitability of sales	-0.04	-0.07	0.01	-0.07
Return on equity	-0.08	-0.13	0.03	-0.15
Coverage ratio	1.80	1.57	1.63	1.49
Coefficient of autonomy (solvency)	0.79	0.77	0.73	0.72
Funding ratio	0.27	0.31	0.37	0.39
Asset turnover ratio	1.38	1.39	1.86	1.47
Inventory turnover ratio	3.82	4.03	4.58	3.54
Fixed assets turnover ratio (return on assets)	0.79	0.74	0.97	0.75
Receivables turnover ratio	33.39	34.71	42.35	33.18
Accounts payable turnover ratio	7.43	7.25	8.21	5.96
Reinvestment ratio	0	0	1.00	0
Return on equity ratio	-0.144	-0.218	0.044	-0.226

Source: calculated and systematized according to the annual financial statements of PJSC "Vinnytsiaagrotransservis".

Table 8. Indicators of financial security assessment of PJSC «Blok Agrosvit» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.15	0.11	0.18	0.24
The return on assets	-0.04	-0.30	-0.32	-0.19
Profitability of sales	-0.07	-1.29	-1.03	-0.98
Return on equity	-0.14	-2.09	1.44	0.54
Coverage ratio	1.13	0.82	0.65	0.59
Coefficient of autonomy (solvency)	0.24	-0.06	-0.35	-0.50
Funding ratio	3.19	-16.79	-3.85	-2.99
Asset turnover ratio	0.53	0.23	0.31	0.19
Inventory turnover ratio	1.85	0.88	1.25	0.83
Fixed assets turnover ratio (return on assets)	5.21	2.34	3.49	2.27
Receivables turnover ratio	0.96	0.59	0.67	0.32
Accounts payable turnover ratio	4.86	0.94	0.83	0.48
Reinvestment ratio	0	0	0	0
Return on equity ratio	-0.225	-1.967	-2.47	-1.608

Source: calculated and systematized according to the annual financial statements of PJSC «Blok Agrosvit».

Table 9. Indicators of financial security assessment of PJSC «Technological agrarian company united» (Ukraine)

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	0.06	0.08	0.05	0.10
The return on assets	-0.17	0.65	-0.25	-0.63
Profitability of sales	-0.23	0.67	-0.42	-2.99
Return on equity	0.54	-6.17	-1.16	3.02
Coverage ratio	0.71	0.43	0.23	0.11
Coefficient of autonomy (solvency)	-0.43	0.22	0.21	-0.42
Funding ratio	-3.33	3.54	3.66	-3.41
Asset turnover ratio	0.75	0.97	0.59	0.21
Inventory turnover ratio	3.31	4.21	4.52	2.62
Fixed assets turnover ratio (return on assets)	1.54	1.79	0.83	0.26
Receivables turnover ratio	4.50	3.12	12.78	4.49
Accounts payable turnover ratio	5.33	3.22	1.48	0.50
Reinvestment ratio	0	1.00	0	0
Return on equity ratio	-29.12	103.32	-50.12	-153.4

Source: calculated and systematized according to the annual financial statements of PJSC «Technological agrarian company united».

Based on the analysis. Using Excel spreadsheets, we display the margin of safety, taking into account the weights and the integral value of the financial security of joint-stock companies in the agricultural sector for each of the analysed enterprises (Table 10-16 and Fig. 2).

Table 10. Dynamics of the value of the safety margin of PJSC «Mykolaiv Agricultural Company» in 2016-2019.

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	5.56	5.00	4.55	3.95
Return on assets	1.10	1.00	1.80	0.90
Profitability of sales	0.86	0.86	1.43	1.09
Return on equity	1.07	1.14	1.93	0.93
Coverage ratio	13.04	11.28	11.16	12.84
Coefficient of autonomy (solvency)	5.60	5.20	5.52	5.20
Funding ratio	11.63	9.26	10.87	9.09
Asset turnover ratio	1.04	1.08	1.11	0.69
Inventory turnover ratio	0.39	0.35	0.22	0.14
Fixed assets turnover ratio (return on assets)	4.47	4.71	5.13	3.33
Receivables turnover ratio	0.27	0.27	0.29	0.23
Accounts payable turnover ratio	0.61	0.56	0.49	0.36
Reinvestment ratio	1.55	1.31	1.35	1.39
Return on equity ratio	1.18	1.39	3.03	1.75
Integral value	48.35	43.40	48.87	41.88

Source: own calculations.

Table 11. Dynamics of the value of the safety margin of PJSC Agricultural firm «Verbivske» in 2016-2019.

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	7.50	4.69	4.17	3.85
Return on assets	0.70	2.30	3.40	2.40
Profitability of sales	0.34	0.91	1.26	0.91
Return on equity	0.71	2.36	3.07	2.00
Coverage ratio	7.52	9.56	26.84	24.32
Coefficient of autonomy (solvency)	5.60	5.60	6.96	6.72
Funding ratio	11.90	11.63	33.33	26.32
Asset turnover ratio	1.88	2.21	2.34	2.24
Inventory turnover ratio	1.80	1.76	1.55	1.54
Fixed assets turnover ratio (return on assets)	6.33	8.67	10.80	10.59
Receivables turnover ratio	0.34	0.40	0.47	0.45
Accounts payable turnover ratio	0.71	0.82	1.29	1.95
Reinvestment ratio	3.28	1.32	1.36	0.39
Return on equity ratio	0.03	0.13	0.26	0.21
Integral value	48.65	52.35	97.09	83.88

Source: own calculations.

Table 12. Dynamics of the value of the safety margin of PJSC «Bakhmut Agricultural Union» in 2016-2019.

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	2.24	2.50	2.42	2.38
Return on assets	1.70	1.60	3.70	2.20
Profitability of sales	1.89	2.00	3.49	2.80
Return on equity	2.21	1.93	3.64	2.14
Coverage ratio	8.00	10.48	16.84	9.40
Coefficient of autonomy (solvency)	4.64	5.12	6.24	5.68
Funding ratio	6.94	8.93	17.86	12.50
Asset turnover ratio	0.75	0.72	0.92	0.68
Inventory turnover ratio	0.28	0.29	0.30	0.32
Fixed assets turnover ratio (return on assets)	5.10	4.83	6.39	4.89
Receivables turnover ratio	0.13	0.16	0.35	0.27
Accounts payable turnover ratio	0.16	0.19	0.35	0.27
Reinvestment ratio	1.75	0.88	0.97	-0.51
Return on equity ratio	1.37	1.50	3.86	2.52
Integral value	37.17	41.13	67.32	45.54

Source: own calculations.

Table 13. Dynamics of the value of the safety margin Agricultural PJSC «Ukraine» in 2016-2019

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	2.38	2.31	2.24	2.21
Return on assets	-0.30	-1.00	-1.90	0.60
Profitability of sales	-0.17	-0.63	-1.31	0.40
Return on equity	-0.50	-1.71	-4.93	1.64
Coverage ratio	4.32	3.84	3.32	5.48
Coefficient of autonomy (solvency)	3.36	3.04	1.44	2.72
Funding ratio	3.62	3.07	1.07	2.58
Asset turnover ratio	1.32	1.31	1.25	1.44
Inventory turnover ratio	0.75	0.81	0.78	0.75
Fixed assets turnover ratio (return on assets)	2.73	2.40	2.13	3.18
Receivables turnover ratio	0.18	0.18	0.18	0.17
Accounts payable turnover ratio	0.27	0.30	0.27	0.29
Reinvestment ratio	0.00	0.00	0.00	1.33
Return on equity ratio	-0.14	-0.40	-0.76	0.10
Integral value	17.82	13.51	3.76	22.89

Source: own calculations.

Table 14. Dynamics of the value of the safety margin of PJSC «Vinnytsiaagrotransservis» in 2016-2019

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	2.27	2.21	2.14	2.08
Return on assets	-0.60	-1.00	0.20	-1.10
Profitability of sales	-0.23	-0.40	0.06	-0.40
Return on equity	-0.57	-0.93	0.21	-1.07
Coverage ratio	7.20	6.28	6.52	5.96
Coefficient of autonomy (solvency)	6.32	6.16	5.84	5.76
Funding ratio	18.52	16.13	13.51	12.82
Asset turnover ratio	2.07	2.09	2.79	2.21
Inventory turnover ratio	1.53	1.61	1.83	1.42
Fixed assets turnover ratio (return on assets)	2.37	2.22	2.91	2.25
Receivables turnover ratio	1.55	1.61	1.97	1.54
Accounts payable turnover ratio	1.06	1.04	1.17	0.85
Reinvestment ratio	0.00	0.00	1.33	0.00
Return on equity ratio	-0.04	-0.05	0.01	-0.06
Integral value	41.46	36.96	40.51	32.26

Source: own calculations.

Table 15. Dynamics of the value of the safety margin of PJSC «Blok Agrosvit» in 2016-2019

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	10.00	13.64	8.33	6.25
Return on assets	-0.40	-3.00	-3.20	-1.90
Profitability of sales	-0.40	-7.37	-5.89	-5.60
Return on equity	-1.00	-14.93	10.29	3.86
Coverage ratio	4.52	3.28	2.60	2.36
Coefficient of autonomy (solvency)	1.92	-0.48	-2.80	-4.00
Funding ratio	1.57	-0.30	-1.30	-1.67
Asset turnover ratio	0.80	0.35	0.47	0.29
Inventory turnover ratio	0.74	0.35	0.50	0.33
Fixed assets turnover ratio (return on assets)	15.63	7.02	10.47	6.81
Receivables turnover ratio	0.04	0.03	0.03	0.01
Accounts payable turnover ratio	0.69	0.13	0.12	0.07
Reinvestment ratio	0.00	0.00	0.00	0.00
Return on equity ratio	-0.06	-0.49	-0.62	-0.40
Integral value	34.06	-1.77	19.00	6.40

Source: own calculations.

Table 16. Dynamics of the value of the safety margin of PJSC «Technological agrarian company united» in 2016-2019

Indicators	2016	2017	2018	2019
Depreciation rate of fixed assets	25.00	18.75	30.00	15.00
Return on assets	-1.70	6.50	-2.50	-6.30
Profitability of sales	-1.31	3.83	-2.40	-17.09
Return on equity	3.86	-44.07	-8.29	21.57
Coverage ratio	2.84	1.72	0.92	0.44
Coefficient of autonomy (solvency)	-3.44	1.76	1.68	-3.36
Funding ratio	-1.50	1.41	1.37	-1.47
Asset turnover ratio	1.13	1.46	0.89	0.32
Inventory turnover ratio	1.32	1.68	1.81	1.05
Fixed assets turnover ratio (return on assets)	4.62	5.37	2.49	0.78
Receivables turnover ratio	0.21	0.15	0.59	0.21
Accounts payable turnover ratio	0.76	0.46	0.21	0.07
Reinvestment ratio	0.00	1.33	0.00	0.00
Return on equity ratio	-7.28	25.83	-12.53	-38.35
Integral value	24.50	26.18	14.24	-27.13

Source: own calculations.

As can be seen from Fig. 2, PJSC Agricultural firm “Verbivske” has the highest level of financial security. The value of its integrated indicator increased during 2016-2018 by an average of 66 points, however, in 2019 it decreased. The same dynamics are characteristic of the integrated indicator PJSC “Bakhmut Agricultural Union”, which is in second place in terms of financial security, given the stability of development in 2016-2018 and a slight decline in 2019, despite the fact that in 2016-2018 The values of the integrated indicator were lower than at the PJSC “Mykolaiv Agricultural Company”. Regarding the latter, the level of its financial security decreased (in 2017 and 2019), then increased (in 2018). At the same time, in 2018 the level of financial security of all surveyed profitable JSCs in the agricultural sector was the highest, as evidenced by the highest value of the integrated indicator: 97.09 - in PJSC Agricultural firm "Verbivske", 67.32 – in PJSC "Bakhmut Agricultural Union" and 48.87 - in PJSC Mykolaiv Agricultural Company.

The integrated financial security indicators of PJSC “Mykolaiv Agricultural Company” and PJSC “Vinnytsiaagrotransservis” are similar in dynamics and close in value, despite the fact that the former is absolutely profitable throughout the analysed period, and the latter - was profitable only in 2018, and the number of losses in 2019 increased by as much as 57.09% compared to 2016.

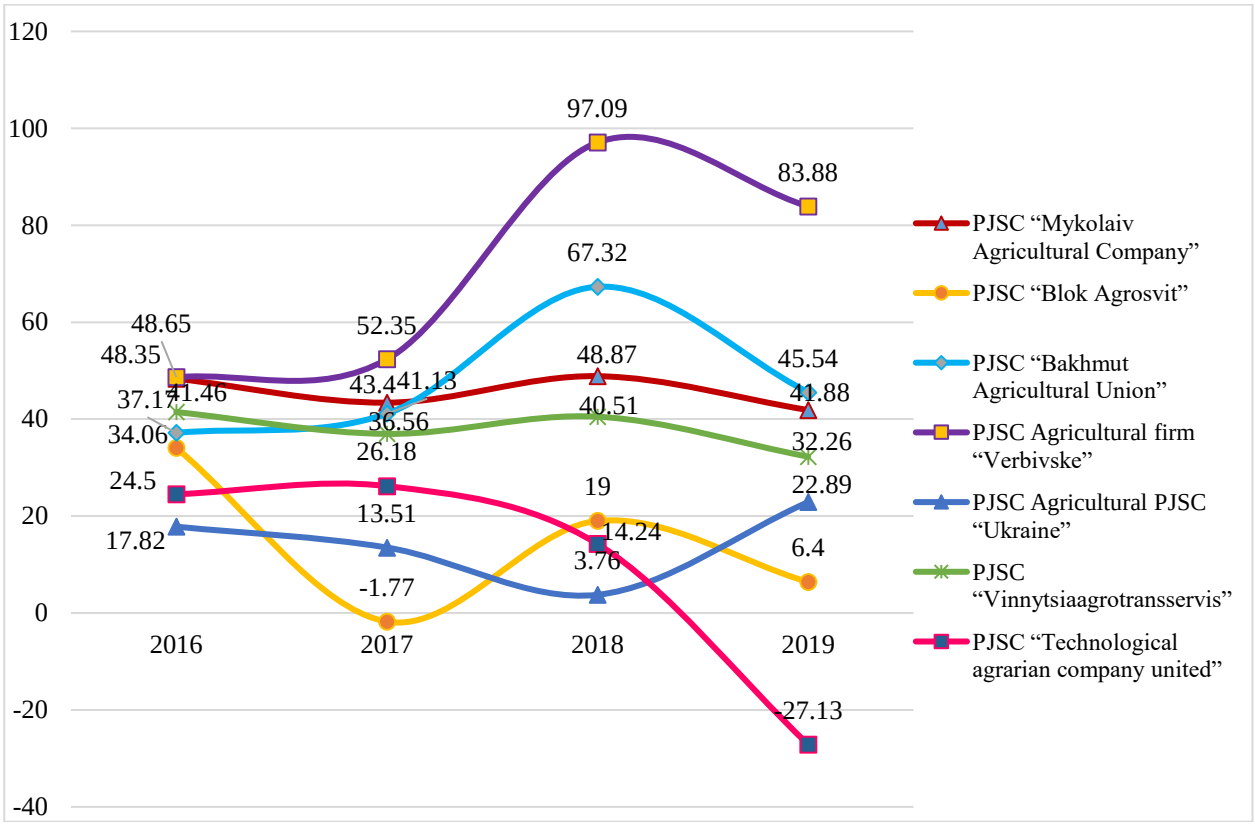

Fig. 2. Dynamics of the integrated indicator of financial security of joint-stock companies of the agricultural sector of Ukraine for 2016-2019
Source: own development.

This is an example of the realities of the JSC agricultural sector, which in terms of losses provide excellent indicators of business activity, liquidity, and financing, due to the specific life cycle of products and independence from external sources of funding.

Given the numerical values of the table. 15, the most attractive for investment is PJSC "Mykolaiv Agricultural Company", the assessment of the effectiveness of financial security management, which from the position of the investor is the highest – 0.6335.

For PJSC Agricultural firm "Verbivske" such an assessment gave less value to the global priority – 0.2884, for PJSC "Bakhmut Agricultural Union" – even less (0.2834). Therefore, in this order, it is necessary to rank the researched joint-stock companies of the agricultural sector of Ukraine on the efficiency of management of financial safety.

It should be noted that the declining dynamics of the integrated indicator in 2019 is typical for all enterprises, except for Agricultural PJSC "Ukraine", for which, on the contrary, the trend line of the integrated indicator was upward, indicating an increase in its financial security as opposed to a steady decline. 2016–2018. This confirms the previously made conclusions about the effectiveness of actions to replenish its own financial resources with funds from the issue of additional shares, which allowed to improve its financial security.

As for PJSC "Blok Agrosvit", its integrated indicator indicates a very low level of financial security: especially in 2017, when the value of this indicator reached -1.77, which, in fact, means bankruptcy. In 2018, it increased slightly (to 19.0), but in 2019 - decreased again (to 6.4).

As expected, the worst level of financial security is PJSC "Technological agrarian company united", the value of the integrated indicator of which in 2019 decreased to -27.13, which indicates a significant deterioration in the financial condition of the company and the threat of its liquidation. This situation is obviously due to the objective need to restore the solvency of the JSC (as a

result of which the company implements the procedure of pre-trial reorganization), and the change of owner in March-April 2019, which significantly destabilized the JSC.

CONCLUSIONS

Thus, the integrated indicator can be used to assess the degree of financial security of joint-stock companies and analyse its changes in dynamics. The two profitable JSCs are characterized by a high level of their financial security, which increases in the short term (2016–2018) and slightly decreases in 2019 (PJSC Agricultural firm "Verbivske" and PJSC "Bakhmut Agricultural Union"). The level of financial security of PJSC "Mykolaiv Agricultural Company" and PJSC "Vinnytsiaagrotransservis" can be described as moderate - slightly lower than the two newly mentioned joint-stock companies with fluctuations in the direction of increase or decrease. The degree of financial security of Agricultural PJSC "Ukraine" is stably low with a slight increase in 2019. As for PJSC "Blok Agrosvit" and PJSC "Technological agrarian company united", the level of their financial security is low and catastrophically low in some periods, as indicated by the low and, in some places, a negative value of the integrated indicator.

Therefore, it can be argued that the application of an integrated indicator of financial security of joint-stock companies in the agricultural sector allows for an adequate assessment of the state of financial security and strength of these enterprises. Based on this, investors receive a well-founded information base on decisions on the feasibility of investing in shares of relevant companies, as the margin of financial strength allows with high probability to extrapolate these data to positive expectations about the return on investment. Based on the fact that for agricultural joint-stock companies the factor of forecasting the payback is one of the most important in the process of attracting investment, it can be argued that the use of an integrated indicator of financial security can solve this problem of investor uncertainty.

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THE MAIN CHARACTERISTICS OF ROMANIAN LABOUR RESOURCES IN TERITORIAL PROFILE

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Abstract

The paper aims to analyze the main characteristics of the Romanian labour resources between 1999 and 2019 by using the statistic database collected in territorial profile. We analyzed the civil employment population based on their territorial distribution and we correlate the results with the main economical national activities. The research proved a polarization of human resources around the important cities, but also a distribution of civil employment population in the counties from central and west part of the country where in the last two decades developed more economic branches like construction and manufacturing industries. By observing the development pattern for 1999-2019 period we can say that Romania is facing many challenges like the decrease of labour resources due to reallocation to other counties or external migration. However we also observed that the industry, constructions and commerce act as polarizing sectors for the labour force, to the detriment of agricultural activities, so the future strategies have to be oriented towards the development of business in these fields.

Key words**:** *labour resources, civil employment population, economic national activities*

INTRODUCTION

In the last decades the shape of Romanian economy changes, the agricultural sector becoming less important in the formation of GDP and the "share of those who are involved in agriculture as a prime activity is very low" [4]. Romania's population has followed a decreasing trend in last decades due to the low natural birth rate and migration. Also, aging of the Romanian population is another feature [6, 9]. Large discrepancies are between rural and urban population regarding the share in the total population, employment rate, productivity, income and education level [10]. Labor force is one de the main production factors in agriculture, but in the territory there is a variation in its number and share by activities [1]. In agriculture it is still a high working population compared to other EU countries [2, 3, 5]. According to [7], some regions, like the ones from center of the country, have an "optimal structure due to the decrease of employment in agriculture and industry and population growth in constructions" and the North-West, West and North-East regions need to reduce "the population in agriculture" and to promote "employment in industry and constructions to support the economic growth" [7]. In the same time the Bucharest-Ilfov Region has a high "employability of human capital in rural areas" due to the proximity of rural areas to Bucharest, the capital of Romania [11]. Starting from this researches, this paper aims to assess the mutations in labour resources during the last two decades at regional and county level and to identify the pattern of development by correlating these mutations with the structure of economy branches.

The purpose of the paper was the analysis of the main characteristics of the Romanian labour resources between 1999 and 2019 using the statistics database collected in territorial profile.

MATERIALS AND METHODS

To assess the main characteristics of labour resources we used the time series from Tempo Online database of National Institute of Statistics from Romania. Our research focused on the dynamics and structure of labour resources, within the 1999-2019 periods and we analyzed the following main indicators: labour resources (people with the capacity to perform

work, at working age); employment rate of labour resources (the share of civil employment population in the total labour resources); the civil employed population ("who work for an income and whose work is usually done in one of the activities of the national economy" - employees, employers, self-employed and unpaid family workers). Our analyze show the evolution of labour resources at regional and county level in correlation with the development of activities of the national economy.

RESULTS AND DISCUSSIONS

In 2019, the Romanian population was formed by 19.3 million persons, with around 15.4% lower than 1999. This decrease is reflected in all the age groups, but during the analyzed period (of 20 years) the labour resources decreased with only 8.77% (1.18 million persons) and reached in 2019 the value of 12.2 millions ("working age population able to work as well as persons under and over the working age but who are still working") (Table 1).

The analysis in the territorial profile revealed a decrease of almost 15% in the Macroregion 2 (from east of the country) and of around 7% in Macroregion 1 (center and North of the country). However in terms on labour force the Macroregion 2 remains one of the biggest source of workforce (28.1%). Also, if we analyze the labour resources in regional profile, we observe that only in Bucharest-Ilfov Region we have an increase of 10.7% (152.2 thou persons) which means that Romania lose around 1.8 million persons, especially due to migration.

Table 1. The evolution of labour resources, 1999-2019

	No (mill. pers)	2019/1999 (+/-) (thou pers.)	2019/1999 (%)	1999 (%)	2019 (%)	1999-2019 Mutations (pp)
TOTAL	12.2	-1172.6	91.23	100.0	100.0	-
Macroregion 1	3.1	-220.2	93.30	24.59	25.15	0.56
North-West Region	1.6	-57.1	96.60	12.55	13.29	0.74
Centre Region	1.5	-163.1	89.87	12.04	11.86	-0.18
Macroregion 2	3.4	-595.9	85.19	30.09	28.10	-1.99
North-East Region	1.9	-281.3	87.42	16.72	16.02	-0.70
South-East Region	1.5	-314.6	82.40	13.37	12.08	-1.29
Macroregion 3	3.4	-65.1	98.10	25.65	27.59	1.93
South Region	1.8	-217.3	89.17	15.01	14.67	-0.34
Bucharest-Ilfov Region	1.6	152.2	110.69	10.65	12.92	2.27
Macroregion 4	2.3	-291.4	88.91	19.66	19.16	-0.50
South-West Region	1.2	-201.6	85.55	10.43	9.78	-0.65
West Region	1.1	-89.8	92.72	9.23	9.38	0.15

Note: "For 1990, until 2000, 16-54 years old for women and 16- 59 years for man"; "For 2016-2019 - 16-60 years old for women and 16-65 years for men".
Source: Own calculation on the basis of data from Tempo on line, NIS, 2021 [8].

Figure 1 reveals the economical poles in territorial profile. Like we may see, we have 4 counties in north-east and north-west which all have universities and offer more opportunities in urban areas (in cities like Cluj - Cluj County, Timișoara - Timiș County, Iași - Iași County, Oradea- Bihor County), but also we can observe how the development of Bucharest (the capital of Romania and the biggest city of our country) led to the increase of labour resources in Dambovita (DB), Giurgiu (GR) and especially in Ilfov County.

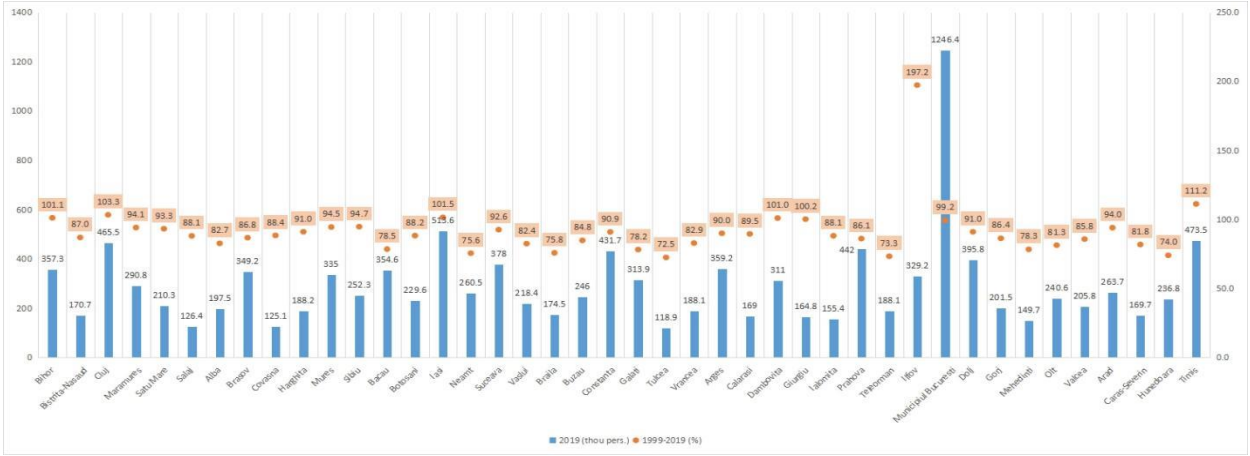


Fig.1. Labour resources mutations in territorial profile (1999-2019 period) (decrease or increase)
Source: Own calculation on the basis of data from Tempo Online, NIS [8] the data from 1999 and 2019 are not directly comparable due to the difference in methodology but we consider that dynamics and structure can be comparable in trend.

When we analyze the employment rate of labour resources the situation is different.

The share of civil employment population in the total labour resources was higher in Macroregion 3 (75.3%) and Macroregion 1 (73.3%).

At regional level, on the first place we may find Bucharest-Ilfov Region with 90.4%, North-West Region with 73.6% and Center Region (73.0%) (Fig.2). Also, we observed at county level that the increase or decrease of available labour force from above is not reflected when we analyse the rate of labour resources. The economical pols in Romania are București and Alba County with a share of civil employment population in the total labour resources over 80%. These are followed especially by counties from center and west of the country with a rate of 70-80%. On the last places are the counties form the east of the country whit a rate of 50-60% and Giurgiu County with only 47.8% (Fig.3).

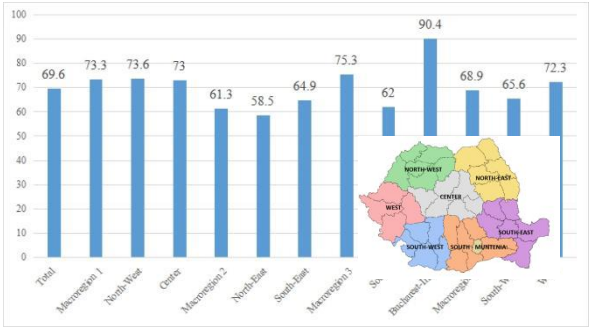
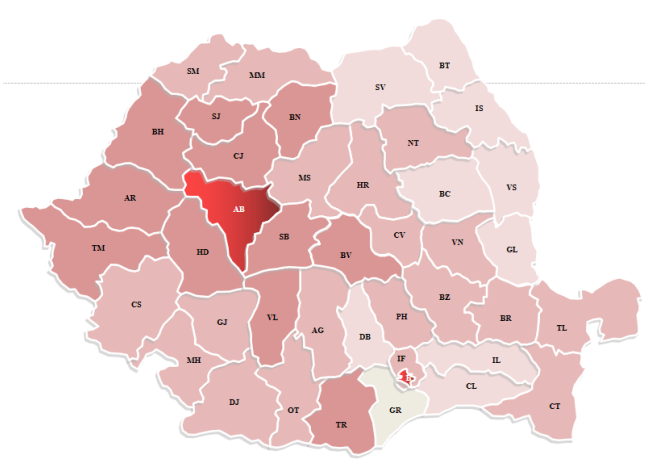


Fig. 2. Rate of labour resources in 2019 (%)
Source: Own calculation on the basis of data from Tempo Online, NIS, 2021 [8].

If we correlate this evolution with the structure of employed population by activity of national economy, we can observe from the following figure that in 1999 the agriculture was the main activity in almost all the counties.



	Employment rate of labour resources
Bucuresti	97.7
Alba	82.7
Arad	79.4
Cluj	79.3
Salaj	78.4
Sibiu	76.5
Valcea	76.1
Brasov	73.7
Timis	73.5
Bistrita-Nasaud	73.3
Bihor	72.9
Hunedoara	70.3
Teleorman	70
Vrancea	69.9
Arges	69.9
Harghita	69
Mures	68.4
Satu Mare	67.9
Maramures	67.6
Braila	67.6
Tulcea	67.2

	Employment rate of labour resources
Neamt	67
Constanta	66.5
Covasna	66.3
Buzau	65.2
Gorj	64.8
Prahova	64.2
Mehedinti	63.5
Olt	63.3
Ilfov	62.8
Dolj	62.7
Caras-Severin	60.8
Dambovita	59.8
Suceava	58.4
Botosani	58.2
Ialomita	57.7
Galati	57.2
Bacau	57
Vaslui	56.5
Iasi	56.3
Calarasi	52.1
Giurgiu	47.8

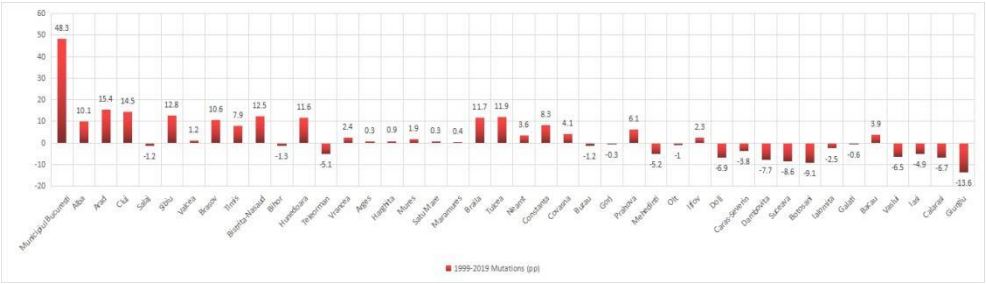


Fig. 3. Rate of labour resources in territorial profile, in 2019 and 1999-2019 mutations
Source: Own calculation on the basis of data from Tempo on line, NIS [8] the data from 1999 and 2019 are not directly comparable due to the difference in methodology but we consider that dynamics can be comparable in trend.

Two decades later, the labour resources from this sector decreased considerably especially in the counties were we have an increase of civil employment population. Also, in these counties we have an increase of activities in industry, construction and commerce (Fig. 4). The increase of the industry is due especially to the development of manufacturing sectors (only in Timiș County the population is split between manufacturing and mining and quarrying industries).

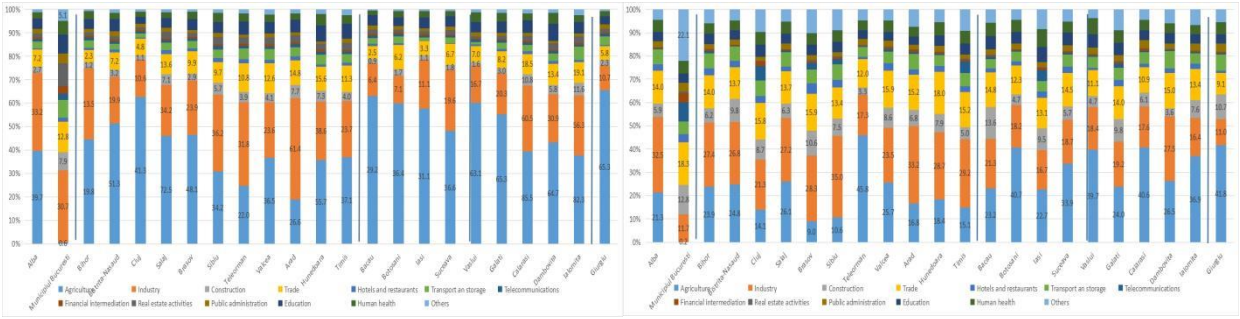


Fig. 4. Structure of civil employment population in 1999 and 2019 by activity of national economy (for the first and last counties by rate of labour)
Source: Own calculation on the basis of data from Tempo on line, NIS, 2021 [8].

The change in the structure of economy in analyzed counties reflects in the GDP per inhabitant (Table 2). Even if is over national average only in few counties, like Cluj, Timiș or Brașov (from the center and west of Romania), the value remains high compared with the counties with a more agricultural profile, like Giurgiu or Vaslui (from South and East of Romania).

Table 2. GDP per inhabitant, RON (2017) (for the first and last counties by rate of labour)

	GDP/pers.	Share in country GDP/pers.
TOTAL	43,788.8	100.0
Alba	44,090.5	100.7
Bucuresti	114,182.1	260.8
Bihor	35,157.4	80.3
Bistrita-Nasaud	31,901.7	72.9
Cluj	61,160.6	139.7
Salaj	35,308.8	80.6
Brasov	52,562.8	120.0
Sibiu	48,723.3	111.3
Teleorman	23,899.6	54.6
Valcea	32,558.7	74.4
Arad	44,807.6	102.3
Hunedoara	34,687.7	79.2
Timis	55,637.6	127.1
Bacau	27,106.2	61.9
Botosani	22,176.4	50.6
Iasi	36,062.8	82.4
Suceava	25,215.1	57.6
Vaslui	20,414.6	46.6
Galati	28,655.1	65.4
Calarasi	26,260.5	60.0
Dambovita	30,066.6	68.7
Ialomita	29,470.7	67.3
Giurgiu	28,355.6	64.8

Source: Own calculation on the basis of data from Tempo on line, NIS, 2021 [8].

CONCLUSIONS

The main conclusion we can extract from this research is that Romania is facing many challenges (the decrease of labour resources. the polarization of resources around big cities, reallocation to other counties or external migration). Also, the industry, constructions and commerce act as polarizing sectors for the labour force due to an evident reduction of employment in agriculture. The future strategies regarding human resources have to be oriented towards the development of business in these fields to reduce the gaps between counties and regions.

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IMPACT OF BULGARIA'S AGRICULTURAL POLICY AND STRUCTURAL CHANGES IN AGRICULTURE AND LAND RELATIONS - AN INTEGRAL PART OF THE CAP

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Abstract

Land relations are complex public relations arising on the basis of land use as an indispensable means of production in the agricultural sector. In the last three decades, the dynamics in development and the specifics of the complex processes related to the improvement of land relations in Bulgaria have reshaped public relations and led to significant institutional changes in the national economy, in particular in the agriculture in Bulgaria. A main factor for the dynamic changes in Bulgarian agriculture and land relations are the historical changes in the social model of society. The implementation of the Community agricultural policy after 2007 has brought new dynamic changes to the business environment in which this primary Bulgarian industry functions. The purpose of this article is to analyze the changes in Bulgarian agriculture which is characterized by great intensity and dynamics, as well as the dynamics in the development and specificity of land relations in Bulgaria in the context of the CAP. The methodical framework of this article provides a summary overview of the main changes in the agricultural policy and the structure of land relations in Bulgaria. A number of contemporary scientific quantitative and qualitative methods are used to achieve the intended objective set in this study: systematic and comparative analysis; monographic analysis; expert assessment. The results pointed out the fragmentation of the use of agricultural land, and the existence of a large number of small farms. In Bulgaria in recent years, extensive farming has been given a strong impetus at the expense of the intensive farming, a process that is of a sustainable nature and has a clear causal link. The agricultural sector has always been a strategic branch of Bulgarian economy.

Key words**:** *agricultural policy, land relations, agriculture*

INTRODUCTION

Land relations are complex public relations arising on the basis of land use as an indispensable means of production in the agricultural sector. In the last three decades, the dynamics in development and the specifics of the complex processes related to the improvement of land relations in Bulgaria have reshaped public relations and led to significant institutional changes in the national economy, in particular in the agriculture in Bulgaria. The implementation of the Community agricultural policy after 2007 has brought new dynamic changes to the business environment in which this primary Bulgarian industry functions. A main factor for the dynamic changes in Bulgarian agriculture and land relations are the historical changes in the social model of society [13].

The agricultural policy in Bulgaria includes, as a component, the implementation of structural reforms in agriculture, just like any other Southeast European country. These reforms are of a different nature and are directly related to the historical stage of development of the country. The following can be identified as such:

-Land reform, including consolidation of production units and consolidation of land ownership;
-Concentration and vertical integration of production;
-Territorial and sectoral restructuring;
-Organizational restructuring and construction of new production structures;
-Product restructuring, including restructuring of international exchange of agricultural commodities, etc. [1].

Since Bulgaria's accession to the European Union in 2007, the agricultural sector has

been facing a number of challenges and issues related to the strict application of the regulations and measures of the Union's Common Agricultural Policy. In the context of the Common Agricultural Policy, it is imperative that Bulgarian agriculture increases its competitiveness and productivity and carries out reforms related to the modernization and restructuring of the industry [10].

MATERIALS AND METHODS

The social and economic processes that are going on in Bulgarian agriculture are in a symbiotic and active relationship [14].
The purpose of this article is to analyze the changes in Bulgarian agriculture which is characterized by great intensity and dynamics, as well as the dynamics in the development and specificity of land relations in Bulgaria in the context of the CAP. Bulgarian agricultural policy should have clear priorities about the development of agriculture and its transformation into a competitive and highly effective branch of Bulgarian economy. The methodical framework of the study provides a summary overview of the main changes in the agricultural policy and the structure of land relations in Bulgaria. A number of contemporary scientific quantitative and qualitative methods are used to achieve the intended objective set in this study: systematic and comparative analysis; monographic analysis; expert assessment.

RESULTS AND DISCUSSIONS

The relevance and importance of the scientific issue under question are due to the structural changes that have taken place in the primary sector in Bulgaria after the country's accession to the Common European Economic Area. Part of these changes, however, have led to imbalances. Given the current stage of the development of land relations in Bulgaria, the relevance and importance of such a research are also derived from the need to solve issues that have emerged as early as during the land reform, as well as issues that have arisen as a result of the implementation of the Community Agricultural Policy. Obtaining financial means to support income and incentives to comply with other European policies distorts the business environment in our country. European subsidies are an attractive reason for a large number of farmers. Too often, obtaining them becomes a priority. They are not always reinvested in the business.
Bulgaria is characterized by fragmentation of land relations in the following directions:
-Fragmentation of the use of agricultural land;
-A large number of small farms;
-A significant difference between own and rented lands used by one and the same farm;
-Internal fragmentation [8].
Compared to the year 2010, in 2016, Bulgaria had 202,720 agricultural holdings, that is by 45.29 % less.

Table 1. Main economic indicators for Bulgarian agriculture for the period 2018 - 2019

	Indexes	***2018***	***2019***	***2019/2018 %***
1	Value of production from plant growing and livestock breeding (at producer price*), incl.	7,460.6	7,628.0	2.2%
1.1	Production from plant growing	5,642.0	5,760.9	2.1%
1.2	Livestock production	1,818.6	1,867.1	2.7%
2	Agricultural services	501.7	492.2	-1.9%
3	Value of gross production in the Agriculture sector (at producer prices *)	8,155.0	8,319.1	2%
4	Value of final production in the Agriculture sector (at basic prices **)	8,457.6	8,504.6	0.6%

Source: acc. to data of the NSI processed by MAFF.
* Producer prices – prices excluding subsidies by product; ** Basic prices – prices including subsidies by product

Table 2. Number of farms, utilized agricultural land (UAA) and standard output (SO) in Bulgaria in 2016 compared to 201

	2010	**2016**	**2016/2018 %**
No. of farms	370,490	202,720	54.71
UAA (ha)	4,475,530	4,468,500	99.84
Average UAA/Farm (ha)	12.08	22.04	182.45
Farm area excluding special agricultural production area (ha)	5,260,520	4,968,500	94.44
Farms with livestock (No.)	279,710	134,970	48.25
Farms with livestock (Livestock)	1,149,470	1,094,240	95.19
Standard Output (Thousand Euro)	2,536,665	3,824,891	150.78
Average Standard Output/farm (Euro thousand)	6,845.7	18,867.8	275.61

Source: Own calculations based on Eurostat Statistics Explained Data [5].

The utilized agricultural land accounted for 4,468,500 ha in 2016 being relatively at the same level with the UAA existing in 2010.

The decrease of the number of farms and the relatively stable utilized agricultural land have led to a change in farm size. In 2016, average size of a holding reached 22.04 ha, being by 82.45% higher than in 2010 [5].

Standard output also increased reaching Euro 3,824,891 thousand in 2016, being by 50.78% higher than in 2010.

As a result, the average standard output per holding raised 2.75 times from Euro 6,845.7 in 2010 to Euro 18,867.8 in the year 2016 (Table 2) (Eurostat, 2020) [5].

This means a process of concentration of land in a smaller number of farms in order to increase farm size and allow the development of a modern agriculture.

However, in Bulgaria, the most numerous farms are the small family farms which accounts for about 90%. The average size of a small farm is about 5 ha, one of the smallest in the EU, but higher than in Greece, Cyprus, Romania and Malta, which are on the last positions from this point of view.

(Eurostat, Farm structure survey, 2016).

Despite that in Bulgaria the small farms are the most numerous they utilize only about 22 % of the total UUA and they represent just 31.3% in the standard output [4, 6].

From the point of view of the National Strategic Plan for Rural Development, it is necessary to employ mechanisms for consolidation of the agricultural lands used by farms. Such tools are land consolidation and land banking [9].

Land consolidation is characterized as a procedure regulated by law and this procedure is applied in order to improve agricultural productivity. According to FAO and the organizations related to land relations in the EU, land consolidation is defined as overall territorial planning subject to regulation and improvement of the spatial structure of a certain territory [15].

This can be achieved by means of classical land consolidation and without change of ownership. Land consolidation with change of ownership can be implemented through obtaining the voluntary and democratic consent of a large percentage of land owners /over 75%/ or by means of purchase and sale. Consolidation without change of ownership is limited in time since the agricultural lands can be used only for a certain period [2].

The majority of small farms in Bulgaria are not market-oriented and produce mainly to cover their own needs. This makes land consolidation difficult for application [15].

In general, Bulgarian agricultural policy is almost entirely linked to the implementation of the Common Agricultural Policy of the European Union and, in particular, to the Rural Development Program. After the accession of Bulgaria to the EU, the more important indicators that characterize rural areas are as follows:

-High levels of unemployment – approximately twice as high as the rate in urban areas;

-Strong dependence on agriculture and forestry;
-Low labour productivity – rural areas create only 27% of GDP;
-Low income – GDP per capita in rural areas is 50% lower than in urban areas [12].
The CAP must remain a Community policy. Bulgaria does not support the idea of re-nationalization of the CAP nor the idea of national co-financing of direct payments - their realization would deepen the disproportion in the development of individual member states [11].
The funds allocated to Bulgaria for direct payments for the period 2014-2020 amount to approximately EUR 5.1 billion. Like farmers everywhere in the EU, Bulgarian farmers must comply with the so-called "greening" rules which purpose is to make ensure that agriculture is carried out in a sustainable manner and that it contributes to the EU's efforts in combating climate change and consequent biodiversity loss and soil degradation. Under this system, 30 % of the allocated funds for direct payments, paid per hectare, are related to three environmentally friendly farming practices: crop diversification, maintaining permanent grassland and dedicating 5% of arable land to areas beneficial for biodiversity (the so-called 'Ecological Focus Areas') [3].
Being one of the new EU member states, Bulgaria will apply a simplified system for allocating direct payments to farmers by the end of 2020, known as the Single Area Payment Scheme (SAPS). Compared to the basic direct payment schemes applied in most of the other Member States of the European Union, the amount of basic income support for Bulgarian farmers under this system is linked, in a simpler form, to the area of land declared by each farmer. Bulgarian authorities dedicate13% of the allocated funds for direct payments (the maximum eligible rate) for voluntary coupled support – i.e. payments are linked not only to the number of hectares cultivated, but also to specific products or processes, in this case beef and veal, fruit and vegetables, milk and dairy products, sheep and goat meat and protein crops. Bulgaria has also chosen to apply re-distributive payments that allow it to achieve a fairer distribution of support among farmers by reducing direct payments by 5% for amounts above 150,000 EUR per individual farm (excluding the first 30 declared hectares) [12].

CONCLUSIONS

Bulgarian agriculture has been in a highly competitive environment - this is the Common European market that comprises over 500 million consumers and imposes a highly restrictive European policy in the sphere of agriculture.
The agricultural sector has always been a strategic branch of Bulgarian economy. The importance of agriculture to the economic stability and prosperity of Bulgaria has been proven many times during the last century. It has always been considered a priority brunch.
In Bulgaria in recent years, extensive farming has been given a strong impetus at the expense of the intensive farming, a process that is of a sustainable nature and has a clear causal link. The subsidies per unit area are the main reason for this - they have made it much more profitable to invest in crops which require much larger areas for sowing, but also give much lower yields per decare [16].

ACKNOWLEDGEMENTS

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CHALLENGES AND TRENDS IN THE DEVELOPMENT OF VEGETABLE PRODUCTION IN BULGARIA

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Abstract

Vegetable production has always been a specific sector of agricultural production. It is characterized by the possibility of growing a wide range of cultivated plant species, many of which are of important significance for the economic contribution of the plant production sub-sector not only to the agriculture, but also to the national economy. The social and economic changes that followed after 1990 have had a catastrophic impact on vegetable production in Bulgaria. What was known as large-scale specialized vegetable production has become multi-assortment, small-scale, low-performance and precarious production. Bulgaria has lost its strong position as a traditional vegetable producer and exporter. A major challenge facing Bulgarian vegetable production is its modernization – it would help increase the production competitiveness so that the vegetable products meet the current quality requirements and compete with the imported vegetables. The purpose of this article is to analyze the challenges and trends in the development of Bulgarian vegetable production which is characterized by great intensity related to the context of the Common agricultural policy with a view to enhancing its competitiveness and sustainable development. For the purposes of the research different information sources have been used - scientific journals, publications by Bulgarian authors, as well as the author's own research. Based on the analysis of vegetable production in Bulgaria and the economic results obtained from the production of the main vegetable crops grown we can draw the following conclusions: The land productivity in Bulgaria regarding field vegetable production is low despite the favorable soil and climatic conditions typical of the area; Average yields of the main vegetables grown in Bulgaria are lower than their potential biological productivity; Enhancing the national support for the vegetable production sector; A major challenge facing Bulgarian vegetable production is its modernization – it would help increase the production competitiveness so that the vegetable products meet the current quality requirements and compete with the imported vegetables.

***Key words*:** *vegetable production, trends, competitiveness*

INTRODUCTION

Vegetable production has always been a specific sector of agricultural production. It is characterized by the possibility of growing a wide range of cultivated plant species, many of which are of important significance for the economic contribution of the plant production sub-sector not only to the agriculture, but also to the national economy. The social and economic changes that followed after 1990 have had a catastrophic impact on vegetable production in Bulgaria. What was known as large-scale specialized vegetable production has become multi-assortment, small-scale, low-performance and precarious production. Bulgaria has lost its strong position as a traditional vegetable producer and exporter [1].

For comparison only, for the period from 1948 to 1990 on a number of indicators, such as grain production per capita, production of vegetables and grapes, white brine cheese, etc., Bulgaria used to be at the forefront in Europe [1].

As a whole, there is a prevalence of the tendency to increase the production costs in vegetable growing in Bulgaria. A lot of changes have occurred in the level of vegetable production cost price for this period. To a significant degree the increase in cost price is formed by the increase in production costs for 1 ton production.

The purpose of this article is to analyze the challenges and trends in the development of Bulgarian vegetable production which is characterized by great intensity related to the context of the Common agricultural policy

with a view to enhancing its competitiveness and sustainable development.

MATERIALS AND METHODS

For the purposes of the research different information sources have been used: scientific journals, publications by Bulgarian and foreign authors, on-line (electronic) periodicals, as well as the author's own research.

Today in Bulgaria, small vegetable production is prevalent and it is distinguished by a low technological level. The reasons for the serious drop in the production of vegetables and the relatively weak competitiveness of vegetable production observed after the accession of Bulgaria to the EU in 2007, are rooted in the failure of the land reform. As a result of this reform, small-scale farms which are ineffective due to the low degree of specialization, insufficient availability of agricultural equipment and modest level of production organization, dominate the structure of specialized vegetable outdoor farms. The strong competition of vegetable production from other European countries after the accession of Bulgaria to the Common European market in 2007 and the imports of fresh vegetables have pressed further Bulgarian vegetable production [5].

RESULTS AND DISCUSSIONS

The crisis, in which our vegetable production is, as well as the constant price increase of the main vegetable crops and the lagging incomes of the population, reveal the negative trends associated with consumption and demand of vegetables by Bulgarians. The reduced domestic production of vegetables is unable to satisfy the demands on Bulgarian market which requires the import of vegetables from countries neighboring to Bulgaria. Bulgaria once used to be a traditional exporter of vegetable production, now it has become an importer. The import of certain crops at relatively low prices from neighboring countries, such as Turkey and Greece, where the climatic conditions are more favorable nearly throughout the year, puts pressure on the Bulgarian production. The lack of responsible national policy and a long-term strategy in the field of agriculture, and in particular the vegetable sector, in recent years has contributed to this state of collapse [10].

Most of the output is marketed on the domestic market, but consumption has significantly decreased and is moving below the recommended daily allowance of the World Health Organization. The export of vegetables is symbolic, especially of greenhouse vegetables. The exported vegetable production is negligible in quantity while the number of imported vegetables is unrealistic since it is impossible to trace the illegal imports. Today, Bulgarian vegetable production is facing the dilemma: production or import? The financial assistance under the programs is only BGN 10-15/dca. For areas of 5 to 50 dca, this assistance reaches up to BGN 750, rarely BGN 1,500/dca. At the same time, the cost of this intensive production is BGN 700-800/dca, while in greenhouse production they are measured in thousands of BGN [1].

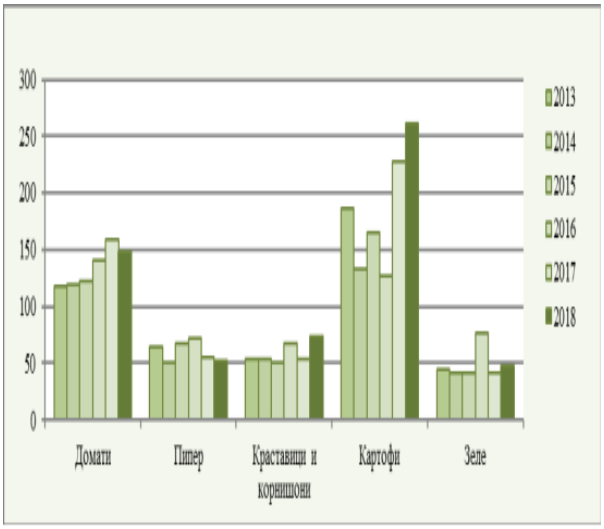

Fig. 1. Comparison of production of vegetables by years (thousand tons)
Source: Ministry of Agriculture and food, Agrostatistics Directorate, 2013-2018 [6].

Bulgarian vegetable production has faced serious challenges after the accession of our country to the EU. This traditional sub-sector of Bulgarian agriculture has been subjected to a constant pressure by the competitive import of cheap vegetables from other European countries.

The prerequisites on which the development of vegetable production depends differ in importance. They can be divided in three main groups: environmental factors, economic factors and subjective factors [3].

A report published by the Institute of Economic Research at BAS (Bulgarian Academy of Sciences) focuses on restoring the traditional structure of agricultural crops imposed in recent years. A conventional type of seasonal vegetable production is required. Also, another type of trade is required – markets and food chains located at a short distance from the producers.

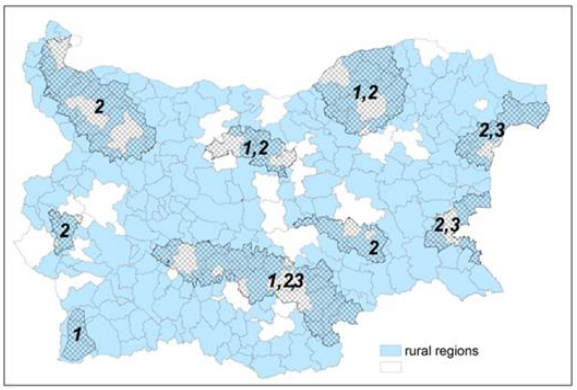

Fig. 2. Regionalization of production strands in field vegetable production
Legend: 1- early field production; 2-medium early field production; 3-late field production.
Source: Kartalov et al. 1990 (Rural Development Program 2007-2013) [3].

According to the scientists, Bulgaria's participation in the EU's common agricultural policy shows that for the period 2007-2023, 75% of the subsidy under the first pillar /direct payments/ was received by 3,700 physical persons and legal entities. For the second pillar /rural development/: from the total EUR 3,240 billion, EUR 2,609 billion was used, of which 67% were absorbed by the 100 related parties [1].

These deformities, according to the authors, have emerged as lasting trends for the past 20 years, namely:

-Concentration of land and capital;

-The state neither manages nor directs the land trade; at the same time it avoids the problem of consolidation. The consolidation that is taking place in Bulgaria is not because of the production itself, but to facilitate the sale of land or its lease [4];

-Monopoly in land lease; declining livestock production, vegetable production and fruit growing;

-Production of low value added production, mainly grain.

-Land reform has eliminated Cooperative Farms (the so called TKZS) before restoring the land ownership. No liability has been claimed for the criminal transactions. The chaotic structural changes that followed have led to the elimination of what have been achieved in the past without the intervention of the state. The loss of old markets and severely limited access to European markets is the other important reason for the current state of the agriculture. The lack of the state's regulatory role has led to the decline and destruction of intensive industries such as fruit and vegetable production, etc. [1].

Given the current development of agricultural industry, the notable significance of vegetable production has not been realized so far. In recent years, there has been a steady tendency towards reduction of harvested areas and realization of average yields, which is far from the biological potential of the cultivated vegetable varieties. Often, the production harvested is of weak competitiveness in terms of the increasing quality demands of the national, regional and common European market [11].

After the accession of Bulgaria to the EU-27, despite the overall positive impact that CAP 2007-2013 has on the agricultural business environment, some significant structural changes are registered at sub-sectoral and sectoral level [7].

The reasons for the serious drop in the production of vegetables and the relatively weak competitiveness of vegetable production observed after the accession of Bulgaria to the EU in 2007, are rooted in the failure of the land reform. As a result of this reform, small-scale farms which are ineffective due to the low degree of specialization, insufficient availability of agricultural equipment and modest level of production organization, dominate the structure of specialized vegetable outdoor farms [8, 9].

In terms of the Vegetable sector, the nature of this process is determined by the method of subsidizing under the Single Area Payment System [12]. Area Payment needs to be changed and other factors in the farm should be taken into account in addition to the size of the land [2].

CONCLUSIONS

Based on the analysis of the development of vegetable production in Bulgaria and the economic results obtained from the production of the main vegetable crops grown we can draw the following conclusions:

-The land productivity in Bulgaria regarding field vegetable production is low despite the favorable soil and climatic conditions typical of the area.

-Average yields of the main vegetables grown in Bulgaria are lower than their potential biological productivity.

-Enhancing the national support for the vegetable production sector [13].

A major challenge facing Bulgarian vegetable production is its modernization – it would help increase the production competitiveness so that the vegetable products meet the current quality requirements and compete with the imported vegetables.

A strategic approach is needed in order to regain the pride and glory of Bulgaria as the 'orchard and vegetable garden of Europe'; This in turn is connected to the promotion of projects that bring not only profit and rapid returns, but contribute to the increase of labor productivity, employment of the rural population and the profitability per unit area [1].

ACKNOWLEDGEMENTS

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THE ECONOMIC-FINANCIAL AND SOCIAL EFFECTS OF THE PANDEMIC ON TOURISM

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Abstract

Affected by high debt, online competition and geopolitical uncertainty, global tourism has been hit hard by the coronavirus pandemic crisis, halting traffic and staggering the lockdown of all countries. This paper analyzes the factors that caused tourism to collapse in 2020 and implicitly precarious economic effects. Romania will be the country studied for analysis, even if the direct contribution of tourism to GDP was 2.70% (2019) and total contribution (direct and indirect) of 5.2% (2019). The key questions posed are those related to the search for means to return to normalcy and to find ways to recover the hospitality industry.

Key words**:** *tourism, pandemic, opportunities, recovery*

INTRODUCTION

In a statistical context, tourism is defined as the activity that visitors perform to a destination outside their usual environment, for less than a year, including business, leisure or other personal reasons, other than employment by a resident employer, a household or an enterprise in the place visited [5]. In a world of dense and interdependent supply chains, the impact of a crisis affecting major tourism will be felt not only in this sector but also in other sectors of the economy - agriculture, food industry, distribution, construction, technology suppliers, transport, energy, etc. Tourism is a major job creator and a safety belt for many economic sectors. Tourism has recovered from many crises and, given its proven importance at every level of society, needs to be supported to sustain and increase jobs again [11]. At European Union level, the tourism sector, as a traditional provider of travel and tourism services, comprises 2.3 million enterprises, especially small and medium-sized enterprises, which provide employment to around 12.3 million people [2]. In 2019, international tourism recorded 1.5 billion arrivals (+4%), of which 745 million in Europe, i.e. 50% of the total (+ 8%) [11]. The outbreak of the COVID-19 pandemic in March 2020, with the uncertainty it created in terms of travel bans and health obligations, is now the biggest challenge for the future of the tourism sector [3, 4, 6, 10, 12]. From a European perspective, tourism policy also contributes to the achievement of general policy objectives in the field of employment and growth [11]. Tourism plays an important role in the EU with deep implications on its economy, employment, environment [9]. Tourism is the most dynamic branch of the world economy, a key driver of the economic development [8].

MATERIALS AND METHODS

The paper was elaborated having as central element the SARS-COV2 pandemic and the devastating impact on the economy and implicitly on the hospitality industry, taking as sources of analysis the statistical situations existing at the level of Romania and the European Union. The comparative analysis of the existing situation before and after the onset of the pandemic (2019 being considered the reference year in the analysis performed), but also the analysis of the evolution and the forecast analysis of the tourist circulation during the pandemic period, led to the formulation of the following key questions:

What are the possibilities for tourism to recover in the next period? What are the opportunities that Romania can benefit from? The answer is that Romanian tourism will be able to resume its contribution to GDP by: increasing accommodation revenues (in 2019 they were 1.4 billion euros), increasing revenues from restaurant and catering (3.5 billion euros in 2019), increasing the average length of stay of tourists (2 days in 2019), increasing the number of foreign tourists (2.85 million foreign tourists in 2019), increasing the number of jobs in hotels and restaurants (220,000 jobs in 2019) [7].

RESULTS AND DISCUSSIONS

Globally, the hospitality industry, severely hit by the crisis imposed by the pandemic, is constantly looking for ways to break the deadlock and lead to a return to normalcy. In this critical period the pandemic imposes the limits of normalcy in tourism and affects the quality of life of the entire population, regardless of whether we refer to beneficiaries of tourism services, employees in this industry, entrepreneurs, managers, commercial or financial suppliers. All these people represent users of tourism services and are both affected by repeated lockdowns and the braking of the activity until it stops. Tourism has the potential to contribute to employment and economic growth, as well as to the development of rural, peripheral or less developed areas.

In Fig.1, there are presented the beneficiaries of tourism industry.

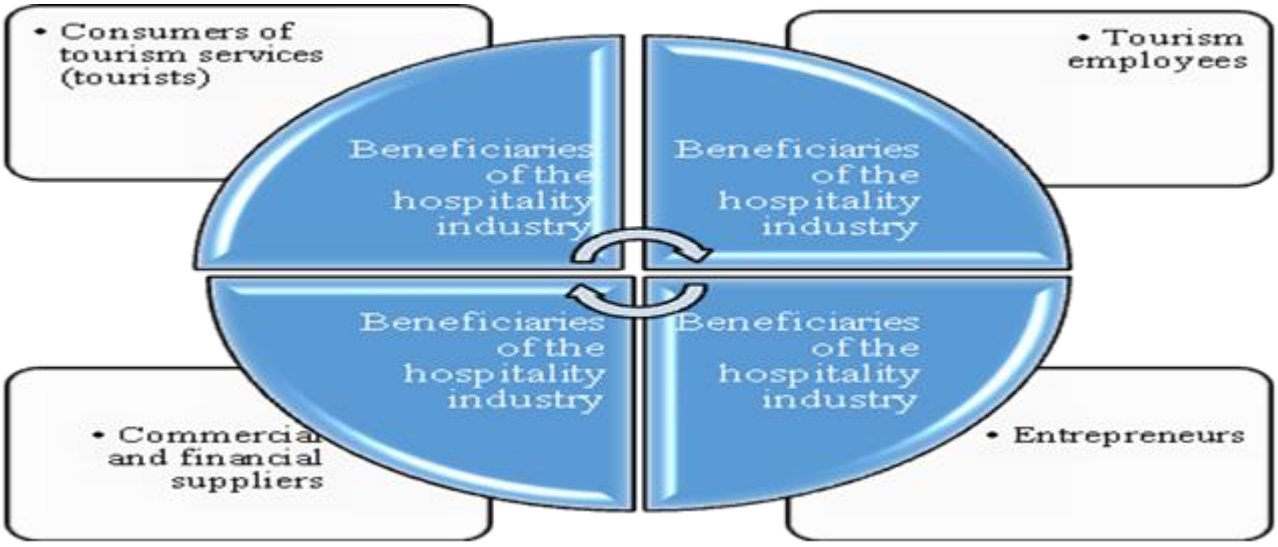

Fig. 1. Beneficiaries of tourism industry
Source: Own design.

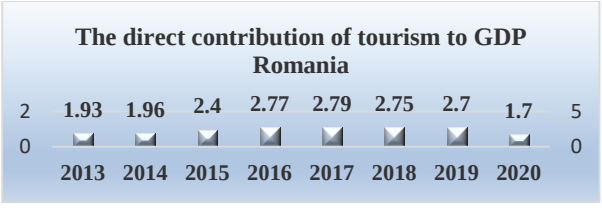

Fig. 2. The direct contribution of tourism to Romania's GDP
Source: Own design based on [2].

The effects of the pandemic on the global economy are difficult to quantify, and in tourism - one of the hardest hit by the crisis sectors - the effects are major, regardless of the GDP share that this branch has in each country. In Romania, the direct contribution of tourism to GDP [1] is presented in Fig.2.

During the analysis period, between 2013-2017 there is a constant increase in the direct contribution of tourism in Romania's GDP, followed by a decrease of this contribution in 2017-2020. The year 2020 stands out with a significantly diminished contribution, even compared to 2013, the year in which tourism begins to develop and lead to an increase in the sector's contribution to GDP.

If we refer to the accommodation capacity of Romania, it is found that in 2019, it was 87,424,172 accommodation structures in the form of hotels, hostels, motels, inns, villas, cottages, tourist and agro tourism pensions, campsites, stops, holiday villages, bungalows and children's camps. Regarding the distribution of these tourist accommodation structures on the Romanian microregions, it is found that the highest concentration is found in Microregion 1 (36.72%), Microregion 2 (27.13%), Microregion 3 (19.5%), Microregion 4 (16.65%).

In microregion 1, comprising the North West region and the Center region, there is the highest concentration of hotels, hostels, motels and inns (30.59%), villas, chalets and tourist pensions (46.38%) but also agro tourism pensions (56%). In Microregion 2, with the North-East and South-East regions, it is found that the highest concentration has campsites, stops, holiday villages and bungalows (54.09%) but also children's camps (40.22%).

In Microregion 3 with the South-Muntenia regions and the Bucharest-Ilfov region, the tourist accommodation structures are mostly represented by hotels, hostels, motels and inns, 24.35% of total at the national level.

Also, in Microregion 4, with the Sout West Oltenia region and the West region, there is a low concentration of tourist accommodation structures, the largest share of which are villas, chalets and tourist pensions with 20.5% of their total existing in Romania (Fig. 3).

The number of tourist accommodation structures increased by 208 new units in 2020 compared to 2019.

A possible explanation for this increase is the introduction of the stimulus measure in tourism through which the holiday vouchers were granted to the employees from the budgetary system and which could be settled only by the registered tourist accommodation structures (Table 1).

Table 1. Evolution of tourist structures number between 2018-2020

	Number of touristis structures types			**Absolute variation**		**Evolution of numbers of touristic structures**	
	2018	**2019**	**2020**	**2019 - 2018**	**2020 - 2019**	**2019/ 2018**	**2020/ 2019**
	Number (absolute values)					**% (relative values)**	
Total	8,453	8,402	8,610	-51	+208	99.40	102.48
Hotels	1,616	1,608	1,581	-8	-27	99.50	98.32
Hostels	319	323	328	4	+5	101.25	101.55
Aparthotels	20	17	18	-3	+1	85.00	105.88
Motels	231	219	214	-12	-5	94.81	97.72
Inns	4	3	3	-1	-	75.00	100.00
Tourist villas	695	709	752	14	+43	102.01	106.06
Tourist chalets	231	222	226	-9	+4	96.10	101.80
Bungalows	533	557	458	24	-99	104.50	82.23
Holiday villages	10	9	8	-1	-1	90.00	88.89
Campings	58	58	61	-	+3	100.00	105.17
Stops	47	47	43	-	-4	100.00	91.49
Tourist cottages	73	82	92	9	+10	112.33	112.20
Children camps	59	55	48	- 4	-7	93.22	87.27
Tourist pensions	1,709	1,669	1,729	- 40	+60	97.66	103.59
Agrotourist pensions	2,821	2,800	3,022	-21	+222	99.26	107.93
Floatels	27	24	27	-3	+3	88.89	112.50

Source: NIS, 2021 [7].

We further analyzed the number of tourist reception structures opened in Romania in September of the pandemic year 2020 and we found that 5,578 tourist reception structures were opened out of the total of 8,610, which represents 64.78% and of these the largest share had the structures that offered individual services (villas, chalets, cottages, tourist and agro tourism pensions, campsites, stops, villages holidays, bungalows) but not mass

tourism (29.65% represented the share of hotels, hostels and inns opened in September 2020)(Fig. 5).

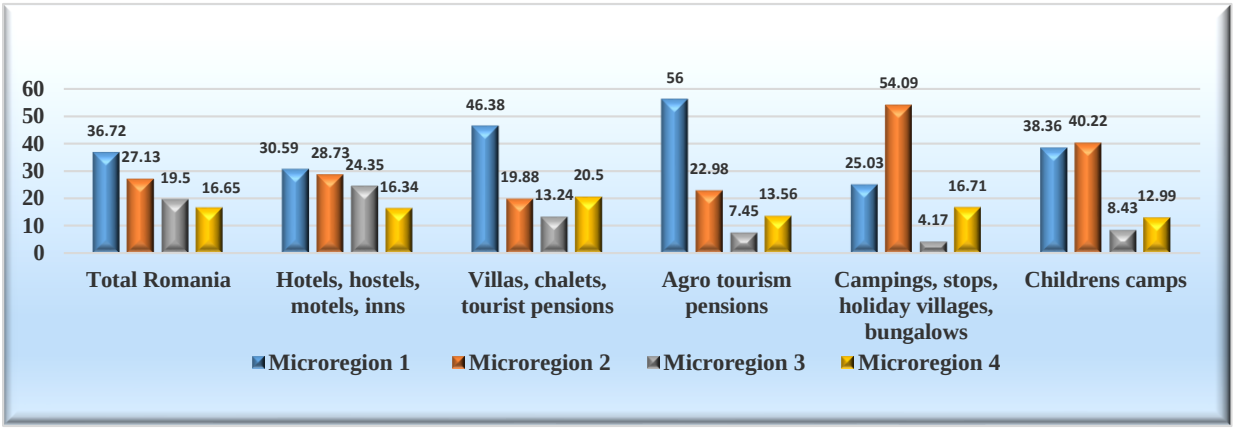

Fig. 3. Romania's accommodation capacity in 2019
Source: Own calculation.

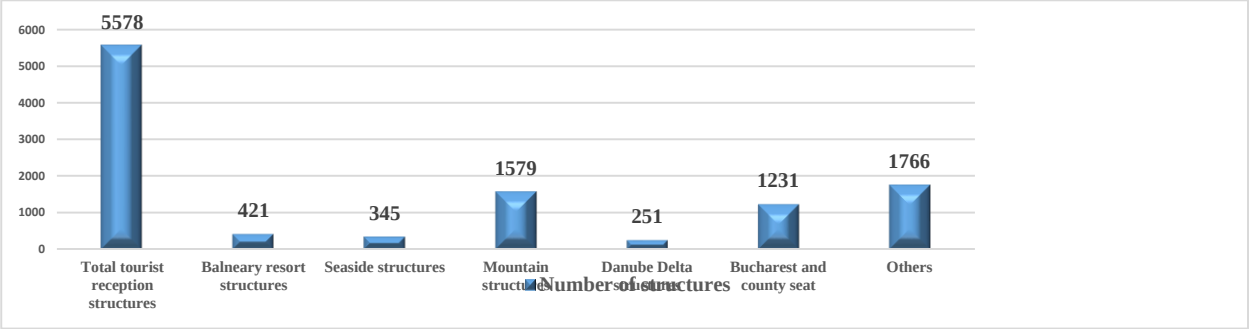

Fig. 4. Tourism reception structures (Sept.2020)
Source: NIS, 2021[7].

In 2020 in Romania, all cultural events and tourist trips were canceled or rescheduled to reduce the crisis impact on tourist's health (the tourist reception structures left open were those that housed quarantined people or medical staff).

The tourism market is a specific market, its finality materializing in obtaining satisfactions from the demand bearers, as a result of the specific activities carried out within the tourism industry and not in the acquisition of material goods [1].

According to EUROSTAT [9], three basic forms of tourism can be distinguished: domestic tourism (activities of residents of a country who travel only within that country but outside their usual residence), inbound tourism (activities of non-residents traveling in a given country, other than the one where they have their habitual residence) and issuing tourism (the activities of the residents of a given country, who travel and spend their stays in another country than the one in which they have their habitual residence).

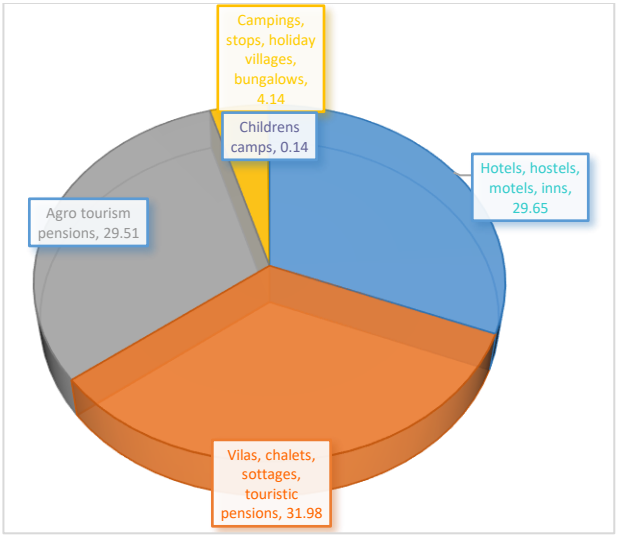

Fig. 5. Types of structures opened in Romania in 2020
Source: Own calculation.

The key criteria for choosing a tourist destination in the pandemic are presented in Fig. 6.

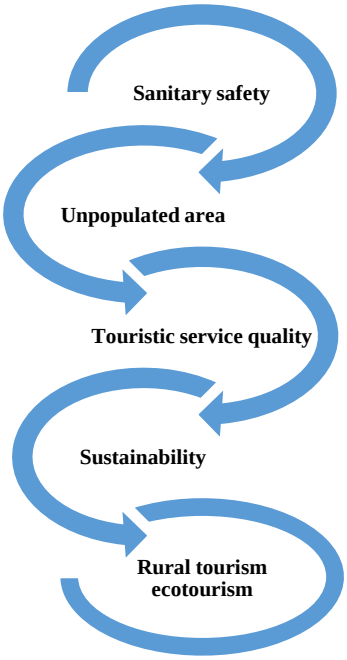

Fig. 6. The key criteria for choosing a tourist destination in the pandemic
Source: Own calculation.

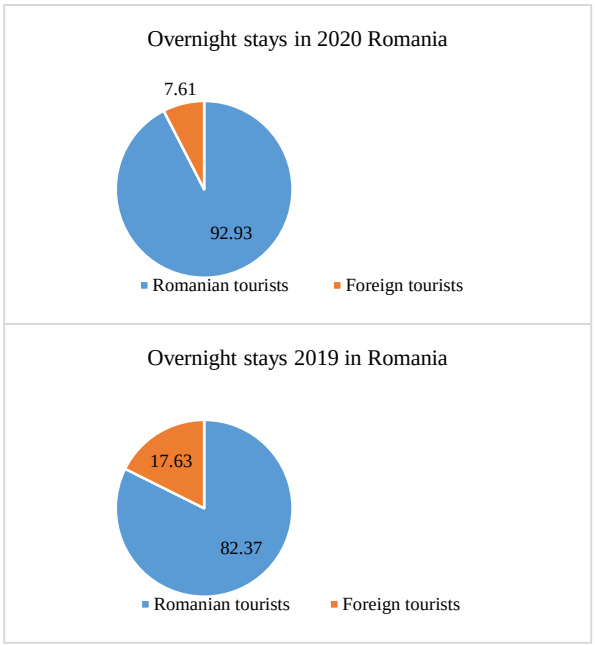

Fig. 7. Total overnight stays in Romania in 2020 compared to 2019
Source: Own calculation.

Comparatively, analyzing the overnight stays of tourists in tourist accommodation structures in 2019 and the first nine months of 2020 (January-September), it is found the significant reduction of overnight stays of foreign tourists who came to Romania, from 17.63% in 2019 to 7, 61% in 2020.
Compared to 2019, overnight stays in tourist accommodation structures decreased representing 40.43% in the first nine months of 2020.

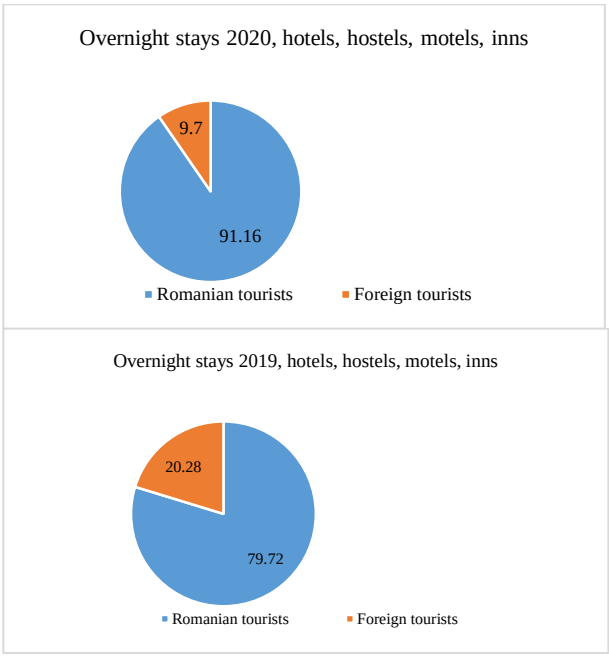

Fig. 8. Overnight stays in Hotels, hostels, motels and inns in 2020 compared to 2019
Source: Own calculations.

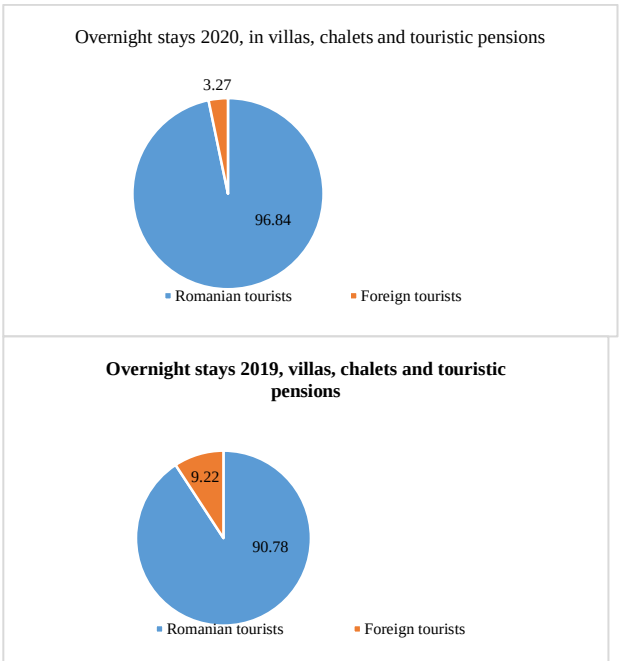

Fig. 9. Overnight stays in villas, chalets and tourist pensions in 2020 compared to 2019
Source: Own calculations.

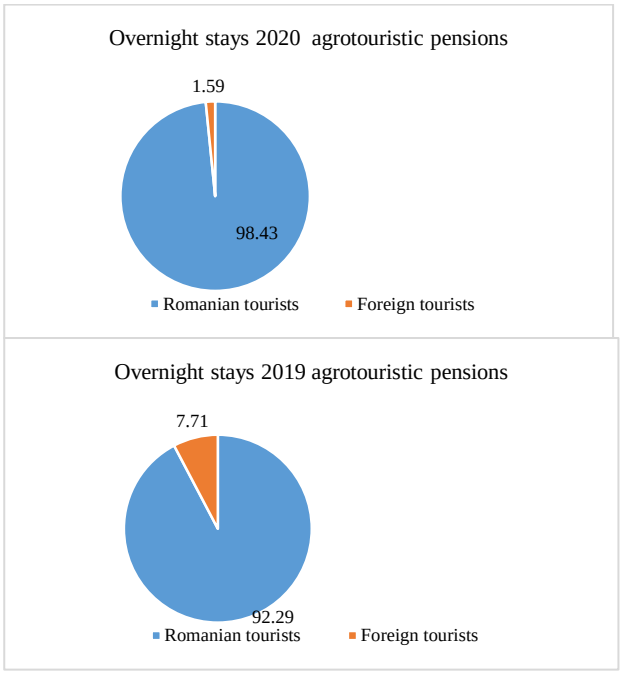

Fig. 10. Overnight stays in agrotourist pensions in 2020 compared to 2019
Source: Own calculation.

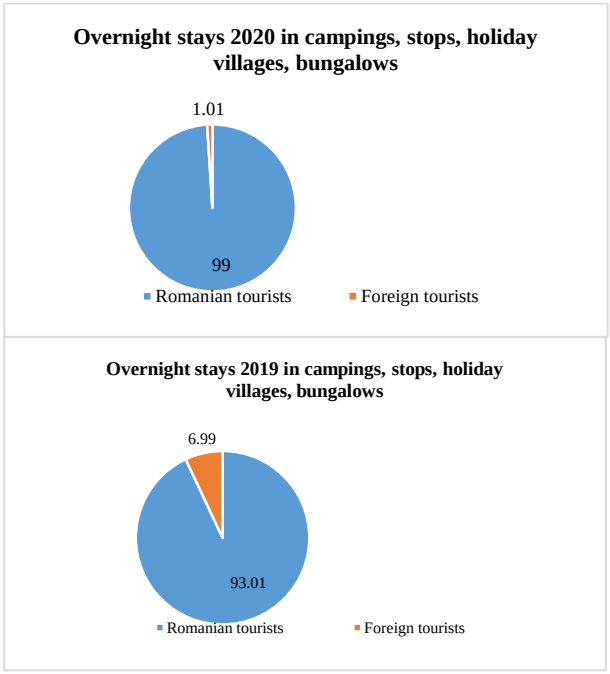

Fig. 11. Overnight stays in campings, stops, hiliday villages and bungalows in 2020 compared to 2019
Source: Own calculation.

Fig. 12. Overnight stays in children capms in 2020 compared to 2019
Source: Own calculation.

Romanian tourists spent the night in tourist accommodation structures in proportion of 45.61% compared to 2019. It is noted that the largest share of overnight stays in 2020 was in campsites, tourist stops, holiday villages and bungalows (77.52% of 2019 overnight stays), followed by overnight stays in agritourism pensions (51.30%), overnight stays in villas, chalets and tourist pensions (46.39%), in hotels, hostels, motels and inns (41.27%) .

The nights in camps of schoolchildren and preschoolers decreased significantly, representing 4.27% of the total 2019 overnight stays. Besides the obvious reduction of overnight stays in the pandemic year 2020, we also find the preference of tourists for individual tourist reception structures, with small accommodation capacities located in isolated areas (campsites, holiday villages, bungalows, chalets, agritourism and tourist pensions and villas) that offer protection and physical distance, compared to structures with high accommodation capacity (hotels, hostels, motels).

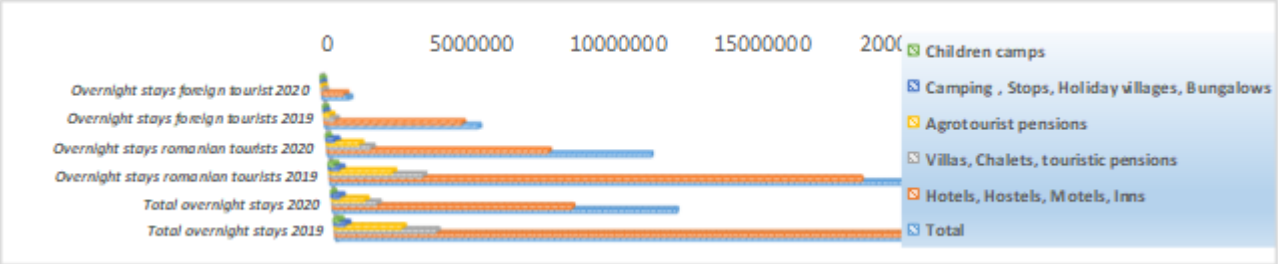

Fig. 13. Evolution of overnight stays in tourist reception structures in 2020 versus 2019.
Source: Own calculation.

There is a significant low share of overnight stays of foreign tourists in 2020 by only 16.20% compared to 2019. Most foreign visitors to Romania came from Europe, European Union member states (53.48%) and other European countries (46.52%).

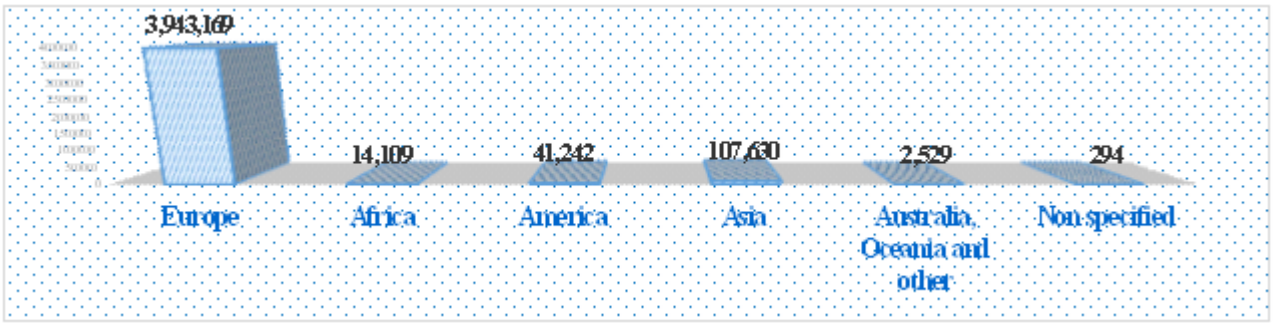

Fig. 14. Foreign visitors arrivals in 2020
Source: NIS, 2021 [7].

Compared to 2019, overnight stays in tourist accommodation structures decreased representing 40.43% in the first nine months of 2020. Romanian tourists spent the night in tourist accommodation structures in proportion of 45.61% compared to 2019. It is noted that the largest share of overnight stays in 2020 was in campsites, tourist stops, holiday villages and bungalows (77.52% of 2019 overnight stays), followed by overnight stays in agritourism pensions (51.30%), overnight stays in villas, chalets and tourist pensions (46.39%), in hotels, hostels, motels and inns (41.27%). The nights in camos of schoolchildren and reschoolers decreased significantly, representing 4.27% of the total 2019 overnight stays. Besides the obvious reduction of overnight stays in the pandemic year 2020, we also find the preference of tourists for individual tourist reception structures, with small accommodation capacities located in isolated areas (campsites, holiday villages, bungalows, chalets, agritourism and tourist pensions and villas) that offer protection and physical distance, compared to structures with high accommodation capacity (hotels, hostels, motels).

There is a significant low share of overnight stays of foreign tourists in 2020 by only 16.20% compared to 2019. Most foreign visitors to Romania came from Europe, European Union member states (53.48%) and other European countries (46.52%).

Taking into account these aspects, in the first nine months of 2020, it was analyzed which was the preferred means of transport for visitors in Romania and those who traveled outside Romania, and it was found that individual road transport, was preferred in a significant proportion, both for arrivals (81.6%) and for departures (69.6%), highlighting the idea that social distance is paramount in making a travel decision. It is also found that in total, arrivals accounted for half of the number of departures (0.52), most being made by road (0.61).

Table 2. Visitors arrivals and departures to/from Romania

Arrivals	Values		Departures	Values		Index Arrivals/Departures	Absolute variation, arrivals vs departures
	Absolute	Relative (%)		Absolute	Relative (%)		
Total arrivals	**4,108,973**	**100.0**	**Total departures**	**7,872,919**	**100,0**	**0.52**	**-3,763,946**
By road	3,351,324	81.6	By road	5,482,630	69,6	**0.61**	**-2,131,306**
By air	649,222	15.8	By air	2,342,335	29,8	**0.28**	**-1,693,113**
By train	35,388	0.8	By train	31,358	0,4	**1.13**	**+4,030**
By ship	73,039	1.8	By ship	16,596	0,2	**4.40**	**+56,443**

Source: Own calculation based on the data from NIS, 2021 [7].

In this context, the tourist intensity indicator was analyzed, (determined by reporting the overnight stays of foreign and Romanian tourists to the demographic dimension of Romania) (in 2019 it was 19,414,500 people and in 2020 of 19,318,000 people). It was found that the tourist intensity in 2020 was 0.63 compared to 1.54 in 2019, amid the reduction in the number of overnight stays but also the demographic decline in Romania due to the pandemic.

CONCLUSIONS

•This increasingly clear the impact of the global health crisis, expecting that by 2023 the growth of the tourism sector at European level and implicitly in Romania, will remain below the levels of 2019 [3]. Job losses in tourism is an important aspect that must be taken into account, given the fact that uncertainty in the evolution of the pandemic continues to persist, and will be decisive for establishing losses in this sector.

•The relaunch of tourism can be done by developing strategies to save millions of jobs and providing optimal conditions in terms of safety to consumers of tourism services.

• Romania will have to discover the strengths it has in the current crisis, primarily through the location of tourist reception structures in rural areas, some of them isolated, which offer high health protection. The strengths and opportunities of Romania identified are:

- the possibility of attracting a larger category of Romanian tourists to spend their holidays in their own country, maybe even in their own region, where they can relax feeling safe.
- the existence of areas where one can practice an individual or even isolated and quality tourism, such as the Danube Delta, large parts of Transylvania, Bucovina, Maramureş, etc. highlighting Romania's competitive advantages through an intelligent promotion of these tourist areas that adapt to the new pandemic conditions.

•An important measure should be taken by government by supporting and prioritizing the tourism sector within the national economy (introduction of capital infusions in tourism that stimulate consumption, with strict observance of protection measures). In order to solve the liquidity crisis and restore consumer confidence, an important measure is to continue granting travel vouchers to all categories of employees in Romania.

•Regarding air transport, the main means of transport that can lead to increased foreign tourists arrivals in Romania, it is proposed to introduce measures and recommendations to stimulate free movement, without restrictions, resuming safely transport services, connectivity and tourism.

•Forms of tourism that must be encouraged and supported by legislative measures are those that refer to family or individual tourism, rural tourism with its components agrotourism and ecotourism as well as the promotion of these green, sustainable destinations, focused on nature, walks and hiking.

•Regarding the types of tourist accommodation structures, campsites, cottages, holiday villages, tourist and agritourism pensions, villas, cottages and small hotels will be preferred, which will inspire the guests to feel safe. Protection measures will have to be prioritized and rigorously observed by both tourism employees and tourists, given that health is a priority, regardless of the mode of consumption of tourist services.

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CULTURAL-HISTORICAL AND EDUCATIONAL RESOURCES OF RURAL AREAS

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Abstract

The process of urbanization is changing the relationship between cities and villages in each of the developed countries in the world. The tendencies are towards reduction of the rural areas, which outlines the risk of destruction of a specific, social-normative culture, bearing the marks of the traditions, customs, rituals preserved over the years - characteristic of the village. The geographical and natural features of the different rural areas presuppose the formation of specific crafts in the past, whose authenticity is preserved to this day through the created ethnographic complexes in many regions of Bulgaria, which have become the basis for the development of rural tourism. These areas have not only cultural and historical significance for generations, but also have educational potential. For the full qualification, education and practice of students in the field of veterinary medicine, zootechnics, agronomy, etc. it is necessary to invest in the maintenance and development of rural areas. Returning to the village and assessing it as a potentially important sector is a strategic priority not only of the EU, but also of any country that values its past but also thinks about its future. The present study aims to prove the need to rediscover the cultural, historical and educational resources of rural areas as a possible perspective for their social and economic development. In the course of the research a comparative and dynamic analysis, literature review, review of legislative frameworks and official documents of the institutions were used. A methodological framework for assessing the potential of rural areas has been proposed, through which stakeholders and institutions can rediscover these resources. Based on the theoretical and empirical analysis, the following conclusions are made: First, the cultural and historical heritage has the potential to become a successful tool for the social and economic development of rural communities. It is the platform for the development of tourism in rural areas. Second, investing in the creation, maintenance and development of training facilities - serving the interests of various educational institutions (schools, colleges, universities) is a necessary perspective that supports learning and is a chance to revive rural areas as authentic sites for cultural and educational purposes.

Key words**:** *development of rural areas, rural tourism, educational potential, cultural and historical significance, practice of students*

INTRODUCTION

The process of urbanization is changing the relationship between cities and villages in each of the developed countries in the world. The tendencies are towards reduction of the population and the geographical area of the rural areas, which outlines the risk of destruction of a specific material, social-normative and spiritual culture, bearing the marks of the crafts, traditions, customs preserved over the years - typical for the village and rural communities. The purpose of preserving and promoting this tangible and intangible cultural heritage is a priority for the future prosperity of rural areas. In many parts of Bulgaria, this potential is reflected in the development of rural tourism, which supports the local population socially and economically. On the other hand, these territories are becoming a good educational platform and their potential in such a direction is yet to evolve. Especially in the last pandemic year, when open learning spaces are preferred and even tendentiously created, orienting in such a direction is a logical alternative. For some specific professional sectors, the connection with the village is a mandatory condition for gaining experience and qualification. Cognitive and cultural-educational interest is also not to be neglected. It is in continuity that the germ of the preserved tradition and the created innovations lies.

MATERIALS AND METHODS

The present study aims to prove the need to rediscover the cultural, historical and educational resources of rural areas as a possible perspective for their social and economic development. The proposed methodological framework for assessing the potential of rural areas is indicative, but it is possible to apply it at municipal and regional level and observing the main criteria, requirements and methods set out in it, stakeholders and institutions can rediscover these resources that have certain areas. In the course of the research a comparative and dynamic analysis, literature review, review of legislative frameworks and official documents of the institutions were used. Consultations with experts in the respective field have been carried out. Previous experience/initiatives for assessment of cultural and historical resources at local level have been studied.

RESULTS AND DISCUSSIONS

Rural development is one of the priorities of EU regional policy. In recent years, Bulgarian villages face many demographic challenges: progressive population decline, negative natural growth, low birth rates, high mortality, deteriorating age structure, increased migration, depopulation and more.

The village - the causes of the crisis

The reasons for the existing and deepening crisis in the village are multifaceted. The systematization of some of them is necessary if we want to reverse the trend, because in addition to the gloomy picture, these areas have a certain natural, human, economic and cultural potential, whose development and full use is the desired basic resource for sustainability in their development.

The crisis in the village has its roots:

First, the bad conditions for our agriculture, agreed before Bulgaria's accession to the European Union. Based on these agreements, the Bulgarian agricultural producer receives and will receive for many years to come many times lower subsidies compared to its counterparts from other EU countries for the same productions and products.

Second, cumbersome and slow procedures for accepting and approving proposals to support farmers who want to develop their farm, as well as the long length of time for the payment of subsidies. For some productions this turns out to be fatal.

Third, nearly 90 percent of the funds coming from EU programs to support the agricultural sector go to the coffers of 10 percent of all our farmers and these are the modern Bulgarian "latifundists" - large tenants-producers of cereals, which is detrimental to other sectors.

Fourth, in the course of most analyses in recent years, the shift in focus from "rural" to "rural" is logically justified. This castling is not accidental and hides various messages. On the one hand, the attention is discretely directed to a wider territorial level - the district, and on the other - the agony of the village as a territorial unit is silently concealed. Of course, not all villages can be placed under one denominator, but this trend is obvious [9].

Fifth, the main threats to the future development of Bulgaria's rural areas are related to depopulation and population aging, high risk of poverty and social exclusion. The devastation is obvious in different parts of our country - schools are closing, depopulated ghostly buildings of cultural institutions (community centres, libraries, clubs) are deserted. The financial resources for rehabilitation and maintenance of the municipalities are minimal.

Opportunities and perspectives

Overcoming some of these problems and ensuring sustainable dynamism in rural communities require the identification and implementation of appropriate economic models to turn untapped resource potential into added value. In this sense, two of the possible solutions for a positive outlook for rural areas are outlined in the following directions:

First, cultural heritage, insofar as it is preserved, in symbiosis with the history of each region, has the potential to become a successful tool for the social and economic development of rural communities. They are the platform for the development of tourism in rural areas (rural, eco, green, culture and

heritage, wine, hunting and the like), and as a type of economic activity, provides opportunities to create direct and indirect benefits for local development.

Second, the investment in the creation, maintenance and development of training facilities - serving the interests of various educational institutions (schools, colleges, universities) is a meaningful and promising initiative, which on the one hand is necessary and supports the practical training of students, professionals, and on the other hand there is a chance for the revival of rural areas as authentic terrains for cultural and educational purposes.

Methodology for assessing the cultural-historical and educational potential of rural areas

In this analysis, we will propose a methodological framework that can support the analysis and assessment of the cultural, historical and educational potential of rural areas. This model can be used by rural municipalities to assess the resources they have, especially if they are oriented towards cultural and historical heritage [1].

Although we focus our attention mainly on cultural and historical resources, it is necessary to specify that they are in one with many of the other available resources in the respective area, because they are located in one territory. Very often some of them (natural, anthropogenic, material, financial, etc.) contribute to the greater attractiveness of the formed tourist product.

Cultural and historical resources can be further classified into: historical (archaeological excavations, fortresses and towers, palaces, monuments, sunken ships, native places, etc.); architectural (fountains, bridges, buildings, aqueducts, etc.); religious (churches, monasteries, sanctuaries, tombs, holidays, etc.); ethnographic (customs, household items, crafts, folklore, cooking, etc.); cultural and cognitive (museums, exhibitions, galleries, treasuries, universities and research centres, libraries, etc.

The main criteria by which the potential of cultural and historical resources in a given rural area should be assessed are the following:

- Requirements that must be met in order to be classified as tourist;
- Properties they possess;
- Characteristics;

If we approach in particular, the requirements [6] that cultural and historical resources must meet in order to be transformed into tourist resources are the following:

(a) accessibility: both in terms of transport and financially, in order to provide opportunities for their use, regardless of their uniqueness or significance;

(b) complexity: single resources (with some exceptions and other things being equal) are more difficult to become attractive for visits compared to a group of resources, and their complex location helps to attract tourists and stimulates long-term development of the territory through the system of tourist activities in it;

(c) attractiveness for tourists: they can attract with their beauty and exoticism or with their uniqueness (size, unusualness, rare resource, etc.), but without complying with the requirement of attractiveness it is practically impossible to refer to the category of tourist resources;

(d) safety: the degree of their preservation is important in this case - the higher it is, other things being equal, the more attractive the resources will be (the ruins of a medieval castle in a non-preserved form attract less visitors than well.

preserved building);

(e) good geographical location: the location of a rural area in combination with a diverse landscape, natural and cultural-historical characteristics is favorably defined;

The **main properties** of tourist resources include: [6] attractiveness, accessibility, degree of study; significance (spectacle); socio-demographic characteristics; potential stock and method of use.

Their specific properties are defined as:

- integrity (indivisibility) of the elements and their existence in interrelation;
- capacity (carrying capacity) - number of tourists that can accept the territory on which the cultural, historical and tourist regions (CHTR) is located;

- reliability - determined by all social, economic and political conditions within the tourist territory;
- uniqueness (rarity, exclusivity) or probability of encountering uniqueness;
- cognitive value - is associated with specific historical facts, personalities, life and work of famous people;
- fame - popularity among tourists;
- exoticism - degree of contrast of the site in relation to the conditions of the permanent residence of the tourists, through which the so-called unusualness of the tourist site is studied;
- expressiveness - degree of interaction with the environment, infrastructure and nature;
- Preservation - readiness for organized reception of tourists;
- safety - absence of possible negative consequences from the use of CHTR by tourists and the local population.

The more important characteristics of cultural and historical resources include [6]:
- volume of opportunities - to determine the potential capacity of tourist sites (resorts, hotels, etc.), the level of utilization and optimized load of the resource: area of tourist territory, visitor potential of a tourist attraction, etc.;
- distribution - determines the potential tourist territory, the circle of sanitary protection, etc;
- period of possible operation - determines the seasonality of the visits and their rhythmicity, the duration of the favorable climatic season for effective tourist operation, etc.;
- possibility for multiple use - in compliance with norms and carrying out activities for restoration and improvement of the resource.

In order to assess the diversity and quantity of cultural and historical resources in rural areas, it is first necessary to register, characterize and typologize them. The general information about the cultural-historical site includes its name, location, marking, type of ownership, literary and other information sources about the site, scheme of disposal. The typology of the site follows, taking as its basis: the information essence of the cultural-historical site, its uniqueness, the typical environment for its type, its cognitive and educational significance, the attractiveness of the site.

The following basic principles are used in the analysis of cultural and historical resources in rural areas:

Chronological - typical of such studies. With it, the objects are grouped and studied depending on the historical period to which they belong. In its application the question arises about the periodization of the monuments - it is more correct to refer them to the period (event) in connection with which they were built, and not to the period of their construction.

Typological - based on different classifications of cultural and historical resources, their characteristics by species; The main goal is to establish the common features specific to each species (for example, many times the same resources are the subject of cultural, rural and ecotourism).

Functional - the resources are studied in connection with their function and in particular in connection with the types of tourism that develop on their basis and the parameters of the facilities serving them and the attracted visitors;

Spatial - emphasizes the peculiarities of the territorial distribution of tourist resources, their zoning, determining their combinations of different hierarchical rank, their integration (supplementation) with other tourist resources, etc.

The main goal in assessing the potential of the selected cultural and historical resources in rural areas is to establish their attractiveness, opportunities for their inclusion in tourist routes, features and problems related to their use and protection.

The selection of parameters for description and analysis is determined by the type of object, but some of them are mandatory for all.

For cultural and historical monuments and places it is necessary to indicate:
- name and type;
- location and transport accessibility;
- historical period or the specific event or person with whom it is associated;
- physical condition and adjacent space;
- organization of visits (if the site is used);
- availability of service personnel;

national origin of tourists visiting tourist sites (real and
potential);
- types of routes in which the site is included or may be included;
- existence of a special security status;
- literary sources for the site, etc.

The tools (means) for measuring the quantitative and qualitative characteristics of cultural and historical resources are distinguished, and the choice of indicators for evaluation of these resources in rural areas is as usually subjective. The guidelines illustrate in a practical and concrete way the individual stages that a local community must follow in order to start discovering, preserving and, above all, exploiting its cultural values for the development of the region and in the interest of future consumers.

Rural tourism

Tourism is the most dynamic branch of the world economy with a deep impact on the development of other economic branches [13].

Usually, rural tourism develops in rural areas. It is often defined as "provincial", "local", "agro", "recreational", "alternative", different from the mass. It is "tourism in rural areas, which satisfies the interests of tourists to traditions, life, culture, agricultural and other specific activities, as well as to the natural, historical and cultural resources of the region in peace and casual human relationships" [2].

In its development, the interests of the local population should take precedence over those of tourists and the tourism industry, and supply should be based primarily on local resources. Rural tourism:
- provides opportunities for economic and social development of the regions;
- maintains and creates local revenues, jobs and population growth;
- assists in raising funds for the economic and social infrastructure;
- helps to protect the environment and cultural resources;
- provides an opportunity to acquire agricultural and culinary skills, enriches the knowledge about the way of life and culture of the region.

These benefits for rural areas as a result of the development of rural tourism in Bulgaria are fully in line with the "National Strategy for Sustainable Tourism Development in Bulgaria (2014-2030)", which provides for tourism in our country to develop as a prosperous sector contributing to the implementation of the principles of sustainable development in all its aspects - environmental protection, prosperity of local communities and economic growth.

With its natural landscape, rural areas undoubtedly offer the best prospects for the development of sustainable tourism. They guarantee visitors not only a different experience, but also create in them a sense of authenticity and belonging. In recent years, rural tourism has become a preferred form of leisure. There are numerous attempts in the literature to define rural tourism as a type of tourist product. The diversity of activities and the diverse nature of rural areas are the reason for the kaleidoscope of definitions of the nature of rural tourism [12].

Many authors tend to assume that the concept of rural tourism arises from the definition of ecotourism. This is a special type of tourist market that is not fully included in the concept of ecotourism. The main reason for this is that ecotourism refers to tourist activities in green spaces located not only in rural areas but also in urban areas.

The difference between ecotourism (green tourism) and rural tourism is based on the definition of the term "rural areas", defined by the European Union in one of the first rural development programs within the OECD member countries (Organization for Economic Co-operation and Development). According to this definition, “a rural area is an area that includes villages or small towns with the following economic activities:
- agriculture, forestry, water management and fish farming;
- other economic and cultural activities of the local community (arts, crafts, tourism, etc.);
- destinations for leisure activities” [8].

When considering the different definitions of rural tourism, three main aspects are revealed, which can be classified as cultural (local arts and crafts, music and dance, festivals, local dialect, cooking methods and traditional

recipes, production of local food products). natural (eco-tourism, hunting and fishing, environment, rural landscape, climbing, horseback riding, etc.) and historical (folklore, architecture, historical heritage).

In order to define tourism as rural, it must reflect the characteristics typical of rural areas. For the development of rural tourism it is necessary to have a good understanding of the peculiarities of the rural environment and its demography, as well as to study the socio-cultural, economic and political origins of the place. The above proposed model for assessing the resources possessed by a given area aims to support precisely this classification and characterization of the places that are potentially possible to become centers for rural tourism.

For European countries, and in particular for EU Member States, rural tourism is not a new phenomenon. In recent years, as a result of the world-critical pandemic of COVID-19, it has seen a great expansion and development of its potential. The targeted policy of the institutions towards the development of this sector will still generate many advantages. The two most significant at this stage are:

- development and rehabilitation of the rural sector;
- development of this type of tourism as an alternative to traditional mass tourism;

The process of rural tourism development must first of all comply with certain requirements such as: identification of suitable rural areas on the basis of the available resources they have; investments in tourism activities with potential for development; development of transport and housing infrastructure. At a later stage it will be possible to take into account the benefits of the development of rural tourism. The positive consequences can be - economic, social and cultural. The following are worth mentioning here:

• creation of new jobs for all categories of the population;
• development of many activities, including agriculture and handicrafts, the main goal of which is to eliminate as much as possible the seasonal nature;
• additional revenues for local budgets;
• maximum reduction of internal and external migration by stabilizing the population;
• improvement of local services related to tourism (trade, transport, telecommunications, etc.);
• restoration and protection of real estate by inheritance;
• preservation and promotion of local traditions, customs and crafts;
• cultural exchange;
• attracting new local or foreign private investors, etc.
• environmental protection;

Rural areas are an integral part of the modern tourist experience. However, they also need understanding in order to provide appropriate forms of tourism, based on the available resources of the region. Only in this way can they help achieve national, regional and / or local goals. The responsibility for assessing the effects of tourism with a lasting impact on rural areas is inalienable; to distinguish between development benefits and costs [7].

Education

If we perceive training as a complete and structured process, it makes sense to analyse the methods of training in this process. Researchers have repeatedly proven that people learn the most through their own experience - in situations involving thinking, experiencing and acting. If we want to expand the opportunities for learning, leaving the classrooms and classrooms, we must look for new methods that will create an opportunity to make sense of theoretical training through practical means and in a real work environment. In the modern educational platforms, purposeful tendencies for linking the classical education with the practice are very clearly distinguished. Due to the heterogeneous nature of the subjects in schools and universities, finding a field for extracurricular learning is a complex process. In this sense, it is the rural areas that prove to be a potentially suitable environment for practical training and development of future professionals with a specific professional orientation. For future zoo engineers, veterinarians, agronomists, foresters, agricultural specialists, livestock breeders, ecologists, etc., rural areas are the basis for

upgrading knowledge and competencies. The revival of natural production is in line with modern trends for the consumption of organic products. Through the rehabilitation of the old crafts and practices the traditions are preserved and it is an attempt to return the young Bulgarians to their roots. The social-normative culture passed down through the generations is the essence that outlines the peculiarities of the Bulgarian national character.

The good examples

The examples that illustrate the multifaceted cultural, historical and educational resources of rural areas in Bulgaria are numerous. Here are just a few that focus on our main focus in the study:

Every year in the village of Karpachevo - Lovech region is organized practices of students who restore houses in depopulated villages in the area. Their goal is for people not to leave their homes in search of a better life, and young people seek inspiration there in the authentic rural atmosphere. The number of inhabitants is no more than 80, mostly elderly people. There is only one child. "There is great potential in the village. Architects and restorers are eager to come here. This work is interesting, and it is important to preserve the cultural heritage of this area "- share the young people. A specially organized exhibition of authentic objects from everyday life and the dying life of the village - promotes their idea [10].

We can mention a number of projects (such as "Grandma's Residence"), which see the village as a reserve. Dozens of young people go and live for a month in different, depopulated villages in Bulgaria, in households that need support and help, there they learn various crafts, specific practices of traditional culture; identify the needs and resources of the village through methods such as design thinking, ethnology and anthropology; together with the local people they come up with and implement ideas that can be useful to the village. The results of such projects are: a restored old oven in one of the villages, which has not produced bread for a long time, recordings on a disc with the disappearing songs of the grandmothers, marking of routes for eco-trails [14, 4].

The Borrowed Village project in the Danube villages is similar, giving young people the opportunity to learn what a seat is and how to make porridge. It turns out that the village is a very serious source of activities, which we can call, for example, an ethnographic-architectural reserve; for today's young people, who grew up with computers and the Internet, it turns out to be interesting to learn something about the contemporary customs in the village [11].

CONCLUSIONS

The analysis of the cultural-historical and educational resources of the rural areas, as well as the proposed model for assessing their potential are based on a real assessment of all factors that are important for creating a positive trend related to the socio-economic development goals of the regions. whole. Achieving these goals requires the provision of the following conditions:

- Development of the road infrastructure and superstructure - improvement of the condition of the intercity transport network, installation of information boards, provision of access for people with disabilities, increase of the places for accommodation, construction of tourist information centers.
- Training of specialized staff, which as professionals will contribute to raising the level of service and attracting more visitors and tourists. The local population must acquire skills and habits related to the offered tourist services. It must cultivate qualities such as hospitality, responsiveness, positivism.
- Creating a variety of tourist services and products that are complex in nature. Apart from the existing cultural landmarks (museum, monasteries, monuments, architectural samples, parks) the interest of the tourists is provoked by the various attractions, events, additional routes, which provide them with more experiences during their stay. Tourism has both direct and indirect effects on a country's economy [3].

- Development of specialized types of tourism for which there is a resource potential. After their evaluation it is possible to make the right choice of the leading sites (natural, architectural, archaeological, ethnological, historical, cultural), which will form the proposed route and services.
- Development of integrated products and networks based on existing and known tourist routes, but with a thematic focus. The provocations in this direction can be different - the so-called "wine tourism" is associated with the interests of tourists to the wine regions. On the same principle, "religious tourism" can be realized, associated with a tour of monasteries and holy places, "argar tourism", very popular in recent years, associated with the production and consumption of traditional food and organic products in specific rural areas.
- The organization of festivals, holidays and other thematic events, in addition to the mentioned "Wine Roads", "Cycling Routes" and "Eco-tours" are a prerequisite for the development of tourism in rural municipalities, preserving cultural and environmental resources.
- The establishment of the rural municipality as a tourist location puts at the center the implementation of a targeted policy in support of tourism with several points of reference: attracting investment, promoting the destination through promotion and advertising at home and abroad, digitalization of the tourist product [5].

Returning to the village and assessing it as a potentially important sector is a strategic priority not only of the EU, but also of any country that values its past but also thinks about its future.

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SMALL FARMS IN THE FRAMEWORK OF SUSTANABLE DEVELOPMENT OF THE AGRICULTURAL SECTOR IN THE REPUBLIC OF MOLDOVA

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Abstract

The general well-being of small farms represents an important and actual issue for the Republic of Moldova. Taking into consideration that they are more likely to be exposed to hazards of different origin, it is becoming increasingly important to enhance their living and working conditions. The aim of the paper is to analyse the current situation of small farms in the Republic of Moldova in the context of sustainable development of the agricultural sector and emphasize their future possibilities of progress. For the purpose of the research, a survey has been carried out on a sample of 552 small farms from North, Centre and South regions of the Republic of Moldova. The main findings present prospects for development of small farms in the country under certain conditions, like: specialization in high added value production, efficientization of working time, modernization of farming activities, establishment of direct relations with the market, etc.

Key words**:** *small farms, sustainable development, agriculture, Republic of Moldova*

INTRODUCTION

The dynamic character of the agricultural sector has manifested during the past decade and can be attributable to a large variety of factors, such as disruption of production, distribution networks enhancement, climate change, economical strategies and globalization or investments dynamics [5]. Therefore, taking into account that in 2019 Moldovan agricultural sector's share in GDP accounted for 10.1% and 21% of the population with usual residence were employed in this segment, the sustainable development of the agricultural sector in the Republic of Moldova should represent a key priority in the context of growth of the national economy.

In the Republic of Moldova, about two thirds of agricultural land is cultivated by agricultural farms that cultivate more than 50 ha of land [6]. At the same time, the number of smallholders accounts for approximately 98% of the total number of land users [7] and their role played in the further development of the agricultural sector should not be neglected. Small farms contribute significantly to ensuring food security, especially in developing countries [7]. They have a considerable social impact, as they are presented as a safety net for the rural inhabitants. Small farms are more likely to preserve the natural environment and biodiversity, produce public goods and they have a significant role in ensuring economic growth, at least at the local level.

The issue related to sustainability of small farms has been researched by various scholars. Thus, D'Souza and Ikerd (1996) indicate that the potential "benefits" of small farms appear to outweigh the potential "costs" when viewed in a sustainable development context. Further, the characteristics of small farms seem to most closely resemble those of sustainable systems [1].

After carrying out a comprehensive analysis of studies cited in benchmark publications in agroecology to sustain the advanced sustainability of small farms, Ebel (2020) concludes that there is evidence that small farms are more sustainable than large farms, but this depends on diverse management strategies, which are more frequently applied in small farms, not directly on their size [2].

In the Republic of Moldova, small farms have been analyzed in the framework of the paradigm of sustainable development by Stratan et al in a chapter of an international monograph [7] mentioning that small farmers can be more flexible and more adaptable to changes occurred on the market. Moroz et al (2014) presented the trends and perspectives of small farms versus large farms indicating that the multidimensional role of small farming for rural areas in the Republic of Moldova is demonstrated by active involvement in different non-agricultural activities that are oriented towards the adding value to the agricultural raw material, but also to related services such as trade, transport and agro-tourism [4]. At the same time, Timofti et al (2015) mention that large fragmentation of the agrarian structure adversely affects the economic results and land productivity. Fragmentation contributes to a significant reduction in the small farms competitiveness [9].

Therefore, the aim of the paper to analyse the current situation of small farms in the Republic of Moldova in the context of sustainable development of the agricultural sector and emphasize their future possibilities of progress is achieved by authors through an analysis based on survey data from 552 small farmers from the Republic of Moldova.

MATERIALS AND METHODS

The current paper is based on processing and analysis of the data obtained from a survey of small farmers from the Republic of Moldova.

Taking into account that there is no an unanimously accepted definition of small farm in the Republic of Moldova and the concept of small farm is not expressly defined within a legal act or regulation, the existing lack of data on estimating the standard output of a farm led to the acceptance by authors of the size criteria for small farms (less than 10 ha), which better fits the particularities of the Republic of Moldova.

Therefore, for the research purpose, a survey on a sample of 552 small farmers from three geographical regions of the country (North, Centre and South) was carried out in 2019. The authors will use just a few indicators obtained as a result of the survey related to socio-economic situation of farmers, market access and future development intentions. One limitation of the received data is that it does not include Transnistria and Gagauzia regions of the country.

RESULTS AND DISCUSSIONS

The social well-being of smallholders represents an important and actual issue for the Republic of Moldova. Taking into account that they are more likely to be exposed to indigenous and exogenous hazards, it is becoming increasingly important to enhance their living and working conditions [7]. In such a way, small farmers will be more adapted to the current conditions from the sector and will represent a generator of sustainable development of the agricultural sector.

Age of managers of small farms represent an important indicator related to the future development or modernization of the farm. According to the carried out survey, most of the surveyed farmers are placed in the range between 36 – 63 years old, followed by the group of young farmers till 35 years old, while 57 of farmers are over 64 years old (Figure 1). The average age of the surveyed farmers is 46.4. As for the gender breakout, 25% of the questioned managers of farms are women, while men account for 75%.

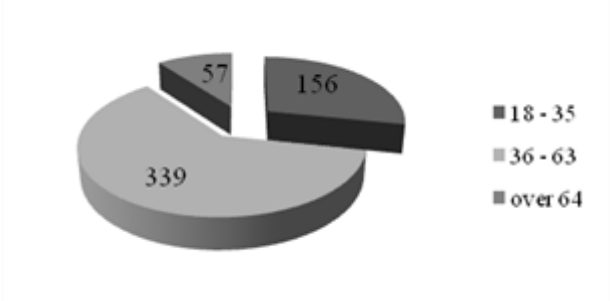

Fig. 1. Age of surveyed farmers, years old
Source: [8].

In regard to the education level of farmers, most of smallholders have a higher bachelor degree (231 farmers), while 166 farmers have secondary education, followed by 112 farmers with vocational education, 30 with general

education and 1 with primary education. Only 12 farmers have a higher master degree (Figure 2). One particularly important moment is that out of the 552 respondents, 175 have received education in the field of agriculture, while 377 farmers have no studies in this field. This can be explained by the fact that not all farmers intended from the early beginning to deal with agriculture, but as a result of the low level of non-agricultural activities in rural areas, impossibility to find a job place according to the held specialization, desire to remain at home and not to emigrate determined their involvement in the agricultural field. From the specialization point of view, this may represent a challenge for the sustainable development of the sector, as most of small farms are not only managers, but also have the function of farmer, having to deal with all the works related to the land/farm. Lack of knowledge may determine a deficient management of farm or even less production and income as a result of lack of specialized information in the field. Nevertheless, a promising fact is that out of the 552 interviewed farmers, 287 mentioned that they participate in the system of continued education, meaning they are really interested in gaining specialized knowledge and learning modern agricultural practices.

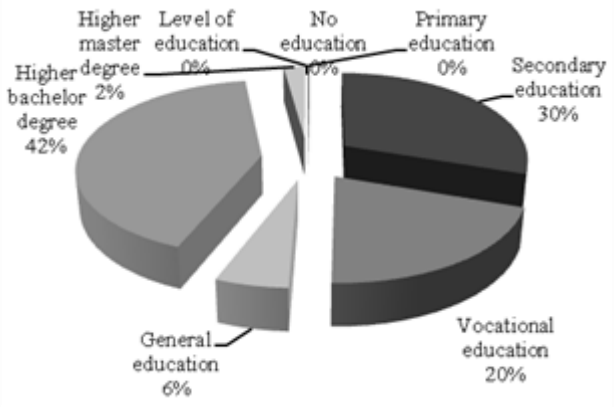

Fig. 2. Level of education of surveyed farmers, %
Source: [8].

In regard to farm specialization, out of the surveyed producers, 131 farms have a mixed specialization, meaning that more than 2/3 of the total production does not belong to one crop, being mixed. Also, 124 producers are specialized in fruit growing, 74 in growing field crops – cereals, 63 - other perennial plantations, 47 – vegetables, 44 – in growing other field crops besides cereals, 31 – other types (i.e. bees, rabbits, nutria, etc.), 23 in growing grapes for wine, 7 – other granivores, 5 – milk producers and 3 – granivores (Figure 3).

These data confirm the previous finding of Moroz et al that small farms, especially subsistence and semi-subsistence farms generate a limited surplus of high value-added crops [4]. The significant number of respondents with mixed specialization of farm indicate on the desire to diversify the production in order to anticipate some potential risks in one sub-sector or another or to ensure the household with various type of production for own consumption. The livestock sector is still not very attractive for small farmers, as it is a very demanding sector that requires significant investments of funds and time. Especially for smallholders, it has additional risks, being subject to a strong dependence with the cereal and forage sub-sector. As a result of the decrease in the harvest of cereal crops, there is always anticipated an increase in their prices, which will contribute to the reduction of feed volumes, and directly, the decrease in the number of animal heads.

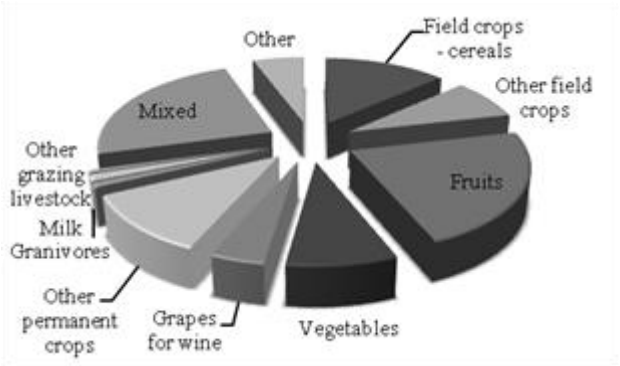

Fig. 3. Farm specialization, number of surveyed farms
Source: [8].

Most of the surveyed farmers are dependent from agriculture in terms of income. Only 46 farmers indicated that the share of income from agriculture ranges between 0 - 20% in the total income and 72 – between 21 and 40%. 434 farmers indicated on the range between 41 and 100% of income from agriculture as a share of total income (Figure

4). Besides offering the necessary products for own consumption, small farms in the Republic of Moldova ensure the owners and their families with a certain degree of income. For a significant share of respondents, agricultural activity is the main generator of household income, being followed by employment in other sectors, self-employment, remittances, etc. Glover and Kusterer identify a major goal of small farm to be to increase the security and income of their families while retaining their independence as owners and operators of a farm enterprise [3]. This goal provides a motivation that might ensure their long-term economic sustainability [1].

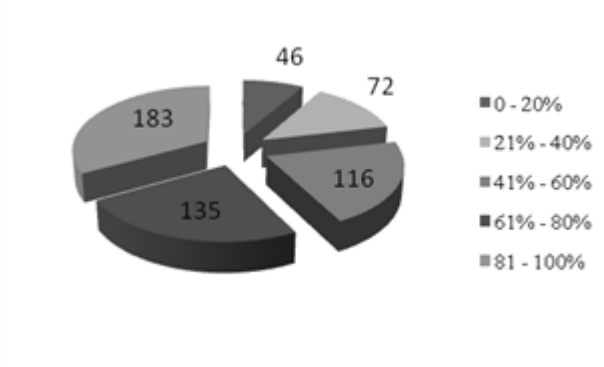

Fig. 4. Share of income from agriculture in relation to the total income
Source: [8].

At the same time, when being asked to assess the financial situation of the household, 57.1% of farmers mentioned that they have enough money to survive, but the standard of living is below the average in the country, 31.3% indicated that they can define their situation as comparable to the average in the country, 8.2% stated that they do not have enough for everyday needs, and have to live on borrowed money or use social benefits, while 3.1% indicated that they can afford a lot without saving money, their standard of living being above the average and only 0.4% mentioned that their financial situation is very good, and they can afford practically everything they need.

As for the current investments in agriculture, being asked about if farmers invest money in the maintenance or development of agricultural production, most of the respondents indicated that they invest funds. In such a case, 48% of respondents mentioned that they invest only from their income, 43% indicated that they invest but partly have to support their selves with loans or credits, 8% stated that they do not invest because can not afford and only 1% indicated they invest, but in whole from loans or credits (Figure 5).

Savings are an important aspect of the functioning of agricultural holdings, as they allow farmers to have a direct influence on the development and changes in their economic activity, as well as being a vital element of financial security in case of unforeseen events [11].

Therefore, the indicator of 48% of small farmers that mentioned they invest in agriculture only from their income is much less that the one of 97% of small individual farms in Poland that were able to self-finance and generate savings from their core business [11].

At the same time, investment of funds in the maintenance or development of their farms expressed by 91% of interviewed farmers indicates on the willingness to continue to activate in this sector, which should be supported by specific targeted programs that would enhance the access of smallholders to financial services.

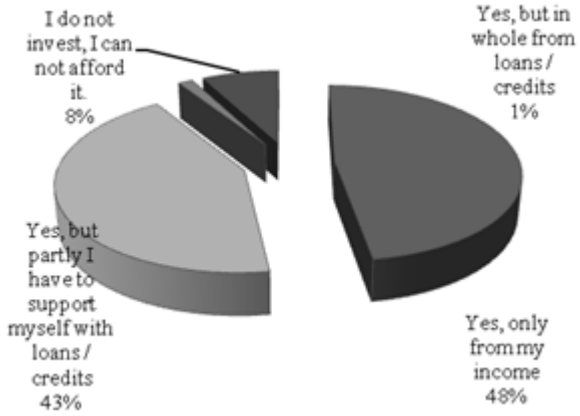

Fig. 5. Farmers' opinion on the question "Do you invest money in the maintenance or development of your agricultural production?"
Source: [8].

The most common indicator for differentiating small farms is the physical threshold expressed in farmland areas such as hectares (ha) or utilized agricultural area

(UAA). Another structural indicator is the size of labor force – annual working units (AWU). Small farms generally use a lower labor input than larger farms [7].

Therefore, based on the results of the survey, one can note that not only farm managers are involved in agricultural activities in their farms, but also their spouses (partners). In average, a farm manager works about 6.9 hours daily at his / her farm, while spouse (partner) is involved for about 5.8 hours (Table 1). At the same time, it is worth mentioning that out of the surveyed farm managers, 288 respondents mentioned they also work outside the farm. This indicator may have an important correlation with the income factor, as one of the reasons for being involved in other activities than agriculture is the low level of income from agricultural work, impossibility to ensure the family with the necessary needs only based on income from agriculture, seasonality of income from agricultural activity, as well as increased risk due to climate conditions or other endogenous or exogenous factors.

Table 1. Daily working time (average in a year) in hours

	No. of persons	Average daily working time
Farm manager - work on farm	551	6.9
Farm manager - work outside the farm	288	5.1
Spouse/ partner - work on farm	401	5.8
Spouse/ partner - work outside the farm	201	4.0
Other members altogether - work on farm	80	8.0
Other members - work outside the farm	8	4.5

Source: [8].

Access to market represents another indicator related to the future development of farms. Being asked about what part of agricultural production is intended for sales, 383 respondents mentioned that the share of sold production is between 81 – 100% of the total amount of production, meaning that they understand agriculture mainly as an income generating activity. 79 of respondents indicate on the shares between 61 – 80%, 34 – between 41 – 60%, 13 – between 1 – 20% and 11 – between 21 – 40%. 32 smallholders mentioned they do not sell at all their agricultural production (Figure 6). Therefore, in the Republic of Moldova activities related to farming are seen as activities not only for ensuring self-consumption within the household, but also in terms of obtaining income.

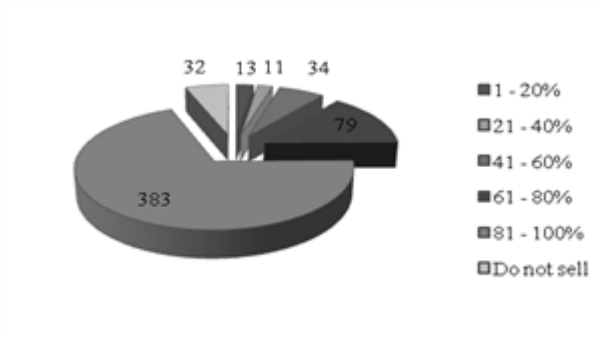

Fig. 6. Farmers' opinion on the question "What part of agricultural production goes on sale (%)?"
Source: [8].

Being asked if the farm sells agricultural products to the market, through which distribution channels, most of respondents mentioned they sell production to local warehouses, local stores and intermediaries, being followed by street markets, marketplace and bazaars. 97 of respondents indicated they sell a certain amount of production to processing plants, while 27 – sell it directly from the farm. Only 10 respondents stated they sell their products in retail chains (Table 2).

Table 2. If the farm sells agricultural products to the market, through which distribution channels (specify the estimated share of a given form of sale in brackets)

	Local warehouse, local store, intermediary	Street markets, marketplace, bazaar	Retail chains	Processing plants	Directly from the farm	Trade fairs	Via websites
Number of persons	396	184	10	97	27	11	0

Source: [8].

It is worth mentioning that when accessing the markets, small farms encounter more difficulties compared to larger ones. First of all, their production capacity is quite limited due to small areas and limited amount of harvest. In such a way, they have no much diversified options for selling their products. Small farms usually sell via long value chains which include intermediates that usually set the price due to the low bargaining power of smallholders. At the same time, due to financial reasons, farmers are lacking in capacities to certify their production. Establishment of associations of producers may represent a solution to the described problems, as there will be possible to ensure large quantities of production, to diversify marketing channels and joint investments can be made in order to develop post-harvest infrastructure.

According to 1990 USDA Farm Bill, sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that over the long term will: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole [10].

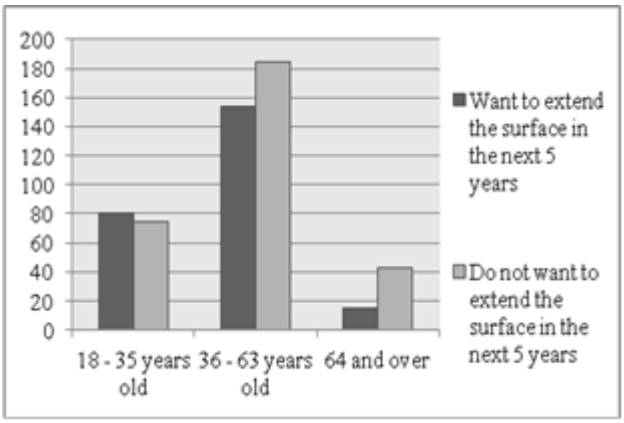

Fig. 7. Interviewed small farmers' intentions for the next 5 years
Source: [8].

Future intentions of small farmers in the Republic of Moldova are strongly connected to the sustainable development of the entire sector. Being asked about their intentions of expanding the current agricultural activities, most of the small farmers, 54.9% answered they do not plan to extend the surface in the next 5 years and 45.1% indicated they would like to extend (Figure 7).

Among the age groups, farmers between 18 and 35 years old are more likely to extend than to leave it as it is (51.6% for and 48.4% against), while for the rest of age groups 36 – 63 years old the proportion shifts to the against group (54.6% compared to 45.4% pros) and when increasing the age group, much less smallholders intend to expand the area (25.9% pro and 74.1% against).

The answers received are not very surprising, as small farmers experience difficulties specific for their sizes, mainly related to intensive labour work and dedication of most of their time to farming activities and additional plots would require much more efforts and time; low level of mechanization in small farms require additional human capital which due to poverty and excessive migration is difficult to find in rural areas; every enlargement requires additional investments and funds which are not accessible for smallholders due to limited financial capacities and lack of targeted programs.

Nevertheless, the desire of 45.1% of surveyed persons to expand the surface may contribute to the further development of the sector especially through valued added production, growth of distinguished products that can find a niche on the market and desire to invest in this sector.

CONCLUSIONS

Small farms from the Republic of Moldova contribute considerably to the sustainable development of the entire agricultural sector, being a safety net for rural inhabitants and providing households with products both, for own consumption and for selling purposes. They have a say in ensuring food security, especially in rural regions and have a

noteworthy role in ensuring economic growth, at least at the local level.

Specialization in high value added production represents an important indicator in terms of future development, but additional factors are needed to be taken into account for increasing their sustainability, like age of farmers, level of education and specialized studies in the field, modernization of farming activities and rationalization or the working time.

In terms of market penetration, establishment of associations of producers may represent a solution to boosting direct access to market and shorten the value chain, as this will lead to diversification of marketing channels and joint investments for developing post-harvest infrastructure.

Desire to invest in maintenance or development of their farms expressed by 91% of interviewed farmers and the will to increase the surface in the next 5 years mentioned by 45.1% indicates on the motivation to carry on activating in this segment. Nevertheless, the problems encountered by small holders like the insufficient level of mechanization, necessity for more labour force during the harvest season, excessive migration and lack of infrastructure and decent living standards in rural areas give us the reason to conclude on the need for specific public support programs that will target small farmers as their main beneficiaries, like introducing the current subsidy program of special measures for small farmers, introduction of subsidies in advance instead of the current post-investment ones, enhancing their access to financial services and instruments, more programs intended for rural development and improved infrastructure in countryside areas.

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THE ROLE OF MULTIFUNCTIONAL AGRICULTURE FOR SUSTAINABLE RURAL DEVELOPMENT

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Abstract

Multifunctional agriculture is a continuation of the meaning of diversification. It is a way of undertaking an agricultural endeavor, combining different practices from different sectors. The idea behind such an approach is to use the typical resources of agricultural holdings to achieve results related to other sectors. Multifunctionality can refer to different functions. It has been adopted in agriculture as a paradigm of sustainable agricultural practices to achieve better rural development. Multifunctional agriculture can be an important factor in the economic development of both farmers and rural areas. The aim of the study is to analyze the economic, social and environmental effects of the application of multifunctional agriculture. The research is based on good practices of different farms in Bulgaria. The results show that multifunctional agriculture stabilizes the economic condition of agricultural holdings and contributes to the development of the rural areas in which they are located.

Key words**:** *multifunctionality; agriculture; good practices; rural regions, Bulgaria*

INTRODUCTION

Bulgarian agriculture occupies an important place in the national economy of Bulgaria. Agriculture is important because it produces food and raw materials, provides employment for part of the population and it is in direct interaction with the environment, biodiversity and nature.

Agriculture has always been multifunctional. Along with traditional agriculture, including agriculture and animal husbandry, multifunctional agriculture covers many different aspects such as social and pedagogical, health and health services, ecotourism, cultural activities, environmental protection or active marketing of agricultural products [13].

Multifunctionality helps to combine environmental and economic principles in the production of agricultural products and leads to improved final economic results in the region, district or settlement. The concept of multifunctionality of agriculture is logically linked to the objectives of sustainable rural development. The development of sustainable agriculture requires its coordination with the natural resources and potential of each region.The complexity of sustainable rural development is connected to interests of larger number of economic and other subjects, as well as all local interested citizens [11].

In 2001, the FAO adopted the following definition of multifunctional agriculture: "Agriculture has significant environmental, economic and social functions in addition to its primary role of food production and contributing to food security. The multiple functions of agriculture are intrinsic"[7].

Within multifunctional agriculture, the different functions can be categorized into five colour categories. Firstly, the white functions represent a contribution to food security and food safety. Secondly, green functions represent a contribution to nature, the environment and landscape. Water management by farmers and the harnessing of energy on farms are categorized as blue and red functions, respectively. The yellow functions, which have a more social focus. The final category is the social farming belongs to the group of yellow functions [12].

Multifunctional farm

Against the background of a significant number of publications for the multifunctional model of agriculture, the problems of multifunctionality at the individual level (in the farm itself) are considered much more limited [5]. Authors such as Belleti, Brunori, Marescotti and Rossi believe that the multifunctional economy is more than a company in which "something related is carried out production of public and private commodity or non-current goods ". According to them, this is a farm in which "multifunctionality is a structural principle, a network of rules that generate short - term and long-term elections". The multifunctionality interpreted in this way gives grounds to conclude that all or many of the agricultural farms have some degree of multifunctionality [4].

At the same time, if we look at things realistically, a small part of them have adopted multifunctionality as a structural principle, i.e. can be defined as multifunctional.

Other authors [14] derive the multifunctionality of the farm itself through a historical overview of the evolution of management systems. They talk about coordination activities on the farm in agronomic and economic principles. On this basis, the effects of multifunctionality are defined as "technological logical synergies" for the agricultural holding itself (from better risk management) and as more positive environmental impacts.

Agriculture uses natural resources to manage activities and this is closely linked to the question of how these activities should be shaped by farmers. Much of the advice in this regard is aimed at pursuing policies related to strengthening the principles of sustainability. Sustainability, in turn, can be viewed from three perspectives:

• Economic - organizing resources in a way that leads to long-term benefits from a business perspective;

• Environment - to live in harmony with the natural environment, protecting it from damage and destruction;

• Social - people recognize and accept as something valuable the applied practices.

In particular, the return of communities to values through inclusive approaches related to a higher quality and healthier lifestyle.

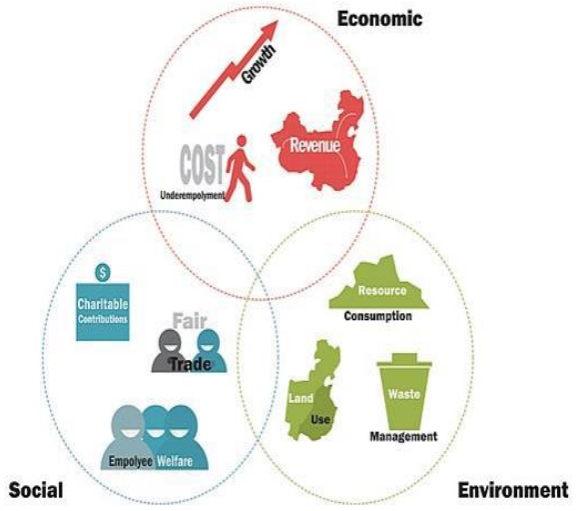

Fig. 1. Three types of bottom lines
Source: [15].

In recent decades, politicians have worked hard to get manufacturers to take sustainable action. Very often the results of their activities are missing. The lack of results from the pre-set goals creates unproductive costs and deteriorating working conditions. There are many reasons for these negative results. Some of them are related to the inability to access key resources due to higher costs, scarce available financial resources, and last but not least to the lack of knowledge and / or skills. Knowledge and skills are two different concepts. In the Skills pillar of the ESCO, a distinction is made between (i) the concepts of skills/competences and (ii) the concepts of knowledge by indicating the type of skill. Knowledge is defined as a set of information that forms a complete description corresponding to a certain level of awareness of a given problem. Skill refers to the ability to use this information and apply it in context. In other words, knowledge refers to theory, and skill refers to the successful application of that theory in practice.

This largely refers to the knowledge and skills related to multifunctional agriculture in Bulgaria. As a theory, it is already known to the public to some extent to some farmers, but

as a practice it is applied to a limited extent. The reasons for this are many and complex.There is no comprehensive state policy for the development of multifunctional activities in agriculture. The theory related to multifunctional agriculture is not taught in higher education institutions. Somewhere efforts have been made in this direction as it is embedded as an elective discipline in the curriculum. The practical successes of applying the theory of multifunctionality are related to the implementation of individual projects in this field.

In 2019, within the project eTOMATO - Training and Orientation for Multifunctional Agriculture - Entrepreneurial Opportunities, a survey was conducted at the University of Agriculture - Plovdiv with 63 students from six specialties from three faculties for bachelor's and master's degrees. Expected year of graduation - 2019-2021.

To the question "Does my education offer me enough knowledge to manage a farm properly?" students answered on average 68.05% positively (52.78% agree and 15.27% strongly agree) that their training offers enough knowledge for proper farm management. The best (74.60% positive answers - agree and strongly agree) is the training in sales, marketing and management, and the lowest is social and didactic agriculture with 12.70% positive answers (1.59% strongly disagree, 11.11% - do not agree that sufficient training is offered and 39.68% are neutral, which in a conversation with them was clarified that they respond because they are not aware of their nature). The situation is similar with short food supply chains – 9.53% believe that they do not receive enough training in this area, 28.57% are neutral.

MATERIALS AND METHODS

An analysis of the multifunctionality in agriculture has been made by observing various agricultural producers in Bulgaria who perform agricultural and non-agricultural activities. Some farmers carry out organic production and offer their products directly to consumers, organizing their deliveries or have their own shops, thus implementing a shortening of food supply chains, which is one of the areas of multifunctionality. Other farms apply unique traditional technologies in their production, have preserved the family tradition and apply the skills passed on to their fathers and grandfathers. A third of farmers combine different productions in order to improve the economic viability and sustainability of the regions. Some of them have guest houses, develop organic farming and animal husbandry and carry out rural tourism. The presentation of the various agricultural sites applying multifunctional agriculture aims to show the impact of this type of agriculture on the social and economic development of rural areas.

The case method was used to gather the necessary information. Researcher Robert K. Yin defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and which multiple sources of evidence are used [16]. The case study is a research methodology that is appropriate for the case. We use the method of multiple case studies, which includes various relies on multiple sources of evidence formed as a result of research and also take advantage of previous developments in theoretical propositions.

As a case study method, it can provide information on the socio-economic characteristics of farms in terms of attitudes, future intentions and behavior, so that it can be used in both quantitative and qualitative research.

The exposition and analysis of the good practices applying multifunctional agriculture shows how much the society in Bulgaria is familiar with the ideas and practices of multifunctionality, how much the respective country has created appropriate conditions for stimulating and popularizing this type of activities.

There is a wide range of multifunctional activities in different regions of Bulgaria. It is therefore difficult to give a precise definition of multifunctional agriculture at farm level.

The study aims to show the social, environmental and economic results of the application of the multifunctional concept in agriculture. The survey covers three farms located in different regions of Bulgaria. The first and third farms are located in the South-Central region and the second in the South-West region. The multifunctionality of the first is expressed in the development of activities related to rural tourism and short food supply chains, the second farm - short supply chains, and the third is definitely related to the social functions of multifunctional agriculture.

RESULTS AND DISCUSSIONS

Rural areas provide livelihoods for many people, much of the food and a number of basic raw materials. Each rural area is unique with its geographical location, its natural diversity, its historical past, the ethnic composition of the population, the religion and the economic potential it has. Rural areas have a huge potential for development in various directions, which is not only related to the development of the agricultural sector [9]

The projects in the Rural Development Program (RDP 2021-2027) are aimed at:

• organic production;
• disadvantaged areas;
• start-up aid for young farmers;
•support for small farms as well as investments in farms;
• processing of agricultural products and non-agricultural activities.

It is envisaged to support young and small farmers in the form of a grant in case their farm is up to 20,000 euros Standard Production Volume (SPV). The gratuitous payment will amount to a 100% grant, which will be available to a larger number of agricultural holdings and an easier and more accessible way of applying. The Rural Development Program also provides for investments in non-agricultural activities in rural areas.

They will target farmers and micro-enterprises, which are a major source of growth and job creation. It is proposed that the financial support be supplemented with the possibility of combining it with loans to be granted by the State Fund "Agriculture".

Rural development policies can be grouped into three categories. The first approach is monosectoral. It is aimed at supporting agriculture as a separate sector for rural development. The second approach is multisectoral, it involves supporting all activities in rural areas. Measures for integrated and sustainable development of the regions are applied. The focus is on diversifying economic activities, caring for the environment, developing infrastructure, education, social services and revitalizing the overall socio-economic life. The third approach is a continuation of the second, but the emphasis is on the participation of target groups in support [3].

Multifunctional agriculture enables individual development, improves the quality of life in rural areas, is a source of additional income and contributes to the sustainable management of natural resources and the revitalization of rural areas.

Organic farming and integrated farming represent real opportunities on several levels, contributing to rural economies. The environmental advantages of these farming systems can bring significant benefits for the economy as well as to help for social inclusion of disabled or mentally handicapped people, long-term unemployed persons, drug addicts or socially disadvantaged people, children and juveniles with behavioral and learning difficulties [12].

Data for the development of organic agriculture in Bulgaria for the period 2006-2019 can be seen from Table 1 and Figure 2. The figure shows the growth of organic agricultural land in the country. At the end of 2019, 117,779 hectares were farmed organically, constituting 2.4% of the total usable farmland in Bulgaria. In 2010, 25,648 hectares were cultivated organically, which represented only 0.47% of the total usable agricultural land in the country. The development of organic livestock in the period 2006-2019 can be seen from the data in Table 1, which shows that since 2012 the number of certified farms and animals is constantly increasing.Organic agriculture had

220,765 beehives under organic management at the end of 2019.

Table 1. Development of the number of operators, organic agricultural land, certified animals and beehives in Bulgaria 2006-2019

	Certified operators	Certified organic land (ha)	Certified animals	Certified beehives
2006	181	3,061	1,514	708
2007	339	11,809	3,101	35,747
2008	285	16,662	4,565	44,861
2009	467	12,320	8,939	41,089
2010	820	25,648	9,952	46,429
2011	1,054	n.a.	n.a	n.a
2012	2,016	39,138	13,179	85,346
2013	3,123	56,287	12,940	117,360
2014	4,092	47,914	13,001	89,553
2015	6,173	118,571	31,460	178,331
2016	7,262	162,352	48,897	236,462
2017	6,822	136,617	49,280	250,434
2018	6,660	128,839	41,813	227,721
2019	6,405	117,779	42,951	220,765
2019/ 2006 %	3,538.6	3,847.7	2,836.9	31,181.4

Source: [6].

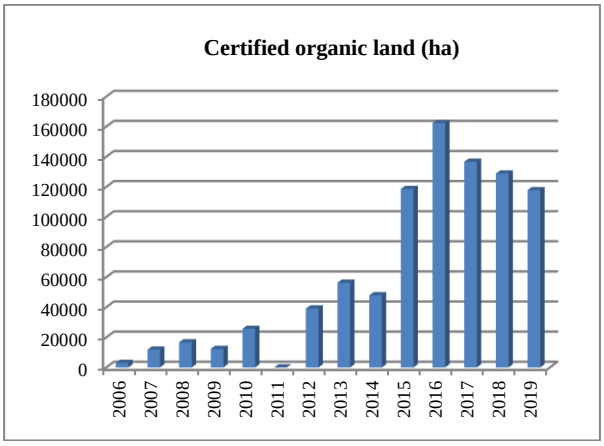

Fig. 2. Development of organic agricultural land in Bulgaria, 2006 -2019 year
Source: [6].

The availability of quality land resources, climatic conditions, traditions in the development of the agricultural sector and good production experience in the crop and livestock sub-sectors are the factors that contribute to the development of organic production in Bulgaria. Defining for the organic sector is the specific method of production, which maintains the ecological balances and produces products covering the ecological principles. Therefore, we could consider organic production as a good basis for the development of multifunctionality in agriculture in the country.

We will try to present several organizations that have chosen a different way of life - to live in nature, to produce organic and environmentally friendly products and to preserve and transmit over time the local way of life, culture, tradition and biodiversity.

They are located in different regions of our country, are dedicated to different activities and bring a diverse range of environmentally friendly products. But there is one thing that unites them - their exceptional love, concern and understanding of nature - for them organic, ecological and organic clean agriculture and attitude to land, nature and life in general, is not just a good business idea - but something very bigger and deeper - it is the philosophy and meaning of life, what they deeply believe in and have dedicated their whole lives to.

The Wild farm of Nikolay and Blagovesta Vasilievi is located in the village of Gorno pole in the Eastern Rhodopes - a preserved and truly wild region of Bulgaria. The following can be indicated as distinctive features and activities of the company:

- The farm has a beautiful guest house;
- The farm is livestock breeding and the animals are being looked at as meat;
- Because of the completely free year-round grazing and constant free movement, the veal of these animals has a clean, deep aroma and is unusually tasty and tender;
- The farm has its own slaughterhouse and meat processing workshop;
- It offers organic products directly in its own shop in Sofia.

The farm combines different activities of multifunctional agriculture: rural tourism as a result of the built guest house and the natural resources of the region, production of organic products from farm animals and their implementation through the application of short food supply chains. One of the goals of the farm is to provide rest and to comply with the specific needs and interests of each guest by offering him organic food produced on the farm.

The Sofina family farm has been in existence since the beginning of 2009. Stoyan and Teodora Simeonov take care of nearly 70 acres of bio-certified plantations. With the help of family and people from the local community, the farm grows fruits, vegetables and birds. From the beginning of 2010 the expansion of the vegetable production begins and already from 2011 the methods of bio-dynamic agriculture are applied in growing vegetables, which contributes to the quality, healthy and tasty harvest.

-Their farm products include: nuts, hazelnuts, different types of tomatoes, cucumbers, zucchini, peppers, celery, pumpkins, carrots, potatoes, beets, beans, spinach, as well as the non-standard kale and chard.

- The proximity of the farm to Sofia allows the products to be picked up a few hours.

The farm welcomes visitors, including families with children - everyone is welcome during the Open Days or as part of Solidarity actions to come, spend a wonderful day with friends and family, to get acquainted with the way of raising vegetables and the principles of bio-dynamic agriculture.

Modern organic farming represents a merging of a number of different streams of thinking [2]. In 1924 the Austrian philosopher Dr. Rudolf Steiner presented an alternative vision of agriculture derived from his spiritual science of anthroposophy [10].

This forms the basis of the development of biodynamics agriculture, which is now practiced in many countries around the world. After Steiner's ideas, many others have contributed to the development of the concept of organic farming [12]. The definition of organic farming includes the concept of sustainability (economic, social and ecological). The term “sustainability” is used in a wider sense to underline not only the conservation of non renewable resources (soil, energy, minerals) but also the issue of social sustainability [8]. "Gerzovitsa" is the name of the area where the prison and the prisoners' farm are located in Smolyan. The location is in the Smolyan region with an altitude of 1,400 meters. Animal husbandry is free, pastures are not fed with chemical fertilizers. The area is far away from settlements in a diameter of 15-20 kilometers. At least 100 km away there are no chemical and other contaminations from factories. Twice a month, the Food Agency checks the performance of fresh milk and all dairy products produced.

Prisoners take care of a total of 50 cows, 43 goats and nearly 100 sheep from whose milk they make their produce. The farm focuses on the breed of Rhodope bovine which is under protection and for which it receives good subsidies. Animals grown from 10 employees prisoners who deal with nutrition, grazing, cleaning and all activities related to good livestock. Each of the prisoners working on the farm is given a psychological profile, which includes the following: a desire to work with animals; skills for working with animals; possibility for work on an external object - assessment by the prison management in Smolyan. The Prison Dairy has all the necessary licenses for the production and sale of yoghurt and cheese. There is a modern production plant built. Every prisoner worker willing to work in the dairy undergoes a training course for working in the dairy. An exam is then held and the eight most knowledgeable and capable are chosen. Selected workers undergo a health check and behavioral control that ends with a psychological profile. Farming and dairy work creates working habits for prisoners while studying a new interesting craft. Workers prisoners receive monthly remuneration and every two working days are counted as three days of the verdict. Despite the frequent staff shift due to the expiration of convictions, the farm managed to maintain the range and quantity of production. For now it has realized its production in three districts - Smolyan, Plovdiv and Sofia. The dairy farm has a motto: "Who once tried just asking for it." In this case, the farm on the prison creates favorable conditions for people with special needs, providing them with participation in the daily activities of the farm according to the individual abilities and capabilities of each of them. The connection with the land, with the surrounding nature, the relationship with the people who train them and the production

process itself have a re-educational effect on the prisoners, and some of them acquire professional skills, which they apply even after their release from prison. The work itself and the calm atmosphere improves their mental state and has a proven healing effect.

The changing socio-economic environment in Bulgaria during the transition period had a strong impact on the social status of people, especially those with disabilities or people in prisons. The growth of unemployment, structural changes in the economy and others lead to the separation of these people from society and increase their social isolation. The constraints of their environment create greater barriers to social inclusion than the disabilities themselves. In order to be integrated into society, they must be included in the work process. Some of these people have lost their work habits and have no desire for social adaptation or it is very difficult to achieve. Many employers refrain from hiring people with this type of problem.

Farms are those that can create favorable conditions for people with special needs, providing them with participation in the daily routine activities of the farm in accordance with their individual abilities, capabilities and desires.This helps their development, integration into society and improves their lifestyle. The farms also provide employment to psychologists, therapists, instructors, teachers, counselors who are committed to improving the health and social adaptation of people with problems.

Sub-measure 6.4.1 "Investments in support of non-agricultural activities" of the RDP 2014-2020 creates conditions for supporting farms to develop their multifunctionality.The measure provides support for investments in non-agricultural activities, which are aimed at: promoting employment, creating new and preserving existing jobs; Reduction of seasonal fluctuations in employment; Encouraging the development of non-agricultural activities in rural areas; Encourage investment activities and support for the development of technologies in the field of "green economy", including energy from renewable sources for own consumption.

The sub-measure started with the first admission in the calendar year 2018, with a total budget of BGN 132,994,400, divided into three support procedures - in the sectors "Production", "Services", and "Crafts".

According to the agrarian report of the Ministry of Agriculture, Food and Forestry 2020 [1], the total number of applications received for admission is 826, with the value of the requested subsidy BGN 220,848,690. The budget for admission in the direction "Investments aimed at the development of crafts" amounts to BGN 5,867,400. 29 project proposals were received, with a total value of the requested grant of BGN 6,026,013. 25 project proposals were admitted for assessment of administrative compliance and eligibility and technical and financial assessment. Under the procedure "Development of services in all sectors and other non-agricultural activities", with a budget for admission in the amount of BGN 68,453,000, 507 applications were received, with a total value of the requested grant in the amount of BGN 133,461,838. As the total amount of the requested financial assistance under the submitted project proposals exceeds the available budget under the procedure, a preliminary evaluation of 471 project proposals was performed.

CONCLUSIONS

The cases described in this article are only a part of the farms applying multifunctionality in their activity. Therefore, there is wide range of multifunctionality activities in different planning regions in Bulgaria. In this situation it is difficult to implement the general definition of multifunctional agriculture at the farm level. Multifunctionality represents much more that economic aspects and income opportunities. It has also strong socio-culture aspect. The case studies show that farm size has an important role for implementation of the different multifunctional activities. In Bulgaria, the large commercial farms are involved in growing up traditional crops and/or livestock production and agro-tourism.

This model is accepted by larger number of commercial farmers and supported by

administration. The small farms implement different model of multifunctionality. Some small farmers often divide their time between on- and off-farming activities because of lack of financial resources, while others implement different activities on farming. Usually, small farmers are more interested in farms activities linked to environmental preservation than large farmers. The research of the Bulgarian farms shows that the development of multifunctional agriculture is still in its infancy, although it is much ahead of 2013-2014. The positive thing in this case is that although in a small scale, some existing examples can be shown. The negative is that the possibilities and the advantages of the this farming are not well known on the society level, as well as on national managing bodies level. As a consequence of this there is no common, purposeful and consistent policy to popularize and to develop this type of activity. The existing in the practice examples are realized as a result of a private initiative on a free principle without any protection, consultation or coordination of the activities from the governing bodies. We can conclude that there is a base for development of multifunctional agriculture in Bulgaria. A good link has been established between organic farmers. Many associations and organizations for organic farming have been established in different regions of the country, which provide a basis for multifunctional activities, i.e. we consider organic farming as one of the prerequisites for the development of multifunctional agriculture. The established network between organic farmers provides an opportunity to disseminate new knowledge and good practices in agriculture. At the same time, this production is associated with a number of environmental benefits that multifunctionality seeks. It is a good basis for the development of social and didactic farming, as well as short food supply chains due to the nature of its work. All this leads to the economic stabilization and sustainability of farms in different regions of the country and ultimately to increasing the sustainability of rural development.

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ECOLOGICAL ASPECTS OF THE ECONOMIC DEVELOPMENT OF THE BLACK SEA REGION OF THE REPUBLIC OF BULGARIA

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Abstract

The article considers the main parameters of the sustainable development of the urban and rural environment as a basis for ecological development of the Bulgarian Black Sea region. Based on the problems of urbanization in the post-totalitarian transition in Bulgaria, conclusions and findings are made about the nature and the parameters of the implementation of the second pillar "Green Bulgaria" of the Plan for Recovery and Sustainability of the Republic of Bulgaria. The thesis is defended that the future development of Bulgarian Black Sea region should be based on environmental friendliness and sustainability. An attempt has been made to highlight the positive and negative changes in the ecological development of the Bulgarian Black Sea region over the last three decades. The main guidelines for the necessary changes in the regulatory aspect are presented. They should ensure the protection of the air, soil, water and nature of the Bulgarian Black Sea region.

Key words: *sustainable development, maritime economy, problems of urbanization, coastal zone, ecology*

INTRODUCTION

The problems in the development, ecology and infrastructural improvement of the settlements on the Bulgarian Black Sea coast are many and varied. Urbanization in the conditions of the socialist totalitarian system still influences the formation of urban and rural communities in the post-totalitarian period of the development of the Republic of Bulgaria. It is imperative that the future development of Bulgarian Black Sea towns and villages be based on environmental friendliness and sustainability. They should strive for coastal centring and location, with a transition from one imitation urban environment to another, with a panorama of tourist- adjusted and adapted area that combines environmental aspects of work and living environment and architecture with the challenges of modern industrial and agricultural technologies. One of the goals of the exhibition is to emphasize the positive and negative changes in the development of the Black Sea area of the Republic of Bulgaria during the last three decades. The changes in the legislation in the Republic of Bulgaria in unison with the Directives and the legislation of the EU aim to ensure the protection of the air, soil, water and nature of the Black Sea region.

In the conditions of established market relations in the Bulgarian national economy, the need for a comprehensive reassessment and reorientation of regional policy on a national scale comes to the fore. Such reorientation is especially necessary for the cities and villages of the Black Sea region, due to their role in strategic for the development of the Bulgarian economy industries such as water transport, tourism, construction, trade, extraction of marine resources and in general due to their position as centres for development of modern Bulgarian maritime economy.

Both of the largest Black Sea cities of the Republic of Bulgaria - Varna and Burgas - grew significantly during the socialist period - after September 9, 1944 Varna was the city with the largest mechanical growth in the Republic of Bulgaria. On September 9, 1944 the population of the city of Varna was 45,000 people. In 2007, when the Republic of Bulgaria became a member of the EU, the city of Varna officially numbered 710,000 people. This is an increase in city residents more than

15 times. The growth rates of the city of Burgas are similar, which for the period from 1944 to the beginning of the Millennium became the fourth largest city in Bulgaria, after Sofia, Varna and Plovdiv.

MATERIALS AND METHODS

The first step of the study is a literature review in order to define theoretical and methodological determinants of the report and identify a broader set of indicators and criteria for environmental priorities in the development of the Black Sea region of the Republic of Bulgaria. The second step was the expert evaluation of the identified indicators in order to select the most significant projects and present more illustrative examples. Data from various sources of information were used, and above all data from the Regional Centers for Environmental Protection and Water in the main Black Sea cities of Burgas and Varna. The third step is related to the selection of various examples illustrating the positive and negative changes in the process of transition to a market-oriented economy. An important methodological point is the summarizing of the activities for sustainable development and the ecological orientation for the development of the Black Sea towns and settlements in the coastal region.

The main documents used for the conceptual assessments of the ecological aspects of the development of the Black Sea region of the Republic of Bulgaria are the National Development Program Bulgaria 2030, as well as the Plan for Reconstruction and Sustainability of the Republic of Bulgaria from February 2021 and the EU Framework Programs for Regional Development.

RESULTS AND DISCUSSIONS

Positive changes in the Black Sea region during the transition to a market economy

The past period of over three decades since the beginning of the democratic changes in Bulgaria has radically changed the realities in the Bulgarian Black Sea cities. Historically, they were formed under different conditions and have different natural and demographic features. The common thing that unites them is their location in the coastal strip of the Bulgarian Black Sea coast and their connection with the sea and the Black Sea ecosystem.

The changes that have taken place in the context of the transition to a market economy have both positive and negative dimensions.

At the present stage, the positive changes are relatively small and have little effect in the direction of improving the environmental situation.

The most significant positive change in the ecological situation on the Bulgarian Black Sea coast is the drastic reduction of industrial production, mainly in the northern Black Sea cities and the utmost in the Varna-Devnya industrial agglomeration. The liquidation of entire structurally defining industries for the region, such as shipbuilding, production of internal combustion engines, radio electronics, heavy chemicals, as well as limiting electricity production to a minimum volume needed to cover the peak moments in the load of the country's energy system, lead to natural results: reduction of pollution of river and sea waters; to less harmful emissions into the air and to reduction of soil pollution.

In Dobrich region, which is represented by several small towns and villages on the Black Sea coast, one of the last eco-projects is the one launched on November 19, 2019. project for closure and reclamation of the landfill for municipal waste in the municipality of Shabla. The investment amounts to BGN 2,284,235, incl. BGN 2,192,211 for technical reclamation, which are provided by the Enterprise for Management of Environmental Protection Activities (EMEPA), and BGN 92,024 for biological reclamation, which are at the expense of the Municipality of Shabla [7].

As a positive fact for the Bulgarian economy can be assessed the fact that cities such as Burgas and Pomorie retain to some extent the industrial production, incl. and the production related to the extraction of marine resources (the Black Sea salt pans in Pomorie and Burgas). In Burgas, oil refining, machine building, metallurgy, ore mining and shipbuilding are the main pollutants of the

ecosystem, including the waters of the Burgas Bay, as well as the lakes: Atanasovsko Lake, Mandre Lake and Lake Vaya.

"One of the industrial giants of heavy chemistry in the Republic of Bulgaria - Lukoil Neftochim" - Burgas has invested over $ 35 million in treatment plants since 2014, which reduce harmful emissions into the air. Reconstruction and modernization of an existing boiler have been carried out in the plant, and a filtering system has been installed. The technology is of a new generation in the field of oil refining and this is one of its first applications within the EU. It reduces emissions from catalyst dust several times compared to the equipment used so far."[4].

One of the last investments in improving the ecological environment in the Burgas region is from March 19, 2020. When a project for reclamation of a landfill for solid waste in the town of Obzor, Nessebar municipality in the Burgas region started. The project has a total value of BGN 1,254,410.89, of which BGN 1,066,249.26 is a grant from the European Regional Development Fund (ERDF) and BGN 188,161.63 is national co-financing.

The purpose of this eco-investment is to carry out technical reclamation of the decommissioned landfill for solid waste in the land of Obzor. The implementation of the project will provide an opportunity for the subsequent improvement of the landscape and for the restoration of the suitability of the terrains for agricultural or forest use [8].

Another positive effect of overcoming the limitations of the totalitarian economy is the opportunity to release the initiative and entrepreneurial potential of the people of the Black Sea region for the development of private initiative and private business. In a short time, all major tourist infrastructure objects in big Bulgarian Black Sea resorts and holiday villages have been privatized. The hotels and the entertainment base have been modernized and renovated. Many new hotels and restaurants have been built. The construction of the Bulgarian Black Sea coast is carried out at a fast and dynamic pace. For about two decades after the beginning of the democratic processes in the Republic of Bulgaria, almost all established resort settlements have been rebuilt. The development and construction of the few remaining undeveloped remote and exotic beaches near Irakli, Aleppo, Otmanli, Durankulak and others has begun. The main Black Sea resorts on the Bulgarian Black Sea coast - Golden Sands and Sunny Beach - are extremely developing and expanding with new hotels and entertainment sites. New modern complexes appear such as Kamchia, Saint Vlas; Ravda; Pomorie. All this creates a good basis for the development of maritime tourism. While the industry is preserved and developed mainly in the southern Black Sea region, the tourism business is in the process of renewal and adaptation along the entire Bulgarian Black Sea coast, including in cities such as Tsarevo and Ahtopol, which in the recent past fell into the forbidden border area.

As Angela Botezatu points out: "Mini vacations" in rural areas are very appreciated by tourists. Tourism development in rural areas should be supported by the state, local authorities, local creativity and initiative and not at least by tourists themselves." [2].

To some extent, the effect of various agribusiness development programs (SAPARD), socio-economic development (PHARE), transport corridors and high technology development (INSA), the EU Framework Programs for Regional Development can be assessed as positive for regional development. All these programs supporting the integration processes in Central and Eastern European countries. Most importantly, that these programs provide financial resources that can be used to solve various environmental and socio-economic problems in the Black Sea region.

Table 1 presents the ecological potential of the parameters of sustainability in the development of the urban environment. As Professor Stella Todorova notes:

"The main considerations when using the indicators for sustainable development are aimed at:

-Setting specific goals;

-Data collection through monitoring;

-Achieving efficiency;

-Reporting on global development;

-Improving the relationship between society and the environment;
-Taking into account the following factors - geographical location, people, culture and institutions." [14].

Table 1. Ecological potential of the parameters of sustainability in the development of the environment on the Black Sea region

Parameters of sustainability	**Changing the ecological indicators of the environment on the Black Sea region**
1. The reduction of input materials used.	Saving of primary raw materials. Reducing the human footprint on the planet.
2. Waste reduction.	Reducing the harmful effects of waste processing and storage.
3. Reducing the emission of harmful substances along the value chain.	Improving the urban eco-environment.
4. Encouraging the reuse of packaging, containers, capacities, pallets and other logistics aspects of production and transport activities.	Reducing the number of pollutants and the degree of pollution of the urban environment.
5. The recycling of resources.	Development of responsible eco-behavior for future generations.
6.Substitution of resources.	Saving resources and raw materials and minimizing the environmental consequences of the extraction of primary resources.
7. The use of alternative energy sources.	Reducing the yield of non-renewable resources.
8.Production of energy from renewable energy sources.	Reduction of harmful emissions.
9. The promotion of ecologically clean and resource efficient productions.	Saving energy and natural resources. Reducing the eco-footprint of urban communities.
10.Development of technological solutions for waste-free technologies in production.	Minimizing the eco-impact of production and economic activities in the urban environment.
11.Innovative solutions aimed at extending the life cycle of products.	Imposition of eco-standards in everyday consumption.
12. Introduction of alternative productions using waste as raw material.	Saving primary resources and responsible for future generations urban consumption.
13. Generating "green" demand for environmentally friendly products and services	Introduction of mass eco-behavior and various ecological practices in the consumption of the urban population.
14. Implementation of intelligent systems for administration and support of the market of recyclable raw materials.	Use of high technologies in supporting environmental business and management decisions.
15.Development and implementation of modern polymeric substitute materials in the production of products, after the use of which widespread waste is formed.	Saving natural raw materials such as wood, natural fibers (cotton, flax, hemp, jute, etc.), ore and non-ore minerals, etc.
16. Achieving market equality of environmental products and services and their equivalents.	The imposition of environmental practices as normal production and consumer standards in urban conditions.
17.Impact on markets through economic instruments to internalize external costs (related to environmental protection) through the polluter pays principle.	The introduction as a legal norm of sanctions for environmental damage and violations by citizens.
18.Promoting green public procurement and green jobs.	Increasing employment in the eco-industry.
19.Development of sustainable forms of tourism (cultural, eco-, balneo / spa, etc.).	Rescue, protection and care of unique natural phenomena in the urban environment as tourist sites.
20. Production of second generation biofuels based on the processing of waste biomass.	Saving of agricultural land used for extraction of first generation biofuels - areas sown rapeseed, corn, sunflower. Utilization of waste biomass. Saving energy and non-renewable energy sources.
21.Reproduction of urban park areas, which includes the activities for the creation of new parks and gardens, conducting breeding, sanitary and regenerative felling.	Direct environmental impact by increasing the "lungs" of cities.
22.Energy certification of the city building and infrastructure fund - survey for energy efficiency of buildings and industrial systems in order to determine the level of energy consumption.	Saving energy and non-renewable energy sources.
23.Checking for energy efficiency of hot water boilers and air conditioning systems in buildings - energy efficiency management in buildings and industrial systems - energy management.	Increasing the environmental efficiency of the operation of energy facilities in the urban environment.
24.Extraction of secondary raw materials and energy from waste from the city park economy (fruit growing, floriculture and gardening).	Reduction of part of the urban waste and more efficient use of the resources of the city parks and gardens.
25.Management of specific waste streams - recycling, reuse of waste from wood processing and production of panels and furniture, sludge from wastewater treatment, obsolete electrical and electronic equipment, batteries and accumulators, biodegradable waste and much more	Activities with a direct environmental impact - conservation of resources, conservation of ecosystems and reduction of the human footprint on the global, and in particular, on the urban environment.

Source: own elaboration.

The predominant part of the sustainability practices presented in the tables are applied in the large Bulgarian Black Sea cities - Varna and Burgas. In general, the tendency towards sustainability in the development of the two large traditional centres in Eastern Bulgaria is more and more noticeable and more and more visible.

Four priority areas are identified in the National Plan for Reconstruction and Sustainability of Bulgaria. These are "Innovative", "Green", "Connected" and

"Fair" Bulgaria. This is the name of the four pillars of the National Recovery and Sustainability Plan, which allocates € 16.7 billion from the next multiannual financial framework for the period 2020-2027 and € 12.2 billion from the Next Generation European Union instrument. Under the second main pillar - "Green Bulgaria" will be invested the most significant part of the resources of the plan - 37% of all planned funds in the National Plan for Recovery and Sustainability. A priority part of these investments will be directed to the Black Sea region, as the main tourist, agricultural and demographic zone of the country [3].

Another important environmental priority of the Black Sea region is to achieve a symbiosis between industrial and agricultural production within the concept of a "circular economy". "The circular economy is a form and a paradigm of the green economy, involving the reuse or recycling of material resources used in products whose life has come to an end or which have lost their usefulness, to construct new objects, of the same quality or even better." [9].

Negative changes in the Black Sea region during the transition to a market economy

Unfortunately, the negative effects of the transition from a centrally managed economy to a market economy are much greater.

The accelerated development of industry in the 70s and 80s of the last century in the Black Sea cities of Bulgaria and especially in the region of Varna and Burgas (electrical production, heavy chemical industry, petrochemical engineering, shipbuilding, electrical industry, cement industry, locomotive production and wagons, etc.), has led to a sharp rise in water consumption and the formation, as a logical consequence, of huge volumes of polluted water. In this regard, the complex and rational use of groundwater and surface resources, as well as the fight against pollution of water bodies and marine waters, is becoming important.

In the Varna region, which is controlled by the Regional Inspectorate for Environmental Protection and Water (RIEW) - Varna, 464 sites have been built and are functioning, which are potential and active sources of air pollution. Atmospheric air treatment facilities operate in only 163 of the above-mentioned sites. 329 autonomously operating facilities purifying the differentiated gas streams have been installed in these sites. Of these 329 facilities, only 304 operate effectively. The remaining facilities are characterized by an unsatisfactory cleaning effect. Reconstruction and modernization, as well as complete replacement are needed for the air purification facilities in TPP Varna, a large part of the electrostatic precipitators of the enterprise "Deven" AD, the facilities of the production association "Agropolichim" AD in the town of Devnya, the furnaces for incineration of hospital waste of the university hospital. "St. Anna", the hospital "St. Marina" and the hospital in Dobrich, the treatment facilities of the plant for microproducts "Kaolin" AD in the village of Ignatievo and the asphalt bases of the enterprises: "Road Construction" AD Dobrich; Roads and Bridges AD Varna and Roads and Bridges AD Provadia.

Table 2 presents the main pollutants in the region of the northern Bulgarian Black Sea coast.

Table 2. Main industrial sources of air pollution in Devnya

Enterprise	**Pollutant**					
Solvay Sodi AD	NH3	Dust	CO	CO_2	NOx	
Deven AD	Dust: coal, fly ash	SO_2	NOx	CO	CO_2	
Agropoli chim AD	NO	NO_2	NH_3	F_2	CO_2	mineral fertilizer powder, phosphorrite
Polymers AD	NO	NO_2	NH_3	F_2	CO_2	
	Cl	HCl	Dichloro ethane	Ethylene	Etan	
"Devnya cement"	Cement powder	SO_2	NOx	CO	CO_2	
TPP "Varna" (from a nearby area)	Dust: coal, fly ash	SO_2	NOx	CO	CO_2	

Source: [13].

They were generated by the industrial enterprises in the agglomeration Varna-Devnya.

Serious polluters of air, water and soil in the Black Sea region are the chemical companies in the region of Povelyanovo, Devnya and the port of Varna-West. The cement plant in Devnya is also one of the major polluters in the region.

One specific danger of pollution of the largest water basin touched by the Republic of Bulgaria - the Black Sea - is oil. The research of the Specialized Laboratory of the Oceanological Institute of the Bulgarian Academy of Sciences found that only 30 grams of gas oil are completely sufficient to destroy 300 units of plankton per 1 cubic meter of water. Statistics show that 10% of the oil that is extracted from the water and 1% of the oil and petroleum products that are transported by sea fall into sea and river waters. In this way, these pollutants degrade water quality, pollute a huge area of the sea area and the coastline and at the same time cause irreparable damage to marine and river flora and fauna.

The negative consequences of pollution (dusting or contamination) of the environment can be inherently reversible and irreversible. Therefore, an important socio-economic criterion in planning and managing the cleanliness of the environment should be the decisive fight to prevent exceedances of maximum permissible concentrations (MPCs) of pollution. A modern solution for strengthening the control in this direction is the creation of an automated system for control and management of the state of the environment [1].

Activities ensuring the sustainable development of the coastal region

The deindustrialization of the northern Black Sea region frees large masses of people from the industrial sector. The service sector and the tourism business are unable to compensate for rising unemployment. People are looking for an opportunity to get their land back and work that land as small farmers and tenants. Lack of experience in agricultural production makes their efforts ineffective. For the first two years of the SAPARD program, for example for the agricultural sector, only 6% of the funds have been used and only 29 projects have been launched. With the accumulation of experience in design, the situation in the agricultural sector tends to improve, but the industry is still far from optimal in the absorption of EU funds.

High unemployment creates demographic and social problems, especially in small northern Black Sea towns such as Shabla, Kavarna and Balchik.

Since totalitarian times, the practice of large municipalities, which already have higher revenues from local taxes and fees, to receive a larger state subsidy than the small Black Sea municipalities has been preserved. The end result is an ongoing and growing asymmetry in development and in the ability of municipalities to solve important and priority problems.

As the famous architect Jan Geel notes, “there are differences between the needs and opportunities of rich and poor cities. It is important for developed countries to pay more attention to social sustainability as a key element of a well-functioning and attractive city.

In low-income societies (such as Bulgarian society - MT) the problems are much more urgent, as the gap between rich and poor is huge, and widespread poverty limits the opportunities of marginalized groups. Solving the problems in these societies requires a reallocation of resources, visionary urban policies and capable leadership."[10].

In a very difficult situation are the small Black Sea towns such as Byala, Obzor and others. Their remoteness from large urban centres and their underdeveloped urban and resort infrastructure limits their ability to compete successfully with established resorts such as Balchik, Nessebar, Pomorie and Sozopol. The lack of developed transport infrastructure is the main obstacle to the lack of promising investments in this region, regardless of its potential for combining sea and mountain tourism and for year-round use of the tourist base. Despite the obstacles and problems of infrastructural and administrative nature, giant hotel complexes have been built in these areas as well, trying to offer

competitive tourist services, despite the underdeveloped infrastructure and the lack of sufficient treatment facilities on the Black Sea coast. As Ivaylo Dichev notes, "the Bulgarian city is again in a 'transition' - from a static place of privileges and national pedagogy to fluidity, cultural collage, multiple scenographies of desire." [5]. Palaces, towers, barn castles, amusement centres, water parks and other highlights of this "scenography of desire" have sprung up along our Black Sea coast.

A rural area does not end within its administrative boundaries in reality. It actively interacts with neighbouring, rural or urban sites and adjacent areas. Its development must be in harmony with its surroundings. It is logical to establish mutually beneficial relations between the rural and urban population, without the rural environment being stereotypically perceived as a service provider for urban areas [15].

"A housing system, to be considered as a whole, will not be viable without ensuring the viability of all its elements, from large cities to small villages." [6].

In general, the current development strategies implemented by the Bulgarian Black Sea cities can be assessed as survival strategies. It relies mainly on the inherited and modernized tourist base. Unfortunately, it is oriented towards a predominantly communal tourism and manages to attract mainly insolvent tourists from the upper age groups, who do not go beyond the tourist package agreed with the tour operators. The small number of companies (52 companies working with the resources of the region) from the Bulgarian maritime economy, which are trying to extract marine biological and mineral resources. They have modest capital opportunities and do not receive serious support from local authorities. There is also a lack of synergies between entrepreneurs in the maritime economy system.

CONCLUSIONS

In the conditions of the fast and dynamic development of the urban environment in the second half of the XX century and at the beginning of the XXI century, sustainability in Black Sea region is practically absent as a priority. The negative consequences on the urban environment are caused by a complex of different in nature and dynamics processes. The most significant of them are: urbanization (mass relocation of the population from rural areas and small towns to large urban centres and industrial agglomerations); industrialization; the development of urban and interurban infrastructure; extraction of various resources in suburban areas (drinking water, inert building materials, logging, food production); problems with municipal waste management; the need for wastewater treatment; pollution and dust in the city air from car traffic. The Bulgarian Black Sea region has great potential, especially when the sustainable development of cities and towns is combined with the necessary environmental activities to protect the air, water and soil. More than half a century of research into public space and urban life since Jane Jacobs's 1961 book, Death and Life in America's Big Cities, "made people who use cities visible to politicians and designers." It is now possible to plan an active increase in urban activities or at least to ensure that public space is usable and pleasant for urban dwellers. Once neglected, urban life is already an established and recognized field, which has a great impact on the attractiveness of cities."[11]. This statement by Jan Geel and Brigitte Sware has its full force for the Bulgarian Black Sea towns and villages.

In the future, it is expected that the National Development Program Bulgaria 2030, as well as the Plan for Reconstruction and Sustainability of the Republic of Bulgaria from February 2021 [12], will give a new impetus to the environmental aspects of development of the Black Sea region of Bulgaria.

The planned funds under the Green Bulgaria – one of the pillars of the Recovery and Sustainability Plan are more than a one third, which is a guarantee for the importance and significance of this priority for achieving sustainable development of all regions and the country as a whole.

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NON-CONVENTIONAL AGRICULTURAL LAND USE: A WAY TO ACCELERATE ECOLOGIZATION AND CAPITALIZATION

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Abstract

The article is devoted to the prospect of introducing innovative measures in agriculture, which will contribute to the growth of agricultural production in Ukraine. In particular, the authors researched the development of non-conventional land use as a path to greening and capitalizing land use of peasant farms and individual farms, as well as small and medium-sized enterprises in the context of growing organic and niche products. In the course of the analysis, the article examines the state of the use of the land fund in Ukraine, namely, by grouping of the average size land plots of agricultural shares owners. Which made it possible to divide the regions into six groups and show that with an increase in the area of agricultural land in the regions, the intensity of its use also increases, this contributes to degradation processes and, in general, less efficient use of land. As an example, the share of sunflower in the total crop structure is presented, and it exceeds the standards by almost 2 times. The authors of the article noted the fact that the forms and sizes of land use of agricultural enterprises are of great importance for the efficiency of land use. In particular, the structure of operating agricultural enterprises in Ukraine by the size of agricultural land is presented, which made it possible to note a significant percentage of small farms (56.7%). This allows us to conclude that the current trends require a reorientation of the development of land use by individual farms, peasant farms, as well as small and medium-sized enterprises to non-conventional, which foresees the use of innovative measures for the production of organic and niche crops, this will allow them to exist in the agricultural market. From an environmental and economic point of view, the cultivation of organic and niche products will contribute to an increase in labor productivity in rural areas, an increase in the production at individual farms, peasant farms, as well as at small and medium-sized enterprises, and in general, will accelerate the greening and capitalization of land use. As the land use is both a place of work and a territory of residence for land share owners and farmers. The authors present agricultural crops that are in demand both for export and for consumption inside the country.

Key words**:** *non-conventional land use, organic products, niche products, capitalization of land use, individual and peasant farms, small and medium enterprises*

INTRODUCTION

Today, with the dynamic development of agriculture, the competition between enterprises in the agricultural market is growing. Despite this, in the international economic space, in particular in the context of the instability of the global economic environment and geopolitical exacerbations, weak economic growth is observed in many countries. A similar situation is developing in Ukraine, in particular in rural areas and the agricultural sector of the economy, where jobs are created extremely slowly and working-age rural population is losing sources of income.

Business diversification and increased productivity of individual and peasant farms, as well as small and medium-sized enterprises

can provide a positive socio-economic effect, as a result of attracting additional labor force (in particular women and youth in rural areas), increasing income levels, in turn, this leads to an improvement of demand structure and to an increase in the production of high added value products. According to economists, an increase in labor productivity at individual and peasant farms, as well as at small and medium-sized enterprises, for example, by 1% leads to an increase in the productivity of large companies by 0.2%, and nationwide - by 0.7% [3].

Such issues preceded the study of the implementation of innovative measures in agriculture, which will contribute to the growth of labor productivity in rural areas, saving material, labor and financial resources, increasing production of individual and peasant farms and, in general, the economic growth of the country.

The solution to these problems can be the intensive introduction of innovations in the specialization for individual and peasant farms, as well as for small and medium-sized enterprises; in the production and export of organic and niche products, which makes it possible to avoid unequal competition with agricultural holdings and expand sales markets in the context of a narrowing domestic segment of agricultural products.

Under conditions of unequal competition with agricultural holdings, the main goal for individual farmers and peasant farms, as well as small and medium enterprises should be to make a profit not so much from quantity as from quality and exclusivity of goods; this will form their competitive advantages on international markets [4].

It is the production and sale of organic and niche goods that can become such an area of activity, in which there has been a growing interest in the global agri-food market in recent years. Thus, a study of the competitiveness of individual and peasant farms, as well as small and medium-sized enterprises in 12 countries in various industries (countries of the G-7 and BRIC), conducted by the international agency DHL showed that enterprises engaged in foreign economic activity show better economic results. In particular, among the most efficient, 26% - economic entities implemented foreign economic activity and only 13% - were focused on the domestic market [1].

In addition, it should be noted that individual and peasant farms, as well as small and medium-sized enterprises, have environmental functions, as agricultural land use is their place of work and residence of the owner and employees.

MATERIALS AND METHODS

In the study process, the materials used were scientific publications on the prospects for the use of organic and marginal niche crops.

In order to reveal the importance of the use of non-traditional agricultural production in Ukraine by individual and peasant farms, as well as small and medium-sized enterprises in Ukraine, an analysis of the state of the land fund in Ukraine was carried out. The statistical base was the official materials of the State Statistics Service of Ukraine, reports of the State Service of Ukraine on Geodesy, Cartography and Cadastre and information documents of FAOSTAT and the Federation of Organic Movement in Ukraine.

During the study, the regions of Ukraine were grouped taking into account that Ukraine has a large territory with different physical, geographical and climatic zones.

When determining the required number of groups, the Sturgess formula was used, where the average size of the land share (pai) was chosen as a grouping feature:

$$n = 1 + 3.322 \lg N \quad (1)$$

the “N” is a total number of observations of the quantity.

This grouping made it possible to draw conclusions about the prevailing negative trends which show the need of optimization of the land fund of Ukraine and about the ineffective use of agricultural land.

RESULTS AND DISCUSSIONS

From the ecological and economic point of view, the condition of agricultural lands in Ukraine is in a critical state. Thus, according

to our research in 6 regions of Ukraine, land use is ecologically unstable, which negatively affects the quality of agricultural products.

Table 1. Grouping of regions of Ukraine by the average size of land plots of owners of land shares (paiv) as of 2017.

Grouping by the average size of the land share (pai), ha	The average size of the land share (pai) in the region, ha	Region	Plowing ratio,%	The average size of an agricultural enterprise, ha	The average size of the individual farm, ha	Profit of agricultural enterprises, per 1 hectare	Average level of profitability (loss) of enterprises in the agricultural sector,%	Physico-geographical zoning	Share in the of sunflower in the structure crops,%	
									regulatory standard *	as it is actually
1.1-2.38	1.10	Ivano-Frankivsk	64.5	882.2	1,220.7	-242.6	-1.5	Partly the Ukrainian Carpathians	-	6.5
								Partly the Forest-steppe zone	5-9	
	1.40	Transcarpathian	44.4	438.6	486.8	384.2	22.2	Ukrainian Carpathians	-	1.4
	1.40	Chernivtsi	70.4	604.5	800.2	200.9	4	Partly the Ukrainian Carpathians	-	6.3
								Partly the Forest-steppe zone	5-9	
	1.90	Lviv	62.2	1,063.1	1,550.8	640.4	10	Partly the Ukrainian Carpathians	-	5.0
								Partly Polissya zone	0.5	
								Partly the Forest-steppe zone	5-9	
	2.10	Ternopil	82.2	1,029.3	1,644.3	865.1	8	Forest-steppe zone	5-9	8.6
2.38-3.67	2.50	Vinnytsia	86	776.8	1,046.3	3,906.7	23.9	Forest-steppe zone	5-9	15.9
	2.50	Volyn	64.2	1,235.3	1,745.8	938.2	19.2	Partly Polissya zone	0.5	4.2
								Partly the Forest-steppe zone	5-9	
	2.60	Khmelnytsky	85	998.9	1,390.2	2,285.6	21.5	Partly Polissya zone	0.5	13.4
								Partly the Forest-steppe zone	5-9	
	2.70	Rivne	71.4	1,669.1	2,479.1	1,303.5	23.4	Partly Polissya zone	0.5	4.3
								Partly the Forest-steppe zone	5-9	
	2.70	Cherkasy	87.8	762.1	1,111	4,161.4	32.4	Forest-steppe zone	5-9	17.0
	3.20	Kyiv	82.3	774.9	836.7	4,324.3	28.2	Partly Polissya zone	0.5	16.2
								Partly the Forest-steppe zone	5-9	
3.67-4.95	3.60	Zhytomyr	76.1	1,393	2,483.6	1,570.5	25.4	Partly Polissya zone	0.5	14.5
								Partly the Forest-steppe zone	5-9	
	4.00	Sumy	72.8	1,599.9	2,615.6	2,431.6	30.4	Partly Polissya zone	0.5	18.8
								Partly the Forest-steppe zone	5-9	
	4.10	Poltava	83.9	882.3	1,164.8	5,144	33.3	Forest-steppe zone	5-9	19.1
	4.10	Chernihiv	70.7	1,877.9	3,297.6	2,080.5	21.3	Forest-steppe zone	5-9	16.4
	4.70	Odessa	80.2	538.5	647.7	1,970.4	35.6	Partly Steppe zone	10	22.0
								Partly the Forest-steppe zone	5-9	
4.95-6.23	5.70	Dnepropetrovsk	84.7	636	778.8	1,965.3	25	Steppe zone	10	30.3
	5.70	Kirovograd	87.1	634.9	782.9	3,228.3	42.2	Partly Steppe zone	10	34.7
								Partly the Forest-steppe zone	5-9	
	6.10	Donetsk	80.9	1,495.3	2,158.5	976.2	25.8	Steppe zone	10	31.1
	6.60	Kharkiv	81.3	1,250.7	1,915.3	2,208.1	27.3	Partly Steppe zone	10	29.7
								Partly the Forest-steppe zone	5-9	
6.23-7.52	6.80	Kherson	90.7	769.3	951.4	2,154.6	35.6	South-Steppe zone	12-15	23.8
	6.90	Mykolayiv	85.4	505.2	591.9	1,798.1	30.5	South-Steppe zone	12-15	35.9
	7.20	Zaporizhia	84.9	829.1	1,093.1	2,024.2	39.6	Steppe zone	10	34.0
7.52-8.80	8.80	Luhansk	66.9	1,826.7	2,380.9	1,139.6	34.8	Steppe zone	10	44.4

* Regulatory Standards for the optimal ratio of crops in crop rotations in different natural and agricultural regions in accordance with the resolution of the Cabinet of Ministers of Ukraine of February 11, 2010 № 164 [12].
Source: calculated by the authors according to the State Geocadastre and State Statistics of Ukraine [9].

This is due to the fact that today the crop rotation, the introduction of chemical fertilizers, the monocultural nature of production and other harmful factors are uncontrolled. In this regard, the attention should be paid to the positive dynamics of greening of agricultural land use through the use of non-traditional land use [13].

According to the State Geocadastre of Ukraine, in 2017 the share of plowed land was

almost 80%, which negatively affects the quality of the products due to the destruction of natural resources of agriculture by the predominance of intensive farming.

Excessive plowing leads to an increase in the area of eroded agricultural land, which in our country is already about 15 million hectares. With irrational use, arable land is subject to degradation processes; their surface is exposed to water and wind erosion, acidity increases, etc.

The regions were grouped for analysis of the land fund of Ukraine and the intensity of its use. To determine the required number of groups the Sturgess formula (formula 1) was used:

$$n = 1 + 3.322\lg 24 = 5.6$$

So, we assume that the number of groups is $n \approx 6$.

The results allow us to form six groups at regular intervals, where an additional indicator for the analysis is the coefficient of plowing.

The results of grouping the regions of Ukraine, shows that with the increase in the area of agriculturally used areas by region also increases the intensity of their use (Table 1).

As the data in Table 1 show, the smallest land plots (from 1.1 hectares to 2.38 hectares) are observed mainly in the zone of the Ukrainian Carpathians and adjacent zones (Forest-steppe, Polissya), where a complex relief is inherent. The largest size (from 4.95 ha to 8.80 ha) in accordance with the grouping mainly in the Steppe and South-steppe zones and partly in the Forest-steppe.

The average size of agricultural enterprises, which are mainly established on the basis of land lease, and individual farms are not tied to the physical and geographical zoning. However, the profitability per unit of agricultural land area mostly correlates with the value of the average size of land plots of owners of land shares. Note the fact that the ecological situation is threatening, which is associated with the proportion of sunflower in the structure of crops, which exceeds the standards by almost 2 times.

This situation is explained by the high profitability of this crop (the level of profitability in 2016 was 63%, Table 2), respectively, affects the greening and capitalization of land use.

Table 2. The level of profitability (loss) of the main types of agricultural products in 2016

Crops	level of profitability (loss), %
Cereals and legumes - total	37.8
including	
wheat	31.7
rye	24.6
oats	34.4
barley	25.4
buckwheat	87.5
peas	76.8
millet	30.2
sorghum	21.4
rice	33.1
corn for grain	45.7
other cereals and legumes	41.1
Sunflower seeds	63.0
Soybeans	52.0
Rapeseed	45.0
Flax seeds	10.1
Sugar beets (factory)	24.3
Potatos	-3.2
Vegetables	13.6
Cucurbits	17.1
Fruits	12.0
Berries	104.0
Grapes	74.6
Hop	100.4
Cattle for meat	-24.8
Pigs for meat	-4.5
Sheep and goats for meat	-35.2
Poultry for meat	5.0
Milk	18.2
Chicken eggs	0.5
Wool	-31.8
Honey	4.8
Fish farming products	-4.4

Source: according to the State Statistics Service of Ukraine [9].

These tables also show significant prospects for organic and niche crops.

The forms and sizes of land use of agricultural enterprises are of great importance in the study of land use efficiency. As the dynamics of redistribution of agricultural land area

among existing agricultural enterprises, in particular for individual and peasant farms, small and medium enterprises and large integrated companies, namely agricultural holdings, has a significant impact on the structure of the land fund in Ukraine.

In general, the analysis of the structure of agricultural enterprises in Ukraine shows that most farms have a small area of land use (Table 3). Its analysis shows that in Ukraine, there were 25,835 agricultural enterprises and farms with an area of agricultural land up to 100 hectares, which is 56.7% of their total number; they used 870.6 thousand hectares of agricultural land. Meanwhile, the 304 agricultural enterprises, which accounted for 0.7% of the total number, land use is more than 7,000 thousand hectares of agricultural land. Such enterprises accounted for 24% of the total area of agricultural land.

Table 3. Structure of operating agricultural enterprises of Ukraine by size of agricultural land as of November 1, 2017

The size of agricultural enterprises	Number	Percentage of total	Agricultural land area, thousand ha	Percentage of total agricultural land
Enterprises with agricultural land	40,735	89.4	19,960.2	100.0
in particular, with area (ha) up to 5.0	3,138	6.9	10.1	0.1
5.1–10.0	2,594	5.7	20.3	0.1
10.1–20.0	3,937	8.6	61.0	0.3
20.1–50.0	11,263	24.7	424.9	2.1
50.1–100.0	4,903	10.8	354.3	1.8
100.1–500.0	7,372	16.2	1,797.1	9.0
500.1–1,000.0	2,651	5.8	1,891.4	9.5
1,000.1–2,000.0	2,481	5.4	3,570.9	17.8
2,000.1–3,000.0	1,084	2.4	2,649.2	13.3
3,000.1–4,000.0	471	1.0	1,635.4	8.2
4,000.1–5,000.0	276	0.6	1,236.1	6.2
5,000.1–7,000.0	261	0.6	1,526.3	7.6
7,000.1–10,000.0	138	0.3	1,140.1	5.7
over 10,000.0	166	0.4	3,643.1	18.3
Enterprises that did not have agricultural land	4,823	10.6	–	–

Source: calculated by the authors on the main State Statistics of Ukraine [9].

The Land Code of Ukraine [11] allows the plot size of up to 100 hectares, specifically for private property and this should have the greatest impact on the development of rural areas. Because it is in these farms that organic and niche crops are and can be grown, which are highly profitable and the capitalization of land use is higher. Thus, the above determines the importance of reorientation in the structure of agricultural production to individual and peasant farms, as well as small and medium-sized agricultural enterprises, which, accordingly, directly and indirectly affects the greening and capitalization of land use. Thus, these trends will reduce degradation processes due to uncontrolled application of fertilizers and non-compliance with crop rotations by monoculture production. This is due to the fact that peasant farms, as well as small and medium-sized agricultural enterprises have ecological functions, as agricultural land use is their place of income and territory of residence.

Note that in modern economic conditions, non-conventional land use in European agriculture is considered as one of the most environmentally and economically efficient land use. One of the main indicators for assessing the economic feasibility of non-conventional land use is the market capacity of niche crops and organic agricultural products.

Figure 1 shows the increasing dynamics of growth in the market capacity for organic products throughout Europe and in particular among the countries of the European Union.

For the Ukrainian economy, non-conventional land use, in particular for the production of organic products, is important, since this is one of the real ways to provide the population

with environmentally friendly agricultural products.

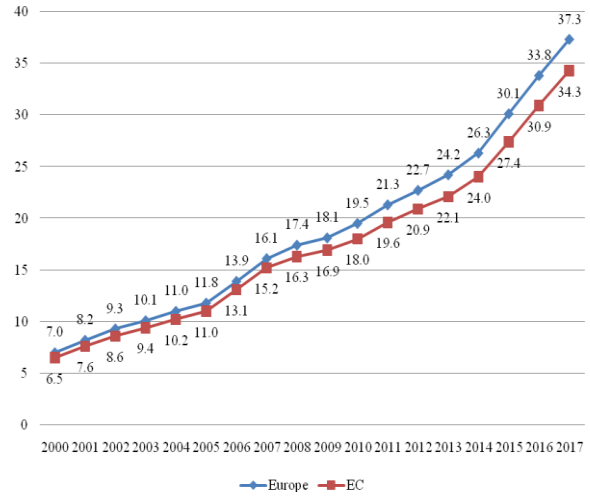

Fig. 1. Trends in the organic products market over a period from 2000 till 2017, billions of euros
Source: created using the data [15].

In addition, at the present stage, non-conventional land use, from the point of view of increasing the level of efficiency of agricultural production, as already noted, is more promising while reducing anthropogenic pressure on the environment [14].
Until now, a specific feature of the production of organic products in Ukraine is that production was mainly concentrated in large farms. In particular, from 2003 till 2007 the average size of land use for the production of organic products was over 3 thousand hectares (Fig. 2).

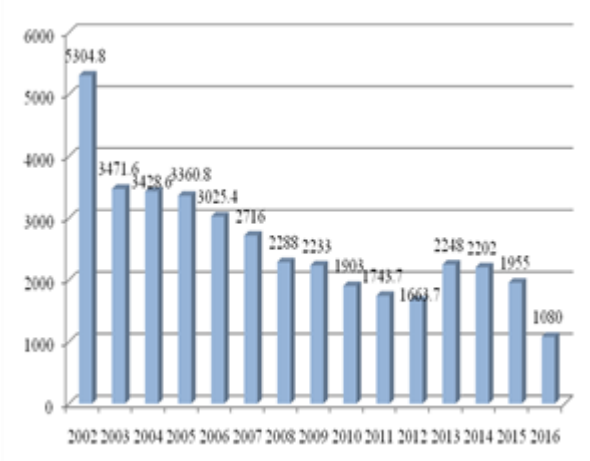

Fig. 2. Dynamics of the average size of land use for the production of organic products in Ukraine, ha
Source: built using data from the Federation of Organic Movement.

In 2016, the average size was 1,080 hectares, which indicates a downward trend in land use for the production of organic products. Note the fact that according to European practice, the organic farming is characterized by a small size of land use.
According to FIBL and IFOAM [2], the total volume of organic food and beverages in 2014 reached almost 80 billion US dollars. The market has grown by 170% compared to 2004. The main sales volume is currently concentrated in developed countries in North America and Europe, which account for 90% of world sales.
As of the end of 2017, there were 375 certified farms in Ukraine that produced organic products (Fig. 3). Every year this indicator grows taking into account the environmental benefits of this method of land use, as well as economic and market prospects for European integration.

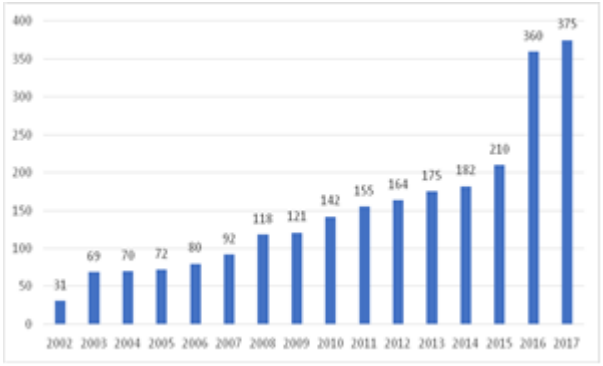

Fig. 3. Trends in the number of certified land users who produced organic products in Ukraine over a period from 2002 till 2017.
Source: built using data from the Federation of Organic Movement.

Considering the trends in climate change, as well as the economic situation contributes to the emergence of crops that are not traditional for us, as noted in the scientific community [5; 6; 7; 10]. For example, peanuts, which until recently were never grown in Ukraine, are now cultivated because they grow well and are in demand on the market.
Thus, first of all, farmers' interest in producing such products should be dictated by the growing demand for it domestically, as most vegetables and fruits fall into the category of so-called "healthy products", the

consumption of which is actively promoted by healthy lifestyle activists. In addition, such products are quite promising for growing with regard to exports. Because the demand for healthy vegetables, fruits and berries, which are rich in vitamins, amino acids, trace elements, antioxidants, etc., in the markets of different countries is increasing. The trend of a healthy lifestyle is rapidly gaining momentum in other countries.

As an example, a pear or a red currant is now quite well known to Ukrainians. This crops have been grown in Ukraine for some time, and the country still has a certain culture of consumption. However, until recently, commercial farms were almost not interested in their production, mainly these crops were grown by the population or small farmers, for a long time they remained niche crops. Only in the last few years have they been able to unleash their potential due to certain trends.

Sweet potatoes are also noteworthy, if a few years ago the vast majority of Ukrainians considered sweet potatoes as a specialty that was available only as a premium product, now this crop is quite confidently conquering the Ukrainian market. The popularity of sweet potatoes in Ukraine is growing due to its beneficial properties. It contains a large number of vitamins and nutrients. It is these qualities that make sweet potatoes more and more popular among fans of healthy eating, who prefer this product as opposed to ordinary potatoes. In addition, for the successful production of such product do not require large areas. Sweet potatoes are quite suitable for growing in almost all regions of Ukraine, but in different areas the yield will vary: from 100 t/ha when grown in the southern region, to 35 t/ha if the plantations are located in the east. For comparison, in Belgium in 2016 the yield of sweet potatoes was recorded at 20-50 t/ha, depending on the variety and growing conditions.

Already in the first year of cultivation, the profitability of sweet potato production can be 180%. At the same time, retail prices for sweet potatoes on the Ukrainian market often reach 160 UAH / kg, and a significant amount of supply is imported products, which could potentially be replaced by locally produced sweet potatoes [8].

Thus, Ukraine has quite good prospects to establish itself in the foreign market of sweet potatoes, in particular in the EU market. According to the ITC, currently almost half of all sweet potato import to the European Union (in monetary terms) comes from the United States.

In addition, the climatic conditions of Ukraine allow it to grow asparagus almost throughout the country. Therefore, according to industry experts, the area under asparagus in Ukraine has tripled in the last 5 years. Moreover, already in 2016, this crop was included in the list of those for which farmers must report. Therefore, according to Ukrstat, last year asparagus plantations in Ukraine occupied 0.2 thousand hectares, and the harvest amounted to 1.09 thousand tons [8].

First of all, the low cost of this product and rather high prices for asparagus in retail chains encourage Ukrainian farmers to try their hand at growing asparagus.

In addition, asparagus has one of the highest export potentials in the industry. Moreover, the country has quite good prospects to conquer the EU market. According to ITC, the European Union annually buys almost 100,000 tons of asparagus on the foreign market.

Pumpkin deserves the next attention, although it is difficult to call it a novelty for the Ukrainian market, however, it remains a niche.

In addition, more and more commercial producers are beginning to share this view, considering pumpkin a very promising product in terms of exports due to its useful properties.

It should be noted that today Ukraine already has experience of quite successful supply of these products to European markets, in particular to the UK. For example, the company "Green Team" (Kherson region) has been exporting pumpkins in this direction for three years, so in this case we can say without exaggeration about systemic exports, rather than trial deliveries.

But it should be noted that the greatest demand in the EU market today are pumpkins

of the premium segment of the so-called "portion" varieties, in which the weight of the fruit does not exceed 1 kg, such as Butternut squash [8].

Red and black currants can also be attributed to the crops, which are well known to Ukrainian consumers, but still remain niche. However, it should be noted that recently the cultivation of currants in Ukraine is gaining momentum, and these two segments are developing in quite different scenarios.

Thus, if the interest of farmers in growing black currants is caused primarily by the high demand of processing companies, the growth of red currant production provokes an increase in consumption in the fresh market.

In addition, according to industry experts, in the near future the red currant will be able to win a place in the TOP-5 of the main berry crops grown in Ukraine, along with strawberries, raspberries and blueberries. At the same time, black currants have already taken a place in the top five in terms of gross harvest.

Due to the high yield and fairly uniform ripening, it is not difficult to collect a commercial batch of products in rather short time. Moreover, with the right approach to post-harvest processing, the shelf life of red currant can reach 6 months. It should also be noted the increase in demand for Ukrainian currants in the foreign markets. Already in the summer of 2017, according to official data, Ukraine tripled the export of currants compared to last year; however, the main buyer remained Belarus. It should be noted here that only black currants were shipped for export [8].

Also today, you can safely attribute the sour cherry to niche crops due to a number of factors. First, in the past few years the share of professional producers has significantly decreased, since, as a rule, commercial farms are primarily aiming at selling the harvest on the fresh market, where the demand for sour cherries is falling every year.

Due to lack of supply of raw materials of appropriate quality, Ukraine is forced import to annually at least 2 thousand tons of frozen sour cherries [8]. The shortage of raw materials is confirmed by the prices for cherries in the procurement season, which in recent years have almost equaled the prices on the fresh market (Fig. 4).

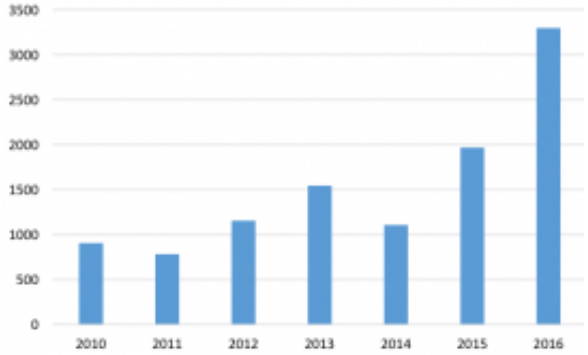

Fig. 4. Imports of frozen sour cherries to Ukraine over a period from 2010 to 2016.
Source: [8].

That is why individual and peasant farms, as well as small and medium-sized agricultural enterprises in Ukraine see an alternative in the so-called niche crops. At the same time, in this case we are talking about both cereals and vegetables, fruits and berries. In addition, it will allow more efficient use of land resources of Ukraine.

CONCLUSIONS

The increase in greening and capitalization of land use leads to the search for ways to reduce the deterioration of land and other natural resources in rural areas, as well as the need to increase the profitability of agricultural land use, and reorientation of land use to less environmentally destructive and more efficient. Full use of the potential of agricultural lands in the traditional way is low effective in terms of greening and capitalization of land use at the level of developed European countries and in Ukraine this problem is relevant. To solve it effectively, the transition to ecologically safe non-conventional land use of individual and peasant farms as well as small and medium-sized agricultural enterprises extends.

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IMBALANCES BETWEEN REVENUES AND EXPENDITURES OF LOCAL RURAL BUDGETS IN THE PROCESS OF FISCAL DECENTRALIZATION IN UKRAINE: ASSESSMENT AND MODELLING

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Abstract

The result of the study was the proposal to use an integral indicator of financial decentralization, as well as partial integral indicators: the indicator of incomes decentralization and the indicator of expenditures decentralization. The use of such a technique allows obtaining objective results of the study. On the basis of the proposed indicators, an assessment of the level of financial decentralization in Ukraine during the period 2013 – 2018 has been conducted. The study showed an increase in the level of fiscal decentralization of local rural budgets during the period 2013 – 2018. The main impetus for this was the changes in the budget and tax legislation that came into force in 2015 and stimulated local rural authorities to expand their own revenue base. In order to increase the efficiency of decentralization processes in Ukraine, it is proposed to timely identify the risks and complications that may arise. The article demonstrates the role of financial decentralization in the development of rural regions as such, which promotes the establishment of effective local self-government with a real impact on local financial management processes. The main contribution was to improve the methodology for assessing the financial decentralization level in Ukraine.

***Key words*:** *local rural budgets, management of decentralization, rural development, integral indicator, evaluation methodology*

INTRODUCTION

World experience shows that the greater the share of own and fixed revenues of the local rural budget, the greater the responsibility of local authorities for tax discipline, the effective use of collected income. In addition, there is a significant increase in the interest of local authorities in developing entrepreneurship as the main base for filling local rural budgets. For this reason, budget decentralization becomes of particular importance in the context of reforming economic relations in the country.

When analyzing financial decentralization, it`s necessary to determine the quantitative parameters for its evaluation. Only with the help of concrete numerical data one can make grounded conclusions about the independence of local self-government, the implementation of the decentralization reform in the country or, conversely, strengthening the role of central authorities in allocating financial resources.

Financial decentralization is a complex aspect of the decentralization of public administration. It is a peculiar measure: the level of democracy and the competence of public administration; the adequacy of the political system to public expectations; the level of trust in the local self-government and the level of perception of the needs of the

society as a whole by the state authorities and local self-government bodies in particular; quality control in the public sphere and responsibility; in the end, it`s an assessment of the adequacy of the administrative-territorial structure of the state [3; 5].

In the financial science of Ukraine in recent years, the problems of financial decentralization evaluating in the country are paying more attention. The most well-known economists who cover the issues of decentralization in Ukraine are O. Agres [1], O. Apostolyuk [2], N. Bykydarova [4], M. Dziamulych [6-9], V. Kravchenko [11], A. Luchka [15], I. Lunina [16], S. Osypenko [17], A. Popescu [19-28], V. Shcherbakova [30], T. Shmatkovska [31-33, 36], R. Sodoma [35], I. Tofan [37], I. Vakhovych [40], V. Yakubiv [41, 42], Ya. Yanyshyn [43], I. Zhurakovska [44] and others.

Among Ukrainian scholars, the first developed and substantiated the indicators that should be used to determine the level of financial decentralization V. I. Kravchenko. The scholar considered the notion of financial autonomy as self-government in the sphere of local finance, and the level of financial autonomy of local self-government suggested that the following quantitative indicators be determined by the system: the indicator of the share of expenditures for the exercise of its own powers, the indicator of the share of obligatory expenditures, the indicator of the share of financing expenditures the delegated authority, the indicator of the share of own revenues in the revenues of local rural budgets, the indicator of the share of own and fixed income in the local rural budgets, the share index of local rural budget revenues from local taxes and fees, specific gravity unbound subsidies to local government revenues [11].

V. I. Kravchenko's indicators remain the basis for the study of the financial decentralization level in Ukraine and now, despite the obsolete individual of them in connection with the reform of the intergovernmental fiscal relations system. In this case, the scientists allocated indicators, including under other names, in the future were used and continue to be used in various interpretations by domestic scientists to study local finance. In particular, I. O. Lunina in his research expanded the existing indicators of financial autonomy by V. I. Kravchenko and established the empirical dependence between the indicators of gross domestic product and fiscal independence on incomes (expenditures) [11; 16].

I. M. Vakhovych analyses the concept of region financial capacity, that is, the financial capacity of public authorities to independently ensure the socio-economic development of the region. I. M. Vakhovych considers financial capacity as a system of indices of three groups: financial sufficiency, financial capacity and financial stability, for each of which the corresponding integral index is calculated [40]. We believe that this methodology is one of the most thorough and may be partially used for the analysis of financial decentralization, taking into account that, first, not all indicators are related to financial decentralization, and secondly, some indicators are out of date due to with the reform of inter-budgetary relations.

A. Luchka [15], V. Shcherbakova [30], O. Kruk [12] also made a significant contribution to studying the of financial sustainability indicators of local rural budgets. Based on these studies, the formation and implementation of a strategy of social economic development in accordance with the type of financial sustainability of the relevant local rural budget is an important factor in the effective socio-economic development of the administrative-territorial unit. As far as the assessment of financial decentralization itself is concerned, Ukrainian scholars mainly research the dynamics and structure of local rural budgets, indicators on the share local rural budgets revenues (expenditures) in the consolidated budget. The most popular works on the subject of financial decentralization are the works of I. O. Lunina [16] his research focused on the study of local rural budget expenditures, their structure, the possibility of making decisions on the disposal of financial resources by appropriate local self-government bodies, to allocate the coefficient of decentralization of expenditures, the coefficient of decentralization of tax revenues, the coefficient of financial independence of local rural budgets.

T. Salo singles out the general indicator of financial decentralization, which is calculated as

the arithmetic mean of the financial decentralization of revenues (the share of local rural budget revenues excluding intergovernmental transfers in the consolidated budget revenues) and the indicator of financial decentralization of expenditures (the share of local rural budget expenditures excluding intergovernmental transfers in consolidated budget expenditures) [29]. In our opinion, such indicator as the share of local rural budgets expenditures, excluding intergovernmental transfers in the consolidated budget expenditures, is not sufficiently functional as intergovernmental transfers serve as a component of local rural budget revenues (except for those transferred to the state budget).
Similar to the T. Salo`s approaches to the calculation of the financial decentralization level used by N. O. Bykydarova, but at the same time distinguishes the coefficient of financial decentralization of parts of local rural budgets, which is calculated as the ratio of incomes of a certain level of local rural budgets (region, district, territorial community) with local rural budget revenues [4].
S. O. Osypenko notes that an assessment of the financial resources decentralization is appropriate with the help of indicators of local rural budgets financial sustainability. The algorithm developed by the scientist for the integrated assessment of the financial resources decentralization includes two stages: 1) analysis of the socio-economic development of the administrative-territorial unit and analysis of the implementation of local rural budgets by income and expenditure; 2) calculation of budget coefficients that characterize the financial sustainability of the local rural budget of a certain administrative-territorial unit; comparison of the obtained results with the established thresholds of financial sustainability coefficients and determination of the type of financial sustainability of the local rural budget [17]. We, in turn, believe that financial decentralization is a much broader concept than financial sustainability, since it covers the whole range of local finances and is, first and foremost, a dynamic feature. In turn, financial stability reflects the state of functioning of the subject of public authority at one time or another. The purpose of the study is to systematize existing methods of assessing the financial decentralization level in domestic and European practice, as well as to identify quantitative parameters of its assessment for implementation in Ukraine. Objectives: to improve methodological approaches to assessing the financial decentralization level; determine the dynamics of local rural budget revenues and expenditures in the context of financial decentralization; to evaluate the effectiveness of the financial decentralization process in Ukraine.

MATERIALS AND METHODS

The research methods used are as follows: the method of analysis and synthesis to substantiate the criteria of compliance with indicators of evaluation of the financial decentralization level; indicator method for identifying typical indicators for assessing the financial decentralization level; an integral method for developing an integral indicator of financial decentralization; theoretical generalization method for determining the role and place of decentralization in the development of the state and regions; a method of logical analysis for the development of proposals for the implementation of assessing methods for the financial decentralization level into practice; tabular and graphical method for visual presentation of research results.
In order to assess the level of fiscal decentralization for incomes, information materials and statistics from the Institute for Budget and Socio-Economic Research, the Ministry of Finance of Ukraine, the State Treasury Service of Ukraine, the Pension Fund of Ukraine for the period 2013-2018 were used.

RESULTS AND DISCUSSIONS

An assessment of the financial decentralization level can be carried out both at the level of Ukraine as a whole and at the level of the single region. At the same time, the implementation of a quantitative assessment of financial decentralization in

Ukraine faces a number of problems, in particular [34; 39]:
- lack of common criteria for assessing the level of financial decentralization;
- settlement difficulties due to insufficient availability of statistical and / or information for the calculation of certain indicators;
- methodological difficulties due, for example, to different approaches in the calculation of transfers during the period of Ukraine's independence, lack of unification in the names of indicators.

In our opinion, the following three conditions must be taken into account for the selection of indicators for assessing the level of financial decentralization:

(1) financial decentralization is a process. That is, the level of financial decentralization can be measured only in dynamics with the help of indicators that characterize the state of local finance at one time or another. Separate data for a particular period do not provide information on the basis of which it is possible to make correct conclusions about financial decentralization in the country.

(2) financial decentralization should not be an end in itself. The central government is implementing financial decentralization in order to ensure the optimal provision of public goods and accelerate economic development. High indicators of financial decentralization without at least an overall assessment of the status of local finances and the level of regional development in general are not sufficient evidence of the effective implementation of the decentralization reform in the country.

(3) financial decentralization level cannot be estimated only on the basis of quantitative indicators. It is important to choose qualitative indicators (qualitative characteristics) that will enable to determine the powers and rights of local self-government in the field of the formation and use of financial resources. Transferring financial resources to places without giving them the opportunity to make decisions about their use indicates only the formal implementation of decentralization.

For effective research, the indicators used to assess financial decentralization must meet certain requirements. Given the permanent nature of regional development developments, we see that these or other indicators of financial decentralization can be used only if they meet the following criteria:
- certainty – indicators of financial decentralization should be clearly quantified or qualitative. Indicators that cannot be determined will not be used by us during the calculations;
- availability – the information used to calculate metrics should be publicly available. We exclude indicators that can be determined on the basis of data received by institutions or organizations to which any citizen of Ukraine cannot obtain access, at least on the basis of a request for access to public information. Priority is given to information from open sources, namely, the Institute for Budget and Socio-Economic Research, the Ministry of Finance, the State Statistics Committee, the websites of local authorities and local self-government bodies;
- relevance – indicators should characterize exclusively the studied socio-economic phenomena or their individual aspects.
- comparability – indicators of the current reporting period should be compared with the indicators of previous and future reporting periods;
- full coverage – the indicators should reflect the essential aspects of the socio-economic phenomenon under study (financial decentralization);
- systemic – the selected indicators should form a set of interrelated indicators that comprehensively describe the socio-economic phenomenon that is being analyzed;
- practicality – indicators should be used to make conclusions about the state of financial decentralization in the country and making appropriate decisions;
- cost efficiency - the time spent on collecting relevant information and calculating the indicators of financial decentralization should not exceed the benefits from the findings derived from these indicators. A schematic description of the choice of indicators of financial decentralization is shown in Fig.1.

A schematic description of the choice of indicators of financial decentralization is shown in Fig.1.

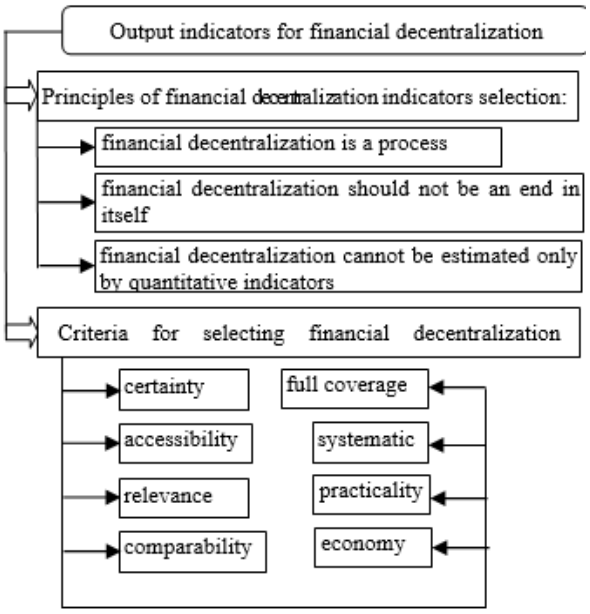

Fig. 1. Schematic description of the financial decentralization indicators selection
Source: Compiled by authors.

It should be noted that in the current legislation of Ukraine there are no indicators of financial decentralization, as well as requirements for their calculation or use. The peculiar approximation is the indicators of financial self-sufficiency, defined in the Methodology for monitoring and evaluating the effectiveness of the implementation of the state regional policy, namely the rate of growth (decrease) in local rural budget revenues (without transfers), local rural budget revenues (without transfers) per capita, rate increase (decrease) of the tax debt on monetary obligations of taxpayers without taking into account the tax debt of taxpayers who are in bankruptcy proceedings or as against their court made a decision (ruling) to suspend the proceedings. However, these indicators do not in any way characterize the phenomenon of financial decentralization, but rather a definite reflection of the state of local finances and the socio-economic situation in the region as a whole. In European financial science, the following indicators are used to assess the level of financial decentralization [18]:

(1)The ratio of expenditures of local self-government (local rural budgets) to public expenditures. This indicator shows the degree of decentralization and deconcentration of public tasks and functions, testifies to the financial capacity of local self-government for their implementation, and, consequently, the quality of implementation.

(2)Expenditures of local rural budgets to GDP. This indicator allows you to see which part of the public resources is distributed among the subjects of local self-government. In other words – reflects the level of financial decentralization in the state.

(3)Share of own revenues in the structure of revenues of territorial communities. It is important to remember that the right of local governments to set tax rates, as well as to determine the volume of revenues from other sources, are realized exclusively on their own income. That right - the right to own revenues and their regulation - ensures fiscal decentralization.

(4)The volume of intergovernmental transfers, in particular, equalization subsidies in the structure of revenues of local rural budgets. The size of this indicator directly indicates the financial autonomy of the MHI. The higher it is – the lower the level of financial autonomy of local self-government. Hence, decentralization is lower, since local government has no influence on the volume of these resources, and so on.

Note that in Ukraine since 2014, due to military actions in the Donbass, the occupation of the Autonomous Republic of Crimea and the sharp fall of the economy, the inflation rate exceeded 10%. Accordingly, we do not see fit to analyze the absolute indicators of financial decentralization, because such indicators contain a significant inflation component, which does not allow to objectively assess decentralization in the country. The main attention should be paid to relative indicators, which should be divided into indicators of decentralization of incomes and decentralization of expenditures based on the appropriate forms of financial decentralization.

Thus, given the mechanism for choosing indicators of financial decentralization (factors and criteria) and the above-mentioned approaches of Ukrainian scientists, we believe that the most reliable estimate of financial decentralization should be determined using an integrated estimation method based on the

indicators of financial decentralization by income and expenditure. For the completeness of the study of financial decentralization it is necessary to take into account the indicators that characterize the role of transfers in the formation of financial resources of local rural budgets. These include the share of intergovernmental transfers in the revenues of local rural budgets, the share of transfers transferred to the state budget, in local rural budget revenues, and the proportion of non-targeted intergovernmental transfers in local rural budget expenditures. The proposed system of indicators is summarized in the table (Table 1).

Table 1. Method of financial decentralization of local rural budgets calculation indicators

Indicator	Calculation method	Indicator interpretation	Dynamics the indicator of financial decentralization
Indicators of incomes decentralization			
Share of local rural budget revenues in GDP	Volume of local rural budget revenues / GDP	Characterizes the level of GDP, centralized in local rural budgets	↑
Share of local rural budget revenues in the consolidated budget	Volume of local rural budget revenues / Volume of consolidated budget revenues	Characterizes the formal role of local authorities in allocating financial resources	↑
Share of local taxes and revenues in local rural budgets	Volume of local rural budget revenues from local taxes and fees / Volume of local rural budget revenues	Characterizes a portion of these budgets revenues, which are formed at the expense of taxes and fees set by the MHI.	↑
Share of local rural budget revenues in the consolidated budget	Volume of local rural budget revenues without intergovernmental transfers / Volume of consolidated budget revenues	Characterizes the actual role of local authorities in allocating financial resources	↑
Share of intergovernmental transfers in local rural budget revenues	Volume of intergovernmental transfers from the state budget / Volume of local rural budget revenues	Shows the level of dependence of local rural budgets on the state-provided additional income base	↓
Share of own revenues of local rural budgets in the revenues of local rural budgets	Volume of local rural budget revenues without intergovernmental transfers / Volume of local rural budget revenues	Characterizes the level of autonomy of local rural budgets, taking into account the long-term transfer of additional income base by the state. An inverted indicator of the intergovernmental transfers share in local rural budget revenues	↑
Indicators of expenditures decentralization			
Share of local rural budget expenditures in GDP	Expenditures of local rural budgets / Nominal GDP	Characterizes the redistribution of GDP by local government entities	↑
Share of local rural budget expenditures in the consolidated budget	Expenditures of local rural budgets / Consolidated budget expenditures	Characterizes the formal role of local authorities in the disposal of their available financial resources	↑
Share of expenditures of local self-government bodies in public expenditures	Local rural budgets expenditures / Consolidated budget expenditures + Pension fund expenditures with the exception of revenues from the state budget	Demonstrates the degree of decentralization and deconcentration of public tasks and functions,	↑
Share of non-protected articles in local rural budget expenditures	Local rural budgets expenditures without less protected items of local rural budgets expenditures / Local rural budgets expenditures	Characterizes a part of the local rural budgets expenditures, which local authorities can dispose of at their discretion	↑
Share of transfers transferred to the state budget (reverse subsidy + subvention from the local rural budget to the state budget for implementation of programs of socio-economic and cultural development of regions) in the expenditure of local rural budgets	Volume of transfers transferred from local rural budgets to the state budget / Volume of local rural budgets expenditures	Displays the level of local rural budget revenues centralization	↓

Source: systematized and generalized on the basis of sources [3; 4; 11; 12; 16; 17; 29].

To sum up the results of the analysis, we propose to calculate the partial integral indicators of incomes decentralization (PIID) and expenditures (PIED) as the geometric mean of decentralization indicators:

$$PIID = \sqrt[n]{P_{i=1}^{n}} \times D_i \quad (1)$$

$$PIED = \sqrt[n]{P_{i=1}^{n}} \times V_i \quad (2)$$

where: Di, Vi – indicators of decentralization of incomes and expenditures respectively;
n – the number of revenues (expenditures) decentralization indicators taken into account.
The consolidated indicator in accordance with the methodology proposed in this paper is the Integral Fiscal Decentralization Index (IFDI), which is calculated as the average geometric partial index of incomes and expenditures decentralization.

$$IFDI = \sqrt{PIID \times PIED} \quad (3)$$

It should be noted that the use of weighting factors to calculate the indicators of financial decentralization in Ukraine is inappropriate in connection with the discretionary nature of such coefficients.
Analyzing the process of decentralization and its management in Ukraine, it can be noted that the active phase of the reform was launched on January 1, 2015, when several laws were passed that changes to the formation of the revenue and expenditure base of local rural budgets, and, therefore, the financial foundations of a certain reform were laid down.
In accordance with the Law on Tax Reform in the composition of local taxes (as part of the property tax) included a payment for land and transport tax; the tax base for real estate, other than land, is expanded; former payers of a fixed agricultural tax are assigned to the fourth group of the single tax [38].
The law on intergovernmental relations aimed at equalizing the financial capacity of territorial communities introduced basic and reverse grants, as well as introduced a new procedure for their calculation. The reallocation of personal income tax revenues (hereinafter – PIT) and environmental tax was changed. Also, local rural budgets secured 10 % of corporate income tax (except for corporate income tax of state enterprises) and revenues from the excise tax on the retail sale of excisable goods. In addition, all cities of with regional value were given the opportunity to carry out external borrowings.
In Ukraine today, the processes of financial decentralization, although irreversible, are not systematic and still do not encourage local authorities to seek sources of activation of their own economic resources. Evidence of this is the dynamics of the structure of revenue distribution between the state and local rural budgets (Fig. 2).

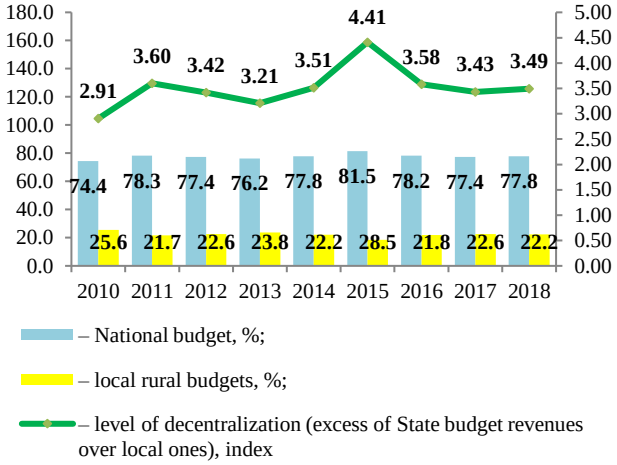

Fig. 2. Inter-budgetary income distribution in Ukraine in 2010-2018
Source: Calculated by the authors according to the State Treasury Service of Ukraine.

The above changes had a direct impact on the process of financial decentralization, which was reflected in terms of indicators of financial decentralization by income and type (Table. 2).
During the investigated period, the share of local rural budget revenues in the consolidated budget of the state had a multi-vector direction, thus falling in 2013 – 2015 from 49.9 % to 45.2 %. Subsequently, it began to grow again, reaching 49.4 % in 2017. The obtained results indicate that the level of redistribution of financial resources through local rural budgets, despite all changes in the area of decentralization,

remains stable. At present, local rural budgets form a little less than half of consolidated budget revenues, which means that a larger share of revenues will continue to be centralized in the state budget.

Table 2. Indicators of financial decentralization for incomes in Ukraine during 2013 – 2018

Indicator	2013	2014	2015	2016	2017	2018
Share of local rural budget revenues in GDP	15.1	14.6	14.8	15.3	16.8	15.8
Share of local rural budget revenues in the consolidated budget	49.9	50.8	45.2	46.8	49.4	47.5
Share of local taxes and revenues in local rural budgets	3.3	3.5	9.2	11.6	10.5	10.9
Share of local rural budget revenues in the consolidated budget	23.8	22.2	18.5	21.8	22.6	22.2
Share of own revenues of local rural budgets in the revenues of local rural budgets	47.6	43.6	40.9	46.6	45.7	46.8
Partial index of financial decentralization of incomes	19.5	19.1	21.5	24.3	24.6	24.3

Source: Calculated by the authors according to the State Treasury Service of Ukraine and data of the State Statistics Service of Ukraine

Local taxes and fees since 2015 have increased their significance, ensuring that by 2018, 10.9 % of local rural budget revenues. Such changes were the result of another tax reform and the transformation of the Ukrainian tax system structure. Local rural budget revenues account for less than half of total local rural budget revenues. This situation indicates a significant dependence of local rural budgets on state transfers and a rather insufficient level of their independence.

Assessing the financial decentralization of expenditures, it can be noted that the indicators that characterize it are somewhat higher in comparison with the indicators of incomes decentralization (Table 3). In particular, the share of local rural budget expenditures ranged from 14.1 to 16.6 % of GDP, while a similar income figure was higher only in 2017, reaching a level of 16.8 %. In Ukraine, the share of distribution of expenditures of local rural budgets in GDP is higher than in Poland, Hungary, Slovakia and the Baltic States [13; 16].

Table 3. Indicators of fiscal decentralization for expenditures in Ukraine during 2013 – 2018

Indicator	2013	2014	2015	2016	2017	2018
Share of local rural budget expenditures in GDP	15.0	14.2	14.1	14.7	16.6	16.0
Share of local rural budget expenditures in the consolidated budget	43.5	43.1	41.2	41.9	46.9	45.6
Share of expenditures of local self-government bodies in public expenditures	31.2	31.5	31.5	33.8	38.6	37.8
Share of transfers transferred to the state budget in the expenditure of local rural budgets	99.3	99.1	98.9	98.8	98.8	98.7
Share of unprotected items in local rural budget expenditures	17.6	24.3	25.3	27.1	28.3	29.8
Partial index of fiscal decentralization by expenditures	32.4	34.2	34.0	35.4	38.5	40.7

Source: Calculated by the authors according to the State Treasury Service of Ukraine and data of the State Statistics Service of Ukraine

Changing the proportions of redistribution of expenditure powers with their shift to the level of local rural budgets is one of the manifestations of decentralization processes in the state (Fig. 3). At the same time, analyzing the distribution of expenditures in the structure of the consolidated budget, we can note that, as in the case of revenues, the beginning of financial decentralization not only did not strengthen the role of local government but also reduced the share of expenditures through local rural budgets.

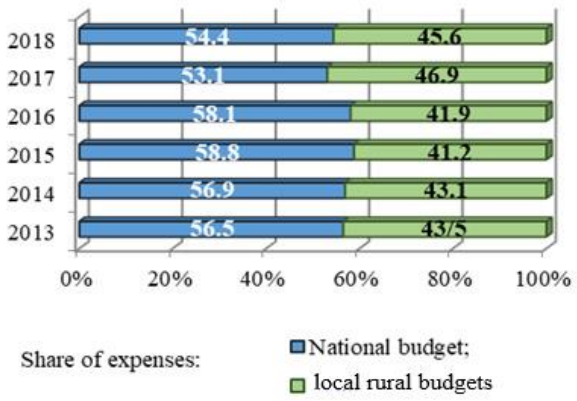

Fig. 3. Distribution of consolidated budget expenditures between budgets of different levels in Ukraine in 2013–2018, %

Source: Calculated by the authors according to the State Treasury Service of Ukraine

The results of calculations of decentralization indicators by local rural budget expenditures confirm that there is no stable tendency to strengthen it. The share of local rural budget expenditures in the consolidated budget remains virtually unchanged in 2013 – 2014 at a slightly higher level of 43%. After the active phase of the decentralization reform implementing and introducing appropriate changes to the Budget Code of Ukraine in contradiction with the expected trend, this indicator dropped by 2 % and only then began to grow, reaching the highest value of 47.3 % in 2017. The given data testify that local authorities have an impact on the redistribution of less than 50 % of consolidated budget revenues.

The share of expenditures of local self-government bodies in public expenditures increased to 39.3 % in 2017. One of the main reasons for the local rural budget expenditures share increase in the consolidated budget and public expenditures is increasing the interest of local self-government bodies in expanding their own revenues base and focusing on social-economic problems of the respective territories. This is explained by the fact that according to the Art. 99 Budget Code of Ukraine from 2015, if the value of the relative tax capacity index of the corresponding budget exceeds 1.1, then the local rural budget transfers 50 % of the amount that exceeds the value of such index to the state budget. Until 2015, all sources of local rural budget revenues that participated in the calculation of intergovernmental transfers were subject to the state budget if the corresponding revenues exceeded the estimated amount of the corresponding budget expenditures, calculated using the financial standards of budget provision and corrective coefficients.

It should be noted that the increase in expenditures of local self-government was accompanied by the expansion of their powers. In particular, responsibility for funding secondary, vocational, and health education institutions was transferred to regional budgets and/or budgets of cities with regional value. The share of transfers transferred to the state budget in the revenues of local rural budgets increased from 0.7 % in 2013 to 1.3 % in 2017. That is, the withdrawal of funds from local rural budgets to the state increases. This indicates the positive impact of innovations in the Budget Code of Ukraine regarding the transfer to the state budget of 50 % of the amount exceeding the value of the index of relative tax capacity of the relevant budget. The share of local rural budget revenues in the local rural budget revenues did not exceed 50 % for the entire period of the survey, which is evidence of a centralized balancing of revenues and expenditures of local rural budgets.

To complete the study of financial decentralization, it is necessary to consider indicators that characterize the role of transfers in the formation of financial resources of local rural budgets. Financial decentralization is carried out using the principle of subsidiarity, which involves the equalization of financial imbalances of local rural budgets through a system of intergovernmental transfers. This process, in our opinion, is somewhat contradictory, as the coverage of local rural budget expenditures by grants and subsidies from the State budget makes them dependent on the center and weakens the stimulating effect of centrifugal processes on the interest of local communities in improving efficiency and productivity (Table 4).

Table 4. Dynamics of intergovernmental transfers in local rural budget revenues

Indicator	Year					
	2013	2014	2015	2016	2017	2018
The share of inter-budget transfers in local rural budget revenues, %	59.1	50.0	59.1	53.4	54.3	53.2
The share of non-target inter-budget transfers (grants) in local rural budget revenues, %	29.2	26.4	2.5	1.9	4.4	4.5
Share of transfers transferred to the National budget (reverse subsidy) in local rural budget revenues, %	0.7	0.8	0.9	0.8	0.8	1.0

Source: Calculated by the authors according to the State Treasury Service of Ukraine.

The share of intergovernmental transfers in local rural budget revenues in Ukraine is over 50%. This indicates a high level of centralized balancing of revenues and expenditures of local rural budgets.

Since the share of intergovernmental transfers in income is an inverse indicator to the share of local rural budget revenues in local rural budget revenues, only one of them should be taken into account when calculating the partial income decentralization index. Since the change in the share of domestic revenues of local rural budgets is directly related to the partial index, that is, its growth has a positive effect on the dynamics of the level of financial decentralization, for this calculation it was precisely this indicator.

The dynamics of the integral indices characterizing the decentralization process in Ukraine is shown on Figure 4.

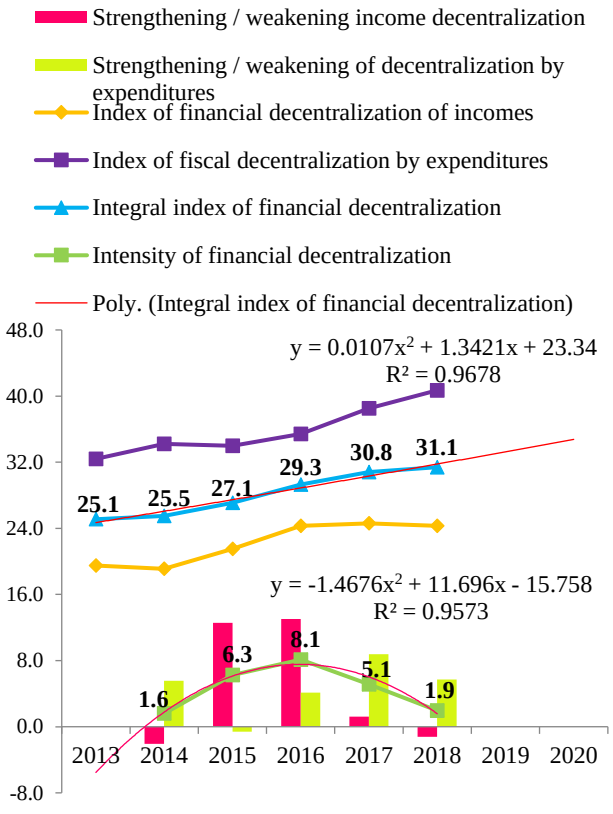

Fig. 4. Dynamics of financial decentralization integral indicators in Ukraine during the period 2013 – 2018
Source: Completed by the authors

As can be seen on the calculations results, in recent years there has been an increase in decentralization changes, indicating an increase in the financial decentralization integral indicator. However, the backlog of the decentralization of incomes shows that for the central government is more difficult to decentralize responsibility for the source of taxation than for local rural budget expenditures.

The partial indicator of fiscal decentralization for incomes has increased from 19.5 % in 2013 to 24.3 % in 2018, while the corresponding expense expanded at a faster pace, from 32.4 % in 2013 to 40.7 % in 2018. In general, the level of financial decentralization by the integral indicator has steadily increased – from 25.1 % in 2013 to 31.4 % in 2018.

In recent years, important steps have been taken in establishing the foundations of local self-government. A transformation of the structure of local government took place, views on the place and role of local self-government in the approval of Ukraine as a European democratic country have changed. At the same time, while continuing to implement the process of decentralization, it is necessary to take into account the complications that may arise. First, this is a complication of the process of redistribution of funds through the budget and management of the budget process in general, since the central government is more difficult to decentralize responsibility for the source of taxation than for expenditures of local rural budgets. Secondly, in conditions of decentralization, it`s more difficult to reconcile the local needs of separate territorial communities with the macroeconomic objectives of the entire state [10; 14].

Using the method of regression analysis, it can be established that the processes of financial decentralization in Ukraine have acquired clearly defined trends, as evidenced by high coefficients of determination in the calculated regression equations (Tab. 5).

The conducted regression analysis confirms the imbalance in the decentralization of revenues and expenditures, which were transferred to the local level in the process of financial reform. This situation creates an additional financial burden on local

governments and deepens the internal imbalances of the fiscal space of the regions.

Based on the results of the calculation of decentralization indices by income and expenditure, a regression model of financial decentralization in Ukraine is built:

Table 5. Results of regression analysis of financial decentralization indicators in Ukraine

Index	Regression equation	Assessing the tightness of the connection
Partial index of financial decentralization of incomes (P_IID)	y = 1.237 x + 17.88	$R^2 = 0.837$
Partial index of fiscal decentralization by expenditures (P_IED)	y = 1.594x + 30.28	$R^2 = 0.911$
Integral index of financial decentralization (I_FID)	y = 0.010 x2 + 1.342 x + 23.34	$R^2 = 0.967$
Intensity of financial decentralization (IFD)	y = -1.467x2 + 11.69x – 15.75	$R^2 = 0.957$

Source: Completed by the authors

$$I\_FID=-0.018+0.648\ P\_IID+0.386\ P\_IED$$

The parameters of the model show that the greatest impact on the level of fiscal decentralization has the intensity of centrifugal changes in the intergovernmental distribution of revenues. According to the interpretation of the calculated model, the growth of the partial income decentralization index (P_IID) by 1% leads to an increase in the integrated indicator of financial decentralization (I_FID) by an average of 0.648%. At the same time, an increase in the partial index of decentralization by expenditure (P_IED) by 1% leads to an increase in the integrated indicator by 0.386%. Thus, the ability of local self-government to generate their own income is the most effective organizational and economic means of regulating regional development.

However, the analyzed indicators and the structure of intergovernmental transfers show that the actual level of financial decentralization remains low, despite changes in the budget and tax legislation. The revealed fluctuations of the indicators of decentralization indicate the lack of a systematic and effective process of transferring financial powers to the places and allow concluding that local self-government bodies have a limited influence on the formation of their own financial resources. In fact, the centralized balance of incomes and expenditures of local rural budgets continues to be realized in Ukraine.

CONCLUSIONS

Thus, fiscal decentralization has become a feature of practical implementation in the regions of the country. Creation of self-sufficient territorial communities, their effective functioning will contribute to the establishment of effective local self-government with a real impact on local processes.

The conducted research shows that during 2013 – 2018, the level of financial decentralization of local rural budgets has increased. The main impetus for this was the changes in the budget and tax legislation that came into force in 2015 and stimulated local authorities to expand their own revenue base.

At the same time, were identified disproportions in the level of financial decentralization in terms of income and expenditure, The amount of income should be sufficient to provide the functions and responsibilities that are set at this or that level of authority. However, the functions transmitted at the level of local authorities do not obey the corresponding changes in the revenue part of local rural budgets. We believe that in order to increase the efficiency of systemic local finance in Ukraine, the issue of compliance with local rural budgets and expenditures, which are financed by their cost, is strategically solved in Ukraine. The need for further improvement of the system of intergovernmental fiscal relations in Ukraine.

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THE ASSESSMENT OF IMPACT ECOLOGICAL STABILITY OF TERRITORY ON THE ORGANIZATION OF RATIONAL LAND USE OF AGRICULTURAL ENTERPRISES

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Abstract

The ecological condition of agricultural land use is studied and the tendencies of significant changes of the ecological condition of lands in the process of transformation of land relations are revealed. Land valuation was carried out according to the degree of anthropogenic load. The coefficient of ecological stability of the territory, which is characterized by the level of intensive land use, is determined. Scenarios for the functioning of modern agroecosystems in agricultural land use have been developed. The main directions of ensuring an effective transition to an adaptive system of agriculture for the formation of efficient agricultural land use are outlined.

Key words*: agroecosystem, degree of anthropogenic load, coefficient of ecological stability, agricultural land use, agrolandscape*

INTRODUCTION

The transfer of agricultural production in modern conditions to a fundamentally new ecological-adaptive system of agriculture, its structural change with mandatory consideration of environmental factors, legislation, requirements and approved standards is certainly an important and effective prerequisite for successfully overcoming the existing environmental crisis, which in Ukraine has affected virtually all components of its natural environment [1].

The main purpose of such a policy should be to ensure ecologically balanced farming systems for the rational use and reproduction of natural (including land) resources, optimal coordination of social, environmental and economic criteria of a particular agricultural land use (territory) [20]. The main state mechanism for the formation of such ecologically safe agroecosystems is land management. Land management is a certain indicator of society's attitude to the ways and methods of the most efficient and rational use of agricultural areas (agrolandscapes) [17]. However, social needs are not always determined by the ecological expediency of land use, so land management should be based on a deep awareness of all the negative phenomena (social, economic, environmental) that can lead a certain agricultural land use (territory) to an ecological crisis. [6, 12].

Problems of formation of ecologically safe agroecosystems in modern agricultural land uses - a subject of numerous researches of many scientists [2, 6, 8, 15, 16, 17, 3, 7, 10, 11, 12, 13, 4]. Therewith, the concept of formation of ecologically safe agroecosystems can be considered as a new approach to effective land management due to the creation of new models of adaptive farming systems. The scenarios of development and functioning of modern agricultural production are not fully studied.

The purpose of the article is to assess the impact of ecological stability of the territory and anthropogenic load on the organization of rational land use in the conditions of transformation of land relations in Ukraine.

MATERIALS AND METHODS

In the field of land protection and soil fertility reproduction, the following standards are set: maximum permissible soil pollution; quality of soils; optimal ratio of land; indicators of land and soil degradation [2]. Standards for the quality of agricultural land are set to prevent their degradation and are used to monitor the quality of soil cover [19, 10].

The ecological situation significantly affects the agro-ecological condition of the soil cover and other components of agricultural landscapes. The ecological condition of the soil is an integral indicator of its ecological stability, level of fertility and pollution. [16, 11].

The ecological situation significantly affects the agro-ecological condition of the soil cover and other components of agricultural landscapes. The ecological condition of the soil is an integral indicator of its ecological stability, level of fertility and pollution [9].

According to the calculations of I. Rytorska and E. Hoike, the coefficient of ecological stability of individual lands is: for lands under built-up areas and roads – 0.00; arable land – 0.14; forest belts – 0.38; perennial plantings, shrubs – 0.43; backyard – 0.50; hayfields – 0.62; pastures – 0.68; ponds and swamps of natural origin – 0.79; forests of natural origin – 1.00. With different composition of land, the coefficient of ecological stability of the land use area (Ke.s) [17] is calculated by formula 1:

$$K_{e.s} = \frac{\sum(K_i * P_i)}{\sum P_i} * K_r \quad (1)$$

where:

Ke.s – coefficient of ecological stability of the land of the i-th type;

Pi – land area of the i-th type;

Kr – coefficient of morphological stability of the relief (1.0 – for stable areas and 0.7 – unstable).

The coefficient of anthropogenic load (Ka.l.) characterizes the magnitude of the impact of human activities on the environment, including land resources. This indicator is determined by formula 2:

$$K_{a.l} = \frac{\sum(P_i * B_i)}{\sum P_i} \quad (2)$$

where:

Pi – land area with the appropriate level of anthropogenic load, ha;

Bi – score of the corresponding area with a certain level of anthropogenic load.

The coefficient of anthropogenic load for lands under reserves is 1; for lands under forest belts, shrubs, forests, swamps, lands under water is 2; for lands under natural fodder lands, under the meadows on the beams – 3; for lands under arable lands and perennial plantations – 4; for lands of industry, transport, settlements 5 score.

RESULTS AND DISCUSSIONS

Land management is an integral part of the economic system of society and is a complex, multifaceted process that depends on the nature of production relations, forms of land ownership and other means of production. Such features suggest that:

–economic efficiency of land use should be assessed based on the system of economic relationships and, accordingly, requires a system of land use indicators;

–in determining the economic efficiency of different types of land use must take into account, on the one hand, the collective and personal interests of land users and landowners, and on the other - the public interest;

–since land is an element of the natural environment it is necessary to take into account the conditions of soil fertility reproduction and ecological characteristics of the territory;

–when calculating efficiency indicators, it is important to highlight the effect of land management, comparing it with the corresponding costs and ensuring qualitative homogeneity and quantitative comparability of indicators (for different enterprises,

components and elements of the land management project);

–as land management projects are related to the implementation of land use improvement projects, water management, industrial and road construction, etc., it is necessary to take into account the investment efficiency of measures taken in the period before the full development of the project. As well as the cost of formation (replenishment) of fixed and current assets and related costs associated with compensation for losses and environmental protection;

– time gaps between the introduction of capital investments and obtaining the effect of them require a comparison of the effect and costs that do not coincide in time [22].

Land use can be considered in relation to the environment, material production and society as a whole. Accordingly, the overall efficiency of land use is divided into environmental, economic and social.

Due to the lack of a full-fledged market for agricultural land, land relations in Ukraine have been forced to become leased. The short duration of the lease is the main reason why most tenants do not have a careful attitude to land resources. In fact, land users are not interested in the long-term preservation of the productive properties of land that is not their property and with which they do not associate long-term economic interests. In addition, the owners of land plots are mostly elderly people who will never work on the land again and who are mostly interested in maximizing the income from renting out property. From the point of view of "big business", agriculture is often seen as a project with short-term goals, which aims to maximize income in the short term without strategic plans for the future. Thus, the former approaches to systemic land protection, which were based on centralized planning and budget financing of almost all soil protection measures in the implementation of land management, no longer work in modern conditions.

Due to the unfounded and intensification of agricultural production ekolohonebezpechnoyu current state lands became threatening, due to the constant strengthening their degradation. The latter is now one of the major production problem that makes it impossible to achieve high ecological and economic efficiency of land use.

If we compare the level of profitability of agricultural enterprises in the region with this indicator of the end of the Soviet period (since 1990), it decreased from 40.8 to 14.2%. This emphasizes once again that the opportunities for reinvestment of profits in soil protection measures in modern conditions are quite limited.

An important component of a comprehensive land use is evaluating the effectiveness of environmental efficiency. Environmental efficiency is related to the need to protect nature, reproduce and rationally use natural resources. It is manifested primarily through the impact of land management measures on the environment and the nature of land use as an important component [21].

Assessments of ecological stability and anthropogenic load of the territory are an integral part of the characteristics of agricultural lands in terms of quality.

Basic qualitative indicators that indicate the ecological balance of agrolandscapes, their sustainability and the degree of transformation under the influence of economic activity – are the coefficients of anthropogenic load and ecological sustainability [2, 8]. These coefficients make it possible to comprehensively assess how rational the structure of the land fund is.

State policy on the use of agricultural land should be based on two interrelated concepts: efficient and intensive use of land resources to provide the population with food, as well as the implementation of a system of measures for the protection of land resources [18, 3].

Rational use of land directly depends on its purpose, because only operating with a clearly defined purpose of land use can develop a list of specific methods of its use, determine the placement features of productive forces within the plot, establish the composition of land, to exercise control over the rational land use.

Soil degradation is a major food security problem in agricultural land use, creating environmental constraints for agricultural expansion.

Agroecological parameters, which are limiting factors in agriculture, include soil, climate and relief [2].

Efficient use of land resources is characterized by the coefficient of ecological stability of the territory, which characterizes the level of intensive land use.

The results of the calculation of the ecological stability of the study area are shown in Table 1.

Table 1. Calculation of ecological stability of the territory of Kyiv region

Name of lands	Coefficient ecological stability of the land, K_i	Land area (thousand hectares) , P_i	$K_i * P_i$	$K_{e.s.}$
Arable	0.14	1,367.7	191.48	-
Fallows	0.60	13.7	8.22	-
Perennial plantings	0.36	40.7	14.65	-
Hayfields	0,62	116.4	72.17	-
Pastures	0.68	136.4	92.75	-
Total agricultural land	-	1,674.9	379.27	0.23
Forests of natural origin	1.00	632.5	632.50	-
Shrubs	0.43	17.2	7.40	-
Built-up land	0.00	116.0	0.00	-
Other lands	0.00	196.0	0.00	-
Ponds and swamps of natural origin	0.79	175.5	138.65	-
Total land	-	2,812.1	1,157.81	0.41

Source: calculated by the authors according to the State Geocadastre of Ukraine.

The stability of the territory is assessed according to the value of Кес.:

–0.33 and less – land use is environmentally unstable;

–0.34-0.50 – land use is stably unstable;

–0.51-0.66 – land use is within the limits of medium stability;

–0.67 and more – land use of ecologically stable.

The coefficient of ecological stability of agricultural lands of Kyiv region is 0.23, and the territory of land use of the region as a whole – 0.41. Thus, the calculations show that the territory of Kyiv region is stably unstable, and the land under agricultural lands is ecologically unstable. The anthropogenic load factor, calculated in Table 2, shows how strongly human activity affects the state of the environment.

Table 2. Estimation of lands by the degree of anthropogenic load

Name of lands	The score impact of land on the territory, B_i	Land area (thousand hectares) , P_i	$B_i * P_i$	$K_{a.l.}$
Arable	4	1,367.7	5,470.8	-
Fallows	3	13.7	41.1	-
Perennial plantings	4	40.7	162.8	-
Hayfields	3	116.4	349.2	-
Pastures	3	136.4	409.2	-
Total agricultural land	-	1,674.9	6,433.10	3.84
Forests of natural origin	2	632.5	1,265.0	-
Shrubs	2	17.2	34.4	-
Built-up land	5	116.0	580	-
Other lands	0	196.0	0.0	-
Ponds and swamps of natural origin	2	175.5	351.0	-
Total land	-	2,812.1	8,663.50	3.08

Source: calculated by the authors according to the State Geocadastre of Ukraine.

The coefficient of anthropogenic load on agricultural lands of Kyiv region amounted to 3.84, which exceeds the average value of this indicator in Ukraine by 11.5%.

High plowing of the territory, especially agricultural lands reduces soil fertility, deepens the ecological crisis in land use. However, plowed land does not fully reflect the state of ecological and economic efficiency of land use. It is advisable to study the coefficient of plowing of agricultural land, which is calculated as the ratio of arable land to the area of agricultural land [14]. The plowing coefficient of the studied territory

was 64%, which is a negative indicator of land use in agricultural land use.

The forest cover ratio reflects the share of forests, shrubs and forest belts in the structure of all lands and is 14%, which is less than the average in Ukraine (18%). In combination with other natural resources, forest resources are an integral part of the productive forces of the country directly involved in economic development, in meeting the social needs of society, act simultaneously as a means of production, object and product of labor.

The territory of Kyiv region is characterized by a satisfactory ecological condition, plowing, the structure of agrolandscapes of which is closest to the optimal values. The landscapes of the region need minor structural changes and maintenance of the existing ecological balance in the ratio of agricultural lands [15]. In the structure of the land fund of Kyiv region, large areas are occupied by soils with unsatisfactory properties (washed away, deflated, waterlogged, swampy, etc.), which is due to anthropogenic factors and negative natural features. According to the classification of suitability categories, these are degraded and unproductive lands (low-fertile soils).

Violation of the ratio of arable land, natural forage and forest lands has negatively affected the sustainability and condition of agrolandscapes. The acute issues that arise in modern agriculture are the result of unresolved economic and environmental problems. Violation of the ratio of arable land, natural lands, forests and water resources, has caused soil degradation.

The formation of sustainable agricultural production mainly begins with the existing specialization of specific agricultural enterprises and the level of agricultural intensity.

Sustainable (sustainable) functioning of agroecosystems is based on scientifically sound specialization of agricultural enterprises, where livestock and crop production are harmoniously correlated, as well as crops that improve the soil and positively affect its fertility [1]. On this basis, the formation of the optimal structure of sown areas is carried out, a flexible system of crop rotations with the best predecessors is developed, energy-saving technologies are introduced. [2, 20].

As a result of the alienation of matter and energy, recycling is significantly increased and, accordingly, the costs of anthropogenic resources for restoring lost soil fertility and maintaining the energy potential of the entire existing agroecosystem are increased [2]. Thus, the narrow crop specialization of production systems causes a decrease in the structure of sown areas of the share of crops with a high ability to improve the environment, including perennial legumes [20]. It is the reduction of livestock, on the one hand, reduces the need to grow crops such as perennial grasses, corn, post-harvest and after mowing fodder mixtures, and on the other hand - leads to a significant reduction of manure from cattle. It is the reduction of livestock, on the one hand, reduces the need to grow crops such as perennial grasses, corn, post-harvest and after mowing fodder mixtures, and on the other hand – leads to a significant reduction of manure from cattle [1].

The agricultural lands of Kyiv region include especially valuable productive lands (54.8%) with an average humus content of 3.1%. Here you can grow almost all crops typical of the forest-steppe zone and Polissya. Investment attractiveness of the agricultural sector of Kyiv region is quite high due to favorable natural and climatic conditions, favorable economic and geographical location, developed production and market infrastructure [5].

Producers of agricultural products in the study region mainly specialize in the production of such highly profitable crops as sunflower, rapeseed, soybeans, which are soil-depleting.

During the period 1999-2019, there was a slight increase in all sown areas of agricultural crops in Kyiv region (5.66%) in Ukraine; although the redistribution of areas by crops during this period has changed significantly, namely, increased crops of highly profitable export-oriented crops. This is evidenced by the structure of sown areas of Kyiv region from 1999 to 2019 (Fig. 1).

Thus, the sown area under sunflower from 1999 to 2019 increased by 87.66%, which violates the crop rotation system and leads to soil depletion. The sown area of cereals and legumes in the period from 1999 to 2004 increased by 20.38%, and from 2004 to 2019 decreased by 8.16%. Crops under sugar beet have significantly decreased (from 1999 to 2019 there was a decrease in area by 77.42%), as they are being displaced from crop rotation by more profitable but lower cost crops.

Failure to comply with crop rotations, the pursuit of high profits, neglect of land protection measures, constant «soil fatigue», soil depletion – all this leads to the inevitable degradation of soils.

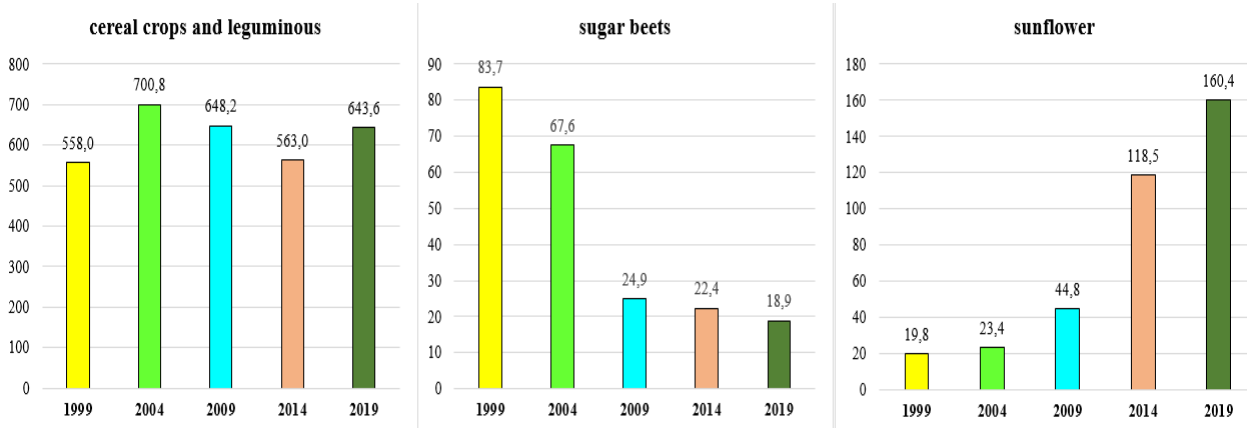

Fig. 1. Sown area of crops in the Kiev region, thousand hectares
Source: Main department of statistics in Kyiv region - Crop Production (1995-2019).

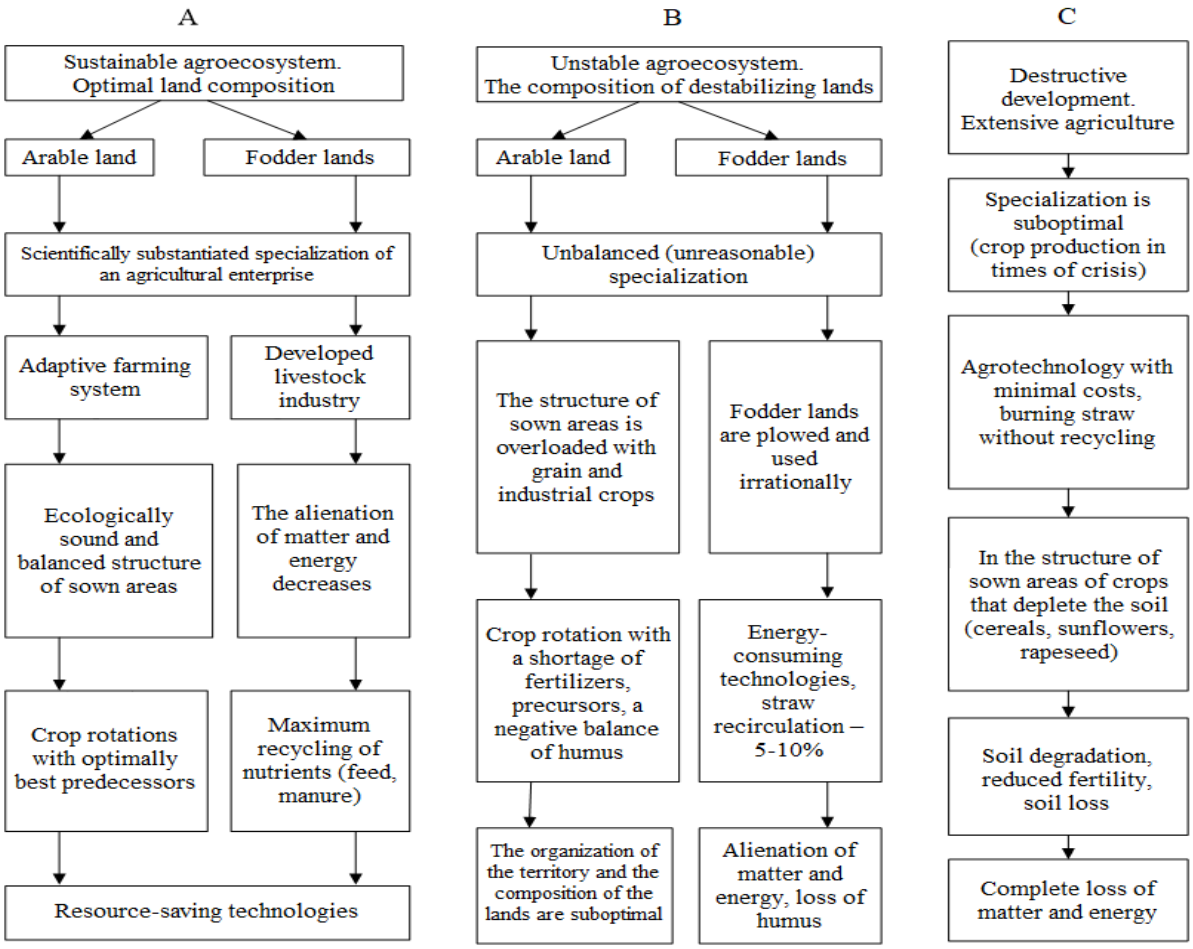

Fig. 2. Scenarios of functioning of modern agroecosystems
Source: Own research.

Destructive development of the agroecosystem is based on extensive agriculture, where crop rotations are not observed, rational organization of the territory, structure of sown areas, which causes a certain degradation of the agroecosystem and reduction of total humus reserves [20]. Such destructive development of the agroecosystem is characteristic of modern agriculture in the newly formed agro-formations on a lease basis [2].

Scenarios for the functioning of modern agroecosystems are shown in Figure 2.

Based on the above scenarios, we can talk about the need for land management in certain areas (agricultural enterprises), where the environmental situation is catastrophic (or close to it). In such cases development of the corresponding projects of the land management with such organization of the territory and system of agriculture which normalize an ecological situation is necessary [6]. At the same time we must not forget the axioms – «environmentally acceptable land use is environmentally sound» and, conversely, negative environmental phenomena lead to significant economic losses.

Ukraine has accumulated extensive experience in developing and implementing various land management projects for the organization of land use, including the soil protection system of agriculture [2].

The need for such capital-intensive measures can be explained by the desire to counteract the numerous erosion processes on unjustifiably plowed slopes with intensive use of such lands [20].

For Ukraine, where the level of plowed land exceeds the ecological norms almost twice, such approaches are unfounded, as most of its territory has enough space for growing major crops (in particular, arable land on slopes up to 3°) [1].

Therefore, when conducting land management in such agricultural enterprises, mainly organizational and economic measures are implemented, which consist in involving only suitable lands (soils) for use [7].

Modern adaptive systems in agriculture should take into account not only the peculiarities of natural conditions (climate, relief, soils), but also individual elements of the existing landscape, choosing the most suitable land for growing major crops [6, 17].

CONCLUSIONS

In the conditions of development of soil degradation due to increase of anthropogenic load, disturbance of ecological stability of agrolandscapes it is important to optimize the ratio of natural ecosystems, to apply anti-erosion organization of the territory both at local and regional levels.

To ensure an effective transition to an adaptive system of ecological and economic agriculture in modern conditions it is necessary:

–to develop (improve) landscape farming systems;

–actively apply economic influence on land use entities (ecologically dangerous land use should be economically unprofitable);

–to withdraw according to the established criteria from intensive cultivation of unproductive lands and introduction of a complex of reclamation measures on arable lands. This will increase the productivity of agroecosystems and preserve soil fertility

–to optimize the composition of land of agricultural enterprises, applying environmental standards in the formation of spatial organization of the territory;

–constant provision in crop rotations of deficit-free balance of humus due to fertilizer application and maximum recirculation of nutrients;

–to improve the structure of sown areas by introducing dynamic (flexible) crop rotations by reducing the share of row crops and increasing the area of perennial grasses.

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SOCIO-ECONOMIC CHANGES UNDER PUBLIC INVESTMENT EFFORTS IN THE APUSENI MOUNTAINS

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Abstract

There is rising concern of peripherality, economic and population decline in mountain areas. A representative area facing similar issues is the Apuseni Mountains of the Romanian Carpathians. The area is appreciated for the picturesque quality of the landscape, with valuable touristic potential. However, the geographic specificity is also associated with the high dispersal of the human settlements, poor connectivity and infrastructure. Economic and political changes during the socialist period led to rural depopulation by favouring the mining industry, and to massive emigration after The closure of mines (favoured by the socialist politics), led to young population immigrating for other revenue sources. The last two decades present a similar trend, especially in the rural communities, where farming is limited to subsistence and the population faces declines up to 40%. The aim of the present study is to assess the economic progress of the communities within the Apuseni Mountains area, by correlating the social and economic situation with the public effort of investments and supporting policies. As the analyzed territory is mainly rural (140 out of 153 localities), we considered the European rural development policies, which are tailored at the national level, and their effects. By the use of the Principal Component analysis, we have analysed at the administrative unit level the impact of European financial subsidies in relation to demographical changes and entrepreneurial activity. Findings show the positive role of pluriactivity in the rural areas, while agriculture is weakly linked with population changes. Investments in renewing villages and the modernization of agricultural holdings are associated with the development of tourism (and agritourism predominantly) and local products certification. The results support the inherent potential of the area to become resilient through tourism, culture-infused food and traditions, and enhanced collective responsibility.

Key words**:** *agricultural policy, mountain areas, rural development, economic diversity, biodiversity, Natura 2000*

INTRODUCTION

There is rising concern, at a global level, of peripherality, remoteness and population decline in rural, mountainous areas. A prominent issue in the Alps [16], a recent phenomenon in China [12], countries consider the potential of innovative activities based on local cooperation systems and sustainable measures [6].

A 2009 European Commission Report's [33] attempt to limit vague rural delimitations includes a peripherality/accessibility index and a land cover index, to improve the basic OECD 1994 classification (based on population density). The peripherality index describes remote communes (LAU2) of above "45 minutes travel time to reach an urban centre with at least 50,000 inhabitants", while an "open space" commune had at least 75% natural area (agricultural, forest), as opposed to "closed space" communes (land cover index) [33]. It has been found difficult to assess one area's remoteness in its entirety of indicators (total length of motorways, number of railway stations, travel time or travel cost to economic centres, access to services etc.), however the supposition remains: physical presence of an urban centre is key for a commune, in respect to the opportunities that follow (access to markets, skilled personnel, public services, private enterprises). Therefore, remoteness represents the lack of opportunity in rural areas [24], which are seen to (have) become "structural failures" [3], with negative socio-economic changes or delayed development [35].

A representative mountain area (with the rural communities in particular) facing similar problems is the Apuseni Mountains area, the western subgroup of the Romanian Carpathians, in Southern Europe.

The Apuseni Mountains area is appreciated for the picturesque quality of the landscape, thus providing enormous touristic potential. On the other hand, a geographic-specific issue is that of the high dispersal of the human settlements, associated with poor connectivity and poor public services/infrastructure [39]. Not only a fragile physical environment, the Apuseni Mountains have known various geodemographic declines due to economic and political changes as well. The socialist period led to an increase in the population of the smaller towns where the mining industry was the main activity sector (Nucet, Ştei, Brad, Baia de Arieş), favouring the prosperity of the urban space of the Apuseni Mountains and, thus, depopulating the rural space. Closure of mines after post 1990's political and economic shifts was then followed by massive emigration, affecting mainly young and adult population, and a dramatic reduction in birth rate [39].

Constantin et al. [10] record that the problems of the local communities have been long documented, on various dimensions, from economic development (since 1936) to sustainable rural development [53]. More recent findings show the permanence of the social and economic issues, and the occurrence of new ones (such as loss of culture-infused traditions). School population decreased along time, with more than 100 LAU having negative migratory balance rate in 2017, or increased slightly in some cases due to ethnic causes (Ukrainian, Romani) [38]. What remains is the phenomena of demographic ageing, with elderly population in and subsistence agriculture [37, 54]. Subsistence and semi-subsistence farming are clearly represented at national level as well, with over 90% of all agricultural holdings under 2 ha of utilized agricultural area (UAA), or under €2000 of standard output (SO) [11].

The presence of rich natural resources, labour and craft traditions within the Apuseni Mountains contributed to the development of industrial activities such as mining and processing of ferrous and nonferrous ores, exploitation and processing of rocks and building materials, agricultural products processing, wood processing, textile industry and production of handicraft items [9], as well as culture infused events and festivals [7]. However, the whole area deals with poverty and high unemployment rates, whether we include ex-mining areas and thus mono-industrial structures located in the east of the Apuseni Mountains [37], or the eastern, agriculturally predominant areas, where farming is limited to subsistence and reluctant mentalities [48]. Employment has suffered alongside the economic restructuring, with a 50% fall in the number of employees at regional level from the '90s until 2010 (with communal or rural-urban differences) [15]. Botezan et al. [4] found in their study the respondents' confirmation of the lack of industry and employment opportunities, with two increasing trends: young people leaving their homes and others choosing traditional activities with low income levels (agriculture, tourism).

Other major issues include environmental issues. Although the area fosters the Apuseni Natural Park, with over 55 natural reservations and three Natura 2000 protected sites, while being officially administered by the National Forest Administration Romsilva, studies show continuous forest fragmentation, inside and outside the park. In the post-establishment period of the Park, forest loss increased considerably, mostly due to illegal logging (economic pressure) and corruption [58]. Petrișor et al. [52] or Kucsicsa & Dumitrica [34] report deforestation as the main dynamic in the area and a re-occurring issue over decades. Natural factors (meteorological, topographical) are also the cause of damage to the forest vegetation, through increased windthrows [27]. Mining activities, which do have an ancient, long-standing tradition [59], have environmental consequences even after their closure, such as mine tailings spills, surface and groundwater pollution or biodiversity loss [45, 54]. The most famous case of planned project, in Rosia Montana, Alba County, attracted serious debate and media coverage, as locals and environmentalists opposed mining exploitations, with reasons including expropriations, the relocation of the cemetery,

the interference with the cultural heritage or the threat of explosives and cyanide tailings [40, 41].

The opportunities of sustainable regional development and of interrupting the socio-economic and environmental decline of the area lie in economic pluriactivity development. Earlier studies present pessimistic conclusions, stating that rejuvenating actions for the area are tardy or that Rosia Montana should merely remain "an unequally alive museum" [2, 26]. A research trend is evident, and studies consider the inherent potential of the area to become resilient through tourism, better access infrastructure, and enhanced collective responsibility [1, 47, 55] solutions which are encouraged on a global scale [6, 12].

The aim of the present study is to assess the socio-economic progress of the communities within the Apuseni Mountains area, by investigating the existing possible correlations between the actual and progressive social and economic scenario with the public effort of investments and supporting policies. As the analyzed territory is mainly rural (140 out of 153 administrative-territorial units are rural), we considered the European rural development policies, which are tailored at the national level, and their effects. Thus, we used demographic indicators (population change, density growth, old dependency ratio, migratory absolute indicators), geographic (remoteness) and economic (NPDR accessed funds, active enterprises, unemployment change rate, tourism indicators) in order to assess the correlation of the public investments (and their effects, e.q., active enterprises) with the demographic changes. At that, the main hypothesis are:

(1)Economic activity and investments in tourism lead to population growth and village revitalization;

(2)Rural development funding has positive effects especially in communes situated in proximity of urban centers rather than in remote areas.

In the European context, rural development policies followed continuous adjustments, some radical in changing the EU budgets (Table 1). A new Rural Development (RD) policy, detached from the market interventions and price policies (today, first pillar of the CAP), has emerged under the "Agenda 2000" reform, and was known as the second pillar of the CAP. The RD policy is implemented through RD multiannual programmes, which are tailored and implemented by Member States, based on their own unique challenges (targeting specific focus areas), the 9 CAP objectives, and the European Agricultural Fund for Rural Development (EAFDR) priorities for each programmed period. EAFRD is the main funding instrument for the CAP policies that support rural sustainable development, but projects are selected and co-financed at national or regional levels [21].

The new dimensions of sustainable rural development were included in the objectives of the European RD support programmes (e.q. the multi-functionality of agriculture, sector-specific diversity, climate action–Table 1) or were integrated in new approaches, such as the LEADER method (a "bottom-up" approach, where local actors form local action groups—LAGs—and develop tailored strategies) or programmes supporting smart villages and fostering innovation [21].

Romania has highly benefitted from the European public support, due to the large agricultural area (58.7% out of total land area, according to the World Bank collection of development indicators, 2016), and the high number of agricultural holdings, of nearly 3.9 million (mainly very small subsistence and semi-subsistence farms). The total CAP support for the programmed periods of 2007–2013 and 2014–2020, at national level, accounted for over € 8 billion and nearly € 9.5 billion, respectively (Table 2).

More than one fifth of farmland is under high nature value farming systems [23] and research supports directing high amounts of investments towards these vulnerable areas, either economically or environmentally or both [30].

Table 1. Milestones in the Development of EU Regional and Rural Policies

Timeframe	Milestone	Focus
60s and 70s	Launch of the CAP	Focus on price support and productivity -> Overproduction, supply control
1992	MacSharry Reform	Introduction of direct payment mechanisms, phasing out price support; income and budget stabilization
2000	Agenda 2000	Direct aid; environmental cross-compliance; rural development policies (second pillar)
2003	The June 2003 reform	Decoupled payments; market orientation; environmental cross-compliance
2009	Health Check	Single farm payment scheme; dairy quota; flexibility in public intervention
2013	The 2013 reform	Targeting certain objectives; inter-pillar flexibility
2018	Post-2020 CAP reform	Simplifying; more flexibility for EU members; higher focus on environment; research and innovation
2021, 2022	Transitional period	

Source: [23].

Table 2. Public support for the Rural Development Programme in Romania

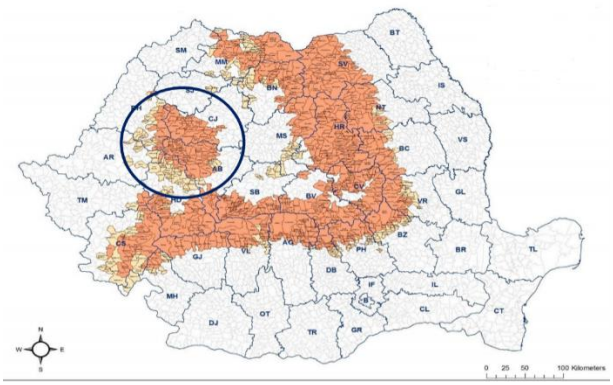
Programming Period	Priority Axis	Objectives	Public Budget (mil. euro)
NRDP 2007-2013	Axis 1 competitiveness	Human resources (vocational training, young farmers)	3,061.43
		Physical capital (farm investments, agricultural infrastructure)	
		Quality of agricultural production	
		Transitional measures (semi-subsistence)	
	Axis 2 land management	Mountain LFA	3,026.91
		Natura 2000	
		Agri-environment/animal welfare	
		Forest	
	Axis 3 wider rural development	Basic services	2,345.01
		Economic diversification	
		Training and information	
	LEADER axis	Within the scope of the 3 thematic axis	366.92
	Total		8,800.27
NRDP 2014-2020	Priority 1 knowledge and innovation	Advisory, cooperation	0.07
	Priority 2 farm competitiveness	Modernisation, generational renewal	1,107.17
	Priority 3 food chain organisation	Quality schemes, short supply circuits, producer groups	1,232
	Priority 4 ecosystems	Biodiversity, soil erosion	1,623.47
	Priority 5 resource efficiency	Water efficiency, renewable energy, carbon sequestration	304.47
	Priority 6 economic development	Economic diversification, local development	1,921.38
	Total		9,446.30

Source: [21, 42, 43].

MATERIALS AND METHODS

Case Study

The Apuseni Mountains (Munții Apuseni in Romanian) represent an expanded mountain unit on about 10.750 km² and a western subgroup of the Romanian Carpathians (Map 1). The boundaries are the Barcău Valley in the north, the Transylvanian Depression in the east, in the south the boundary is given by the Mureș Valley, and in the west the limit is the connection with the West Hills. The Apuseni Mountains are not high, with a maximum elevation of 1,849 m in the central part of the area (Bihor Massif). The mountains' rounded crests contrast with deep river valleys, and extensive limestone formations give rise to some spectacularly eroded landscapes. Pastureland and settlements are scattered among the mountains, and the Metaliferi (Metal) Mountains in the south, with volcanic conical crests, are rich in mineral ores [19].



Map 1. Territorial-administrative map of Apuseni Mountains, Romania
Source: [22].

For the administrative delimitation of the Apuseni Mountains we consulted the existing literature ([38], from [13] and [56]). The administrative area of the Apuseni Mountains consists of 154 administrative-territorial units (LAU 2) from 6 counties (NUTS 3): Alba, Arad, Bihor, Cluj, Hunedoara and Sălaj. Of the 154, 141 are communes (rural area), with the mention that the Negreni municipality was established by referendum in 2002, and 13 are cities (urban space). The area (14,322.17 km^2) is inhabited by a little over 416,600 persons, and presents low population density: 29.1 inh./km^2 vs. 90 inh./km^2 national mean; high isolation degree is translated by the remoteness indicator mean of 33.01 km, with almost 50% of rural communes going above the mean [49]. 46.49% of the total area is forest covered, followed by 30.17% of grasslands and 14.71% with agricultural area. Almost 60% HNV and 28% Natura2000 protected area.

Methods

The Principal Component Analysis (PCA) was used to study the possible correlations between the investments made with NRDP grants and the socio-economic and natural variables in the Apuseni Mountains area, Romania. PCA is a multivariate methodology with the purpose of extracting information from a dataset by reducing its size to a smaller set of factors, allowing predictions and revealing specific trends [32, 36, 57]. However, as the factors cannot represent all the information inherent in the items, the focus is to extract a minimum number of factors that account for a maximum proportion of the variables' total variances, instead of absolute accuracy [44]. In this case the principal components were selected using the computed eigenvalues (>1), and the interpretation was performed using a varimax matrix. The KMO statistic and the correlation matrix with the associated significance level provided a first insight into the correlation structures and explained that data are appropriate for the PCA method. Data was assessed by the help of the software package IBM® SPSS® Statistics for Windows, Version 20.0 (Armonk, NY, USA). Several studies have used socio-economic dynamics in a quantitative approach in order to define contextual ruralities [5, 18] and the role of European rural development initiatives in certain European countries [50] with interesting insights, such as the idea that urban centres are being better supported by RDP [5], with no apparent redistributive effects towards rural areas. Studies conducted in Romania have previously used the method in correlating CAP subsidies with agricultural production types [17, 28], or recently, in correlating CAP subsidies with farm net

incomes and permanent emigration—at national level, which allowed to make use of FADN data sets [29] or other national statistical figures. Studies on the area of the Apuseni mountains record either demographical changes [39], the reorganization of economic activities [14], or the CAP funds spatial distribution [46]. Thus, this article aims at providing an inclusive perspective, by looking at spatial correlations of demographical changes, sectorial activity and NRDP funding.

Table 3. Descriptive statistics of the PCA factors

Variables	Explanation	Mean	Std. Deviation	Min	Max
Population change	Absolute differences between years 2018 and 2008 (number)	-219.19	253.1	-1,742.00	923
Population density	Density growth between years 2018 and 2008 (%)	-9.04	6.76	-27.43	12.05
Old-age dependency ratio	Population 65+ y. o./ population 15-64 y. o. (growth rate between years 2018 and 2008, %)	-1.41	9.12	-74.51	48.89
Unemployment rate	Growth rate between years 2018 and 2008 (%)	-3.75	5.31	-100.00	577.53
Emigrants	Emigrants 2008-2018 (number)	7.77	12.08	0.00	69
Imigrants	Imigrants 2008-2018 (number)	4.32	6.48	0.00	49
Certified products	Certified products/commune (number)	0.82	3.28	0.00	32
HNV area	HNV area (%)	0.87	0.33	0.00	1
Natura2000 Site	% of total area	24.6	27.63	0.00	100
Remoteness	Distance (km) until the closest urban centre (>10,000 inh.)	33.01	20.35	0.00	78
Primary sector	Differences of active enterprises in the primary sector between years 2018 and 2008 (number)	2.29	2.92	-7.00	13
Secondary sector	Differences of active enterprises in the secondary sector between years 2018 and 2008 (number)	1.41	8.12	-28.00	69
Tertiary sector	Differences of active enterprises in the tertiary sector between years 2018 and 2008 (number)	2.6	16.38	-74.00	110
Hospitality sector	Differences of active enterprises in the hospitality sector between years 2018 and 2008 (number)	0.5	2.17	-7.00	10
Touristic capacity	Differences in number of beds between years 2018 and 2008 (number)	15.9	79.46	-244.00	553
Touristic attractiveness	Differences in overnights between years 2018 and 2008 (number)	214.97	6,253.53	-43,012.00	23,172
Agric_measures (07-13)	Projects funding for measures 112, 121, 122, 125, 123, 141, 142 (2007-2013)	517,764.57	735,183.88	7,500.00	4,617,027.40
Agric_measures (14-20)	Projects funding for measures 4 and 6 (2014-2020)	762,943.01	974,480.02	15,000.00	4,273,141.00
Measure 312	Projects funding for measure 312 "Support for microenterprises creation" (2007-2013)	224,545.06	361,530.87	10,906.00	2,377,815.65
Measure 313	Projects funding for measure 313 "Support for touristic activities" (2007-2013)	149,588.16	214,288.58	64,470.29	1,128,406.96
Measure 322	Projects funding for measure 322 "Village renewal and development" (2007-2013)	1,290,180.88	2,382,648.55	649,919.00	13,854,703.72
Submeasures 6.2 + 6.4	Projects funding for "Support for microenterprises creation" (2014-2020)	106,559.94	168,062.93	50,000.00	956,350.00
Measures 7	Projects funding for "Basic services and village renewal" (2014-2020)	391,700.17	677,725.43	106,058.00	3,275,539.00

Source: Own calculation.

Data collection

The present study considers both programming periods of the two National Programmes Rural Development—NPRD (2007-2013 and 2014-2020), and the CAP context indicators were utilized in assessing the support impact upon the regional and local development of the Apuseni mountain area, of 141 rural LAU and 13 towns [20]. Socio-economic data was retrieved from the online database (TEMPO) of the National Statistics Institute [49]. Funded projects within the NPRD were selected from the online reports of the competent national authority AFIR – Agency for Financing Rural Investments [51]. All indicators refer to data at LAU level and are described below (Table 3).

RESULTS AND DISCUSSIONS

The results of the analysis are displayed in Table 4.

The PC1 – "Economic diversity and population changes" Describes the factors influencing the population, thus leading to village renewal. Growth in population and density rates along the chosen timeline (between 2008 and 2018 as reference years) are positively correlated with NRPD funds (accepted projects) from Measure 312 „Support for microenterprises creation", as well as with the growing number of enterprises activating in the secondary and tertiary sectors. Results confirm the first hypothesis of the study, namely that the Economic activity and investments in tourism are linked to population growth and village revitalization. Both urban and rural areas know decreasing trends in population, with highest negative figures in towns like Brad (-1,742 persons since 2008), Ștei, Câmpeni, Baia de Arieș, and notable numbers in Poieni, Hălmagiu, Roșia Montana and Iara (-511 persons). In this way, the need for economic diversification and focus on industry and services aligns with recent studies, especially for previous mining areas [4]. Policies should be designed to diversify the local economies and to provide more jobs and employment opportunities.

PC2-„Economic development and migration" Emmigration and immigration figures are positively correlated. Generally, these areas with strong migratory rates have recorded decreasing numbers of active tertiary enterprises. This suggests that the economic environment is negatively influenced by the demographic instabilities.

PC3-„Investments and hospitality infrastructure" shows that measures in tourism, village renewal and microenterprises creation are correlated with each other, as well as with hospitality figures (growth in number of active hotels and restaurants). The measures included in the component belong to both programming periods, which explains how locals continued to further apply for projects and invest. The results are, thus, visible, through the growing number of hotels and restaurants, and especially of agritouristic infrastructure (represented by 40% of the total, and by 37 communes out of total to be involved solely in agritourism). However, how areas without touristic potential (and thus zero touristic infrastructure) have known population increase, while also having positive changes in tertiary firms numbers (Cricău, Tetchea, Rapoltu Mare, Vetel).

PC4 – „Agricultural investments and population density" Presents a correlation among agricultural measures and the way they are accessed, in that there is a continuation of investments from the first through the second programming period. Moreover, they are positively linked with density growth, showing the benefit over depopulation. An important role could be played by submeasure 6.1 „Young Farmers Set-up Grant", having this exact objective, of encouraging youth to either remain or start up a life in rural areas. Buteni (AR) and Vetel (HD) score the highest amounts of continuous funding in agricultural measures, however only the latter enjoys population growth.

PC5 – „Natura2000 and tourism"

There is a positive correlation between Natura2000 sites and touristic indicators, such as an increase in overnights, which can contour tourists' preference. In addition, the positive link with the increase in

infrastructure capacity (number of beds) can suggest that entrepreneurs have taken note of the opportunity and invested accordingly.

PC6 – „Location and microenterprises"

Show the link between geographical characteristics and investments in setting-up microenterprises. Funding for this type of projects is positively correlated with Natura 2000 areas, a possible explanation being that other economic activities arise in complementarity to touristic ones. Conversely, highly isolated and HNV areas register lower levels of investments from this measure.

PC7- „Location and population aging"

Principal Component 7 deals with the link among geographic aspects and the change in time in the old-age dependency ratio. The ratio presents a general decrease in Natura 2000 sites, sites which are positively correlated with a high degree in remoteness. A general decrease in the ratio means more people of working age for each elderly person aged 65 and over. This can be explained by either growing senior depopulation due to natural causes, or a higher number of working population due to the touristic aspect of the Natura 2000 sites.

PC8 – „Agriculture and certified products"

The link between the agricultural activity and number of certified products. This suggests an increase in both the number of agricultural activities, as well as the quality of the products. However, there are only 126 certified products in the area, out of which 100 are mountain products, 23 of traditional recipe, 2 consacrated recipe (in the town of Vascau) and 1 certified wine in Ighiu (AB).

PC9 – „Sectorial activity and unemployment"

It is shown the overall relationship of unemployed population within the territory. The unemployment rate presents upward trends in both agricultural and touristic areas, as well as Natura 2000 sites. The issue seems to persevere in spite of the investments volume.

Table 4. Principal Component Analysis results

PC	Eigen Values	% variation explained	% variation accumulated	Indicators and correlation with the PCs (the most discriminant variables, above ± 0.3)
PC1	2.722	11.837	11.837	Population changes 0.855 Secondary sector 0.761 Tertiary sector 0.752 Population density 0.574 Measure 312 0.433
PC2	2.192	9.529	21.366	Tertiary sector -0.313 Population density 0.433 Emmigrants 0.928 Immigrants 0.888
PC3	2.092	9.097	30.464	Submeasures 6.2 + 6.4 0.783 Measure 313 0.681 Hospitality sector 0.560 Measure 322 0.505 Measures 7 0.439
PC4	1.762	7.663	38.126	Population density 0.352 Agric_measures (07-13) 0.792 Agric_measures (14-20) 0.791 Measures 7 0.475
PC5	1.686	7.332	45.458	Touristic attractiveness 0.781 Touristic capacity 0.710 Natura2000 Site 0.342
PC6	1.661	7.220	52.677	HNV area -0.797 Measure 312 0.594 Natura2000 Site 0.433 Remoteness -0.432
PC7	1.396	6.068	58.745	Natura2000 Site -0.403 Old-age dependency ratio 0.864 Remoteness -0.586
PC8	1.205	5.239	63.984	Certified products 0.849 Primary sector 0.407
PC9	1.201	5.223	69.207	Hospitality sector 0.375 Natura2000 Site 0.304 Unemployment rate 0.767 Primary sector 0.475

Source: Own Analysis. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Results confirm the overall importance of economic diversity (industry, services) with regard to positive population changes (PC1), however tourism does not have a direct impact in our findings. There are no correlations between touristic indicators and demographic data referring to population trends. Agritourism is considered a «smart chance» for mountain rural environments [8], if employed efficiently and policy-based [31]. The number of certified agricultural products, which should stand at the core of agritourism industry and touristic areas, are correlated with areas with agricultural firms (PC8). Analogously, Galluzzo [29] finds no unique effects of EU funding on agritourism development at national level, with weak and ambiguous correlations within regions.

Areas appreciated for high biodiversity (Natura 2000 sites) corresponded with areas in which touristic infrastructure has been developed (PC5). Unfortunately, the more remote the area is, the more it is put at an unfair disadvantage. High biodiversity areas present increasing unemployment rates (PC9) and a low old-age dependency rate (depopulation due to natural causes). The results are confirmed by national data [29], as agritouristic areas are strongly correlated with high rates of permanent emigration.

CONCLUSIONS

The present study focused on finding possible correlations among demographic changes and investments through the NPRD, in an area with potential and interest in revitalization. Previous research noted how certain types of farming are more prone to apply for grants, or how the direct payments are beneficial in maintaining farm income (not necessarily to improve farmers well-being). Investments in tourism were also found prolific, especially when correlated to agritouristic infrastructure. In this case, however, there is no correlation between overnights and tourism investments, and it shows arbitrary results when correlated to population changes or unemployment. In fact, the unemployment rate seems to be negatively linked to both agricultural and touristic areas. In agriculture, there is no correlation between agricultural firms and the investments in this type of measures. Small agricultural holdings do benefit from grants, but without the capacity to expand and flourish. As shown from the results, the Apuseni Mountains area is divided in touristic and agricultural zones, evident through resources, as well as the history of accessing the NRDP funding. Focus should be turned to education in preserving these resources and accessing finance, through steady, collaborative projects. Public financing for rural development (Pillar 2) seems, however, to be proposed for “inappropriate” reductions (up to 28%) for the following programming period (2021-2027), which if put in action, will demand higher attention to managing the funds (and perhaps higher national efforts) [25].

This study has potential limitations. Funding data are retrieved from the official reporting authority (AFIR), with the available option of “selected projects”, which might omit retracted or unsuccessful projects. We encountered difficulty in finding larger data on economic indicators at commune level (such as farm income, average wages). PCA is an exploratory method, thus for accuracy in explaining the correlations, further research should employ statistical modelling, while involving more explanatory variables.

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ROLE OF FOREIGN DIRECT INVESTMENT IN INNOVATIVE DEVELOPMENT OF THE AGRARIAN SECTOR

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Abstract

Overcoming the shortage of investment resources for the development of the agro-industrial complex of Russia makes it necessary to mobilize both internal and external sources of investment. Attracting foreign direct investment in the agro-industrial complex, creating favorable conditions is one of the most difficult tasks. The purpose of the study is to assess the available mechanisms to stimulate the attraction of foreign investment and determine their contribution to the innovative development of the agricultural sector and increasing the possibilities of food exports; identification of the relationship between the scale of foreign direct investment and the investment attractiveness of Russian regions. Studied foreign and domestic theoretical and methodological approaches to assessing the conditions, opportunities and limitations of foreign direct investment, macroeconomic and globalization effects from their use. The necessity of increasing the inflow of foreign investment in agriculture in order to activate the process of innovative structural transformation of the Russian economy has been substantiated. Investigated the provision of foreign investments in agriculture. An empirical assessment of the scale of foreign investment in agriculture has been carried out, measures are proposed to stimulate the attraction of foreign investment in agriculture. The practical significance of the results of this study lies in the development of measures to improve investment policy in relation to foreign direct investment.

Key words**:** *foreign direct investment, innovative development, agricultural sector, investment contract, efficiency assessment, government regulation*

INTRODUCTION

The federal scientific and technical program for the development of agriculture in Russia for 2017–2025 has identified as one of the priority areas the creation of conditions for the early transfer of the agro-industrial complex to a new technological base, the transfer of scientific results into production and their subsequent effective use. At the same time, an increase in innovative activity in agriculture and attracting investment are considered as the main indicators of the Program, innovative activity in agriculture should reach the level of 30% by 2025 [20].

Attracting foreign capital makes it possible to fill the deficit of financial resources and has a positive effect on the development of the economy, which necessitates the creation of favorable conditions for foreign investors.

Theoretical, methodological, and methodological problems of studying the conditions, opportunities, and limitations of foreign direct investment, macroeconomic and globalization effects from their use, the main models of foreign investment are reflected in detail in the works of domestic and foreign scientists.

The greatest contribution to the study of this topic was made by such foreign authors as D. Danning, J. Keynes, C. Kindleberger, P. Krugman, M. Casson, B. Olin, M. Porter, A. Ragman, E. Heckscher. J.S. Mill, R. Harrod,

E. Domar. Porter substantiated theoretical approaches and models of direct investment export at the macro level; A. Chandler, J. Danning, A. Rugman - at the micro-level. In turn, S. Hymer, C. Kindleberger, and R. Caves, based on the synthesis of micro-and-macroeconomics, emphasized the need for a foreign investment firm to have specific advantages over national enterprises (originality of products, advanced technologies), which allows it to borrow a monopoly position in the market of the host country [2, 27, 31].

A significant contribution to the theory of foreign direct investment was made by A.M. Rugman, who developed the FSA-CSA matrix to reflect the specific strengths of both the firm and the country [41]. For a firm, the main motivational prerequisite for the export of direct investment is the desire to get the maximum benefit from the use of such specific advantages as technology, knowledge, managerial and marketing abilities in the presence of stimulating factors in the recipient country of direct investment (natural resources, the availability of cheap labor, the investment attractiveness of the business) ... According to M. Porter's theory, the competitiveness of a particular country is largely determined by its location at a certain stage of the life cycle (stage of factors of production, stage of investment, stage of innovation; stage of wealth) [39].

The eclectic paradigm of foreign direct investment by economist J.H. Danning (OLI paradigm) is based on the study of the special competitive advantages of foreign investors in comparison with domestic companies (O), the advantages of the location of host countries with the prospects for the development of local markets (L) and the advantages of internalization arising from the coordination of economic activities within the firm (I) [7].

The prevalence of OLI advantages predetermines the existence of conditions for the preferential export of capital from the country.

In the development of these theoretical provisions of J.H. Danning and R.Narula developed the theory of "the way of investment development of the nation", according to which the export or import of capital is determined by the level of investment development of the country in comparison with the rest of the world. The authors identified five stages of the country's economic development. The first phase is characterized by a low inflow and insignificant outflow of foreign direct investment due to the use of restrictive measures by the state, a weak technological base and a small number of asset-generating firms, and low investment attractiveness. In the second phase, there is a slight increase in foreign direct investment and export inflows; the outflow of foreign direct investment is still low; there has been a slight increase in the competitiveness of national firms. In the third phase, both exports and imports of foreign direct investment increase. A feature of the fourth phase is the equality of exports and imports of investments (and in some cases, outstripping exports). Per capita income and demand for high-quality goods are growing; national firms demonstrate a high level of competitiveness in the domestic and foreign markets. The fifth phase - further growth of exports and imports of foreign direct investment, maintaining a high level of competitiveness of local companies in the domestic and foreign markets, active support for the export of investments [28]. Thus, the theory of "ways of investment development of the nation" can be used to classify countries (external investors or recipients of investments). Placement of foreign direct investment is focused on countries with a lower level of GDP per capita in comparison with the investing country.

In modern foreign studies, the phenomenon of foreign direct investment is of great importance. The problems of increasing the efficiency of using foreign direct investment in agriculture are quite relevant. World experience shows that inefficient investments usually mean low productivity and stagnation of production [25].

Investment opportunities are most limited in developing countries, which impedes overcoming food crises and achieving food security. In the least developed countries, large investment gaps in infrastructure

development have led to a sharp decline in agricultural efficiency and underutilization of agricultural land. Given the disastrous investment security situation, the CFS (United Nations Committee on World Food Security) asked the HLPE (High-Level Panel) to ask experts to prepare a report "Multi-stakeholder partnerships (MSPs) to finance and improve food security and nutrition by 2030 of the year"[26]. As a result, many developing countries have begun to make more active use of foreign investment in agriculture in order to increase the productivity of the sector and meet the needs of agriculture for various resources [30].

Thus, in the past few decades, the higher profitability of agriculture and the relatively low cost of land have been factors in attracting foreign investment in agriculture; multinational companies are actively involved in this process, especially in developing countries [24]. However, there is still a debate about whether foreign investment can improve food security in developing countries [6]. Several authors note the high potential of foreign investment in agriculture to support agriculture in developing countries [29].

This promotes more active technology adoption, increased yields, and improved quality of agricultural products, which, in turn, have increased the share of developing countries in global agricultural production and exports [15].

According to studies by foreign authors, investments have contributed significantly to the creation of jobs and higher incomes for farmers, meeting the growing demand for food and eliminating the problem of hunger [9, 32].

However, some scholars see foreign investment as a threat to local small farmers, leading to a deterioration in food and environmental security, as well as socio-economic destabilization [34]. In selected African countries, foreign investment in agriculture has resulted in the marginalization of smallholder farmers, local labor replacement, food insecurity, and severe environmental problems. In general, foreign investment in agriculture must be viewed in terms of economic, political, institutional, legal, and ethical issues [10, 33].

Their real effect can be underestimated due to the above circumstances [3].

In Eastern European countries, the foreign investment makes a more significant contribution [35, 36].

Considering the situation in Serbia, Jovanovic, R.J. emphasizes that an increase in the inflow of foreign direct investment has a beneficial effect on the development of agriculture and the food industry, as well as on economic growth and the maintenance of international competitive positions. It is necessary to take into account international rules regarding foreign investment. Too tight restrictions impede the flow of agricultural investment, as a result of which the problems of insufficient production capacity and backward infrastructure persist. In this case, it is difficult to introduce and use agricultural technologies, especially in developing countries [11,13].

Therefore, in the process of deciding on foreign investment in agriculture, especially in developing countries, one should take into account the ratio of positive and negative effects of investment; the state of the investment environment; investment attractiveness of the business. The main determining factor remains the presence of positive externalities of investments, therefore, about developing countries, it is recommended to relax international rules and increase the scale of foreign investment, even if there is a low investment attractiveness.

Thus, research has proven significant advantages of foreign direct investment for the host country: increased investment activity in the national economy and individual industries; economic growth due to the influx of technology and the transfer of innovation; increasing exports by increasing the production of competitive goods; creation of new jobs in joint ventures with foreign capital participation; increasing production efficiency and expanding sales markets; the formation of new competencies of employees through training, knowledge transfer and advanced training. Foreign capital can saturate the host country with resources to modernize its

production base and form a modern consumption model [4].

The purpose of this study is to assess the available mechanisms to stimulate the attraction of foreign investment and determine their contribution to the innovative development of the agricultural sector and increasing the possibilities of food exports; identification the relationship between the scale of foreign direct investment and the investment attractiveness of Russian regions.

MATERIALS AND METHODS

The methodological basis of the study was research in the field of food security and nutrition in the world, the achievement of the sustainable development goals of the FAO, IFAD, UNICEF, WFP, WHO of the World Bank [16, 17, 22, 23, 46].

In the course of the research, monographic, abstract-logical, analytical, economic-statistical, expert research methods were used. Information from the International Monetary Fund, Rosstat, the Central Bank of Russia, and the Ministry of Agriculture of Russia was used as an information base for the study.

The specificity of accounting for foreign direct investment in the context of certain types of economic activity according to the balance of payments methodology is to reflect the balances of direct investments from abroad, which include the participation of foreign direct investors in the capital (equity) and debt instruments. However, it should be borne in mind that in agriculture in Russia, the main recipients of funds are such organizational forms as agricultural holdings, whose activities in statistics can be reflected in other codes for the classification of economic activities (consulting services, financial services, foreign economic activity) and accounted for in other industries [12].

Such incompleteness of information forces us to build cause-and-effect relationships empirically and use expert methods.

RESULTS AND DISCUSSIONS

Foreign investments are investments of foreign capital in objects of entrepreneurial activity in the form of objects of civil and property rights, intellectual property rights, as well as services and information. Direct investments can be carried out in the form of acquisition by a foreign investor of at least 10% of a share in the authorized capital of a commercial organization; capital investments in the fixed assets of a branch of a foreign legal entity established on the territory of the Russian Federation; leasing of certain equipment by a foreign investor with a customs value of at least 1 million rubles, which is declared by the relevant decision of the Council of the Eurasian Economic Commission of July 16, 2012, No. 54 [8].

The legal basis for foreign investment is established by the norms of Russian and international legislation. The institutional framework for regulating foreign investment in Russia is determined by the provisions of the Federal Law "On Foreign Investments in the Russian Federation", confirming the existence of state guarantees for investment activities: non-discrimination and respect for their rights and interests, in particular: equal conditions for doing business, exclusion of unfavorable changes in legislation, compensation for nationalization and requisition, justice, participation in privatization. The Federal Law "On the Procedure for Making Foreign Investments in Business Companies of Strategic Importance for Ensuring the Defense of the Country and the Security of the State" defines some restrictions on foreign investments in the interests of protecting the constitutional order, security of the state, the rights and legitimate interests of others. In most states, it is prohibited to attract foreign finance to national defense, postal service, education, production of harmful and environmentally polluting products. Any country has the right to establish its own restrictions on attracting foreign direct investment. For example, in China, in addition to the above-mentioned areas, foreign investments in medicine, fishing, electricity production, as well as in enterprises, the influence on which could shake the monopoly on political power, are prohibited. Also, to attract foreign capital to

the Russian Federation, the legislation provides for some benefits.

The regulation of the activities of foreign investors in Russia is confirmed by intergovernmental agreements; currently, more than 70 such agreements are in force. On April 1, 2020, a new law on the protection and encouragement of investment was adopted, according to which investors can implement investment projects, backed up by state guarantees not to take measures that worsen the situation of investors. For foreign investors, the conclusion of agreements on the protection and promotion of investments (SZPK) is possible only through participation in the capital of a Russian legal entity [18].

In Russia, there is a special mechanism for concluding investment contracts (SPIC) between the state and a private investor in the form of a public-private partnership, aimed at the development and implementation of modern technology that ensures the serial production of industrial products, including in the sectors of the agro-industrial complex. This measure will make it possible to produce products that are competitive in the world market. The term of contracts does not exceed 15 years with an investment volume of up to RUB 50 billion and 20 years with investments over 50 billion rubles [19].

Thus, the mechanism of investment contracts is aimed at the development and transfer of technologies, the inflow of unique technological and production competencies to Russia in exchange for guarantees of stability of business conditions in the long term. contribute to the activation of the process of innovative structural transformation in agriculture and the sectors of the agro-industrial complex

Information on direct placed and attracted investments, as well as gross domestic product (GDP) in Russia as a whole, is presented in Fig. 1. Comparison of these indicators makes it possible to determine the stages of investment dynamics in accordance with the provisions of the theory of the development of the investment path of J.H. Danning and R. Narula. With the exception of 2000-2002, as well as 2012 and 2016, the volumes of direct Russian investments placed abroad exceeded the volumes of foreign direct investments.

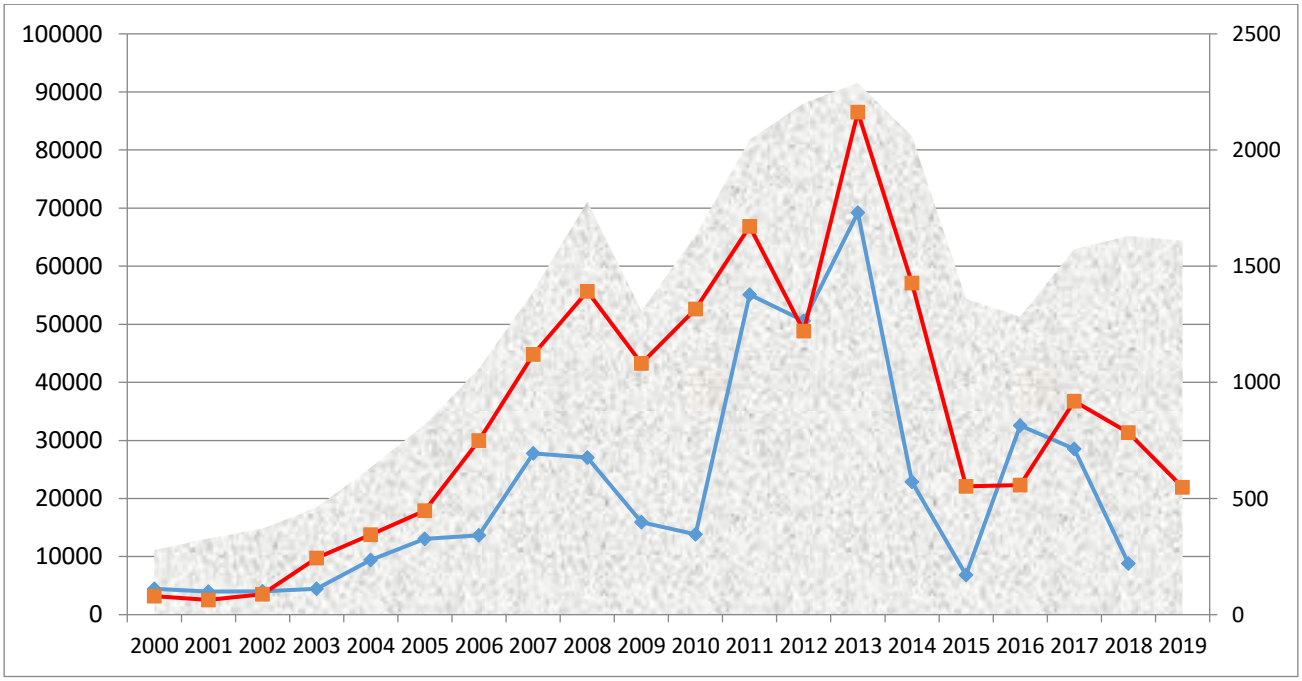

Fig. 1. Dynamics of direct investment and gross domestic product in Russia, USD million
Source: Own calculations based on the data of the International Monetary Fund, federal statistics of the Russian Federation, statistics of the Central Bank of Russia

The largest gap between exports and imports of investments was observed in 2010 (USD 52,616 million and USD 13,810 million, respectively). The lack of investment resources was especially noticeable in 2017 when there was a sharp decrease in gross domestic product as an indicator of economic growth. The excess of exports of direct foreign investments over their imports was observed in 2009-2011, and both the outflow and inflow of direct investments increased; economic growth was observed. In 2013-2015 and 2017-2019. the inflow of direct investments into Russia was less than their outflow from the country, although their scale has noticeably decreased. At the same time in 2013-2015. there was a sharp drop (by more than 30% of gross domestic product. In 2017-2019, a further decrease in the volume of inbound and outbound direct investments continued, and the economy, despite an increase in growth rates, did not reach the maximum of 2015 GDP (2,289 billion dollars).

The foregoing allows us to conclude that the dynamics of foreign direct investment is somewhat inconsistent with the theoretical model of J.H. Danning and R. Narula, which is explained by the long-term effect of such factors as an imperfect institutional environment, low investment attractiveness (especially agriculture), high political and financial risks, underdeveloped infrastructure, and a lack of qualified personnel.

It is necessary to take into account the country's low competitiveness in the world market (according to the global competitiveness rating) in 2019, Russia ranked 43rd in the world) [42]. Studies of individual foreign authors also show a fairly conditional correspondence of the dynamics and structure of direct investments to various concepts, including the theory of J.H. Danning and R. Narula, which is especially typical for the Chinese economy [1].

Taking into account the identified trends in the import and export of direct investments against the background of the dynamics of the gross domestic product, the following stages of investment development in Russia can be distinguished. The first stage (2000-2004) is distinguished by a rather low scale of both the inflow into the country and the outflow of direct investments from Russia. During this period, the economy is characterized by a weak level of innovative transformations. At the second stage (2005-2013), there is a rapid increase in the volume of inbound and outbound direct investments. So, in 2010-2013. foreign investments increased 4.6 times, and the outflow of direct investments doubled. At the same time, the innovative restructuring of the economy does not yet fully affect such low-tech industries as agriculture; products of the agro-industrial complex are notable for their low competitiveness in the world market. Consequently, the second stage according to certain criteria (growth of direct investments) can be attributed to the third phase according to the theory of the investment path; on other parameters (low competitiveness, technological backwardness) - to the second phase. The third stage, which began in 2014, does not meet the criteria of J.H. Danning and R. Narula, since there is a pronounced cyclical movement of direct investment and GDP. With a certain degree of conditionality, it can be noted that Russia is at the stage of transition from the third to the fourth phase of the investment path, which predetermines the need to use foreign capital in the economy, especially in agriculture and other sectors of the agro-industrial complex.

The analysis of the structure of direct investments for certain types of activity showed an insignificant share of agriculture, forestry, hunting, and fishing in comparison with the production of food products, beverages, tobacco products (Fig. 2).

In 2010-2019. the share of direct investments in the type of activity "Agriculture, forestry, hunting and fishing" accounted for from 0.2 to 0.5%. In the production of food products, beverages, tobacco products, investments were made from 2.5% in 2013 to 6.5% in 2017. Some decrease in direct investment was observed in 2019. It is necessary to note the high degree of differentiation of foreign investment flows in agriculture across the territory of the Russian Federation, as evidenced by the calculated indicators of foreign investment concentration.

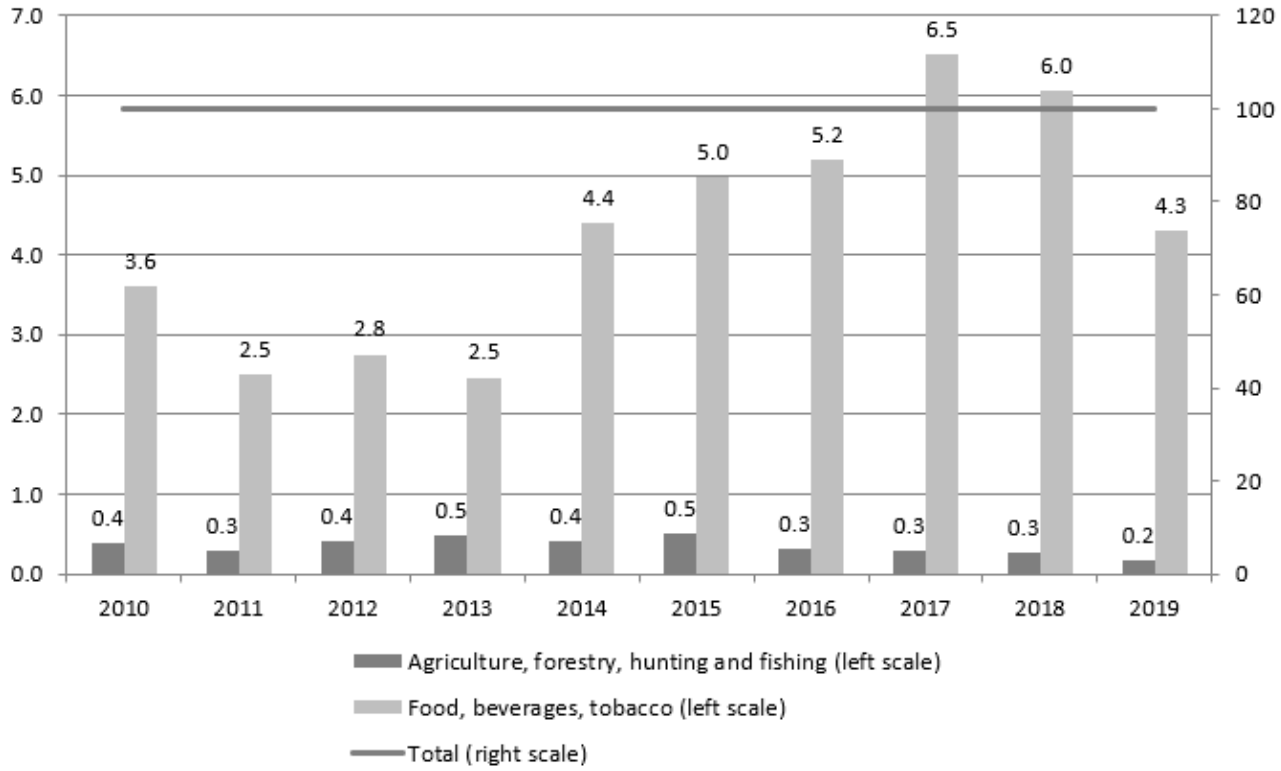

Fig. 2. Direct investment in Russia by type of economic activity, %
Source: Own calculations based on data from the Central Bank of Russia

In the economy as a whole, in 2019, the concentration indicator of direct investment CR3, calculated for the three regions with the largest scale of direct investment, was 81.3%, which characterizes a high degree of concentration, and the bulk of foreign direct investment in the period under review was concentrated in St. Moscow (29.8%), Sverdlovsk (10.2%) and Tyumen regions (41.3%). For the type of activity "Agriculture, forestry, hunting and fishing" in 2019, direct investments prevailed in the Kaliningrad region (52.0%), Krasnodar region (21.6%), and Leningrad region (14.1%); the concentration indicator was 87.7%. An empirical method using the available information from the Central Bank of Russia determined their absence in 2019. in most regions of the North Caucasian Federal District, as well as Kursk, Lipetsk, Oryol regions, the Republic of Adygea, the Altai Republic, the Republic of Buryatia, the Republic of Mordovia, and the Trans-Baikal Territory.

In this regard, one of the tasks is to attract foreign direct investment to the peripheral regions of Russia to increase their export potential and raise the technological level [47].

In modern conditions, the most priority areas for foreign investment in Russia are identified: the introduction of high-performance technologies for the cultivation of crops and raising animals; creation of production facilities and a raw material base for the production of containers and packaging materials; development of agricultural engineering; provision of production services to various parts of agro-industrial production; application of progressive, resource-saving and environmentally friendly technologies [5].

Many investors are showing interest in using the country's natural and climatic potential for the further export of manufactured goods to world markets [21, 37, 38].

Russian agriculture remains an extremely attractive sector for European companies that are members of the food industry committee of the Association of European Businesses (AEB), for example, Bonduelle, Cargill, Danone Russia, Ferrero Russia, Nestle Rossiya. However, it should be noted that there is a high degree of competition between

foreign companies in terms of using more beneficial natural, climatic and economic resources). To determine the contribution of direct investment to the innovative development of the agricultural sector and increasing the possibilities of food export, the relationship between the scale of foreign direct investment and the investment attractiveness of Russian regions was investigated, taking into account the innovative parameters and export opportunities of agriculture (Table 1-3).

Using the indicator "Direct investments in the Russian Federation as a percentage of the gross regional product" allows you to characterize investment activity. It is calculated on the basis of the balance of direct investment, and in some cases its negative value indicates an excess of disinvestment over their receipts. The degree of investment activity is determined by the corresponding indicator value: above 1 - high, below 1 - low. The reason for the withdrawal of investments may be the closure or sale by the company of existing divisions or a branch. In the analyzed period, in twenty Russian regions, the inflows of direct investments were less than their withdrawals, which reflects low investment activity. This conclusion is confirmed in relation to agriculture. According to information on the balances of direct investments in the Russian Federation by type of activity "agriculture, forestry, hunting and fishing", in 2018-2019. such regions as the Stavropol Territory (with a balance of $ 258 million), the Penza Region ($ 125 million), and the Krasnodar Territory ($ 28 million) had the greatest investment activity.

Comparison of average values for different groups of regions made it possible to characterize them as follows. The first group of regions with high investment attractiveness (Table 1) is also distinguished by higher innovation and investment activity, better opportunities for food exports, although agriculture occupies a smaller share in the gross regional product.

Table 1. Innovation and investment activity of Russian regions with different production and export potential in the group of high investment attractiveness in 2018

Regions of Russia	Investment attractiveness category	Direct investments in Russia as% of gross regional product	Share of gross agricultural product in gross regional product,%	Share of the region in the export of food and agricultural raw materials,%	Share of agricultural organizations that have implemented technological innovations,%
Moscow	High, first level	0.2	0	13.8	5.6
St. Petersburg	High, second level	0.2	0	4.16	9.5
Republic of Tatarstan	High, second level	0.6	9.2	0.65	17.1
Moscow Region	High, second level	2.1	2.6	3.3	9.2
Tyumen Region	High, second level	-1.4	5.2	0.07	11.4
Leningrad Region	High, second level	-1.2	8.3	0.85	5.0
Sakhalin Region	High, second level	9.4	0.9	3.25	0.00
Belgorod Region	High, second level	-0.1	29.7	1.41	14.7
Kaliningrad Region	High, second level	0.2	7.5	5.15	0.00
Kaluga Region	High, third level	1.4	9.4	0.15	0.00
Magadan Region	High, third level	0.0	1.6	0.42	0.00
Tula Region	High, third level	-0.9	10.3	0.57	6.0
Sverdlovsk Region	High, third level	7.4	3.7	0.42	3.3
Voronezh Region	High, third level	-0.1	23.2	2.17	10.6
Nizhny Novgorod Region	High, third level	0.0	4.9	0.86	5.7
Samara Region	High, third level	2.3	5.9	0.89	12.1
Republic of Bashkortostan	High, third level	-0.4	9.4	0.31	2.0
Krasnodar Territory	High, third level	1.0	16.3	10.5	3.6
Lipetsk Region	High, third level	3.9	20.6	1.30	15.9
Perm Territory	High, third level	-0.2	3.4	0.07	1.6
Khabarovsk Territory	High, third level	-3.3	2.4	1.22	0.0
Regional average		1.1	8.3	2.5	6.3

Source: Own calculations based on data from the Central Bank of Russia.

The second group of regions with an average investment attractiveness (Table 2) has the lowest indicators of investment activity (0.15), although compared to the first group, the scale of agriculture is slightly higher, but export opportunities have not been fully utilized.

Table 2. Innovation and investment activity of Russian regions with different production and export potential in the group of average investment attractiveness in 2018

Regions of Russia	Investment attractiveness category	Direct investments in Russia as% of gross regional product	Share of gross agricultural product in gross regional product,%	Share of the region in the export of food and agricultural raw materials,%	Share of agricultural organizations implementing technological innovations,%
Novosibirsk Region	Middle, first level	-2.2	6.4	0.72	2.8
Rostov Region	Middle, first level	0.8	17.6	21.6	29.5
Krasnoyarsk Territory	Middle, first level	5.6	3.4	0.17	1.4
Murmansk Region	Middle, first level	-4.3	0.4	2.52	0.0
Kursk Region	Middle, first level	2.4	34.2	0.77	6.3
Astrakhan Region	Middle, first level	0.1	7.9	0.94	0.0
Chelyabinsk Region	Middle, first level	2.3	8.1	0.43	4.0
Kamchatka Territory	Middle, first level	0.0	3.5	3.19	11.1
Primorye Territory	Middle, first level	0.7	4.8	6.07	2.7
Vologda Region	Middle, first level	-5.6	5.0	0.09	16.7
Tomsk Region	Middle, first level	3.7	5.3	0.05	21.7
Republic of Sakha (Yakutia)	Middle, second level	0.8	2.4	0.00	4.8
Irkutsk Region	Middle, second level	-0.2	4.6	0.14	7.1
Amur Region	Middle, second level	1.2	15.8	0.68	5.6
Vladimir Region	Middle, second level	-0.7	6.7	0.56	0.00
Ulyanovsk Region	Middle, second level	0.1	10.9	0.08	6.9
Novgorod Region	Middle, second level	0.0	9.9	0.11	5.6
Udmurtian Republic	Middle, second level	1.5	10.2	0.01	5.1
Yaroslavl Region	Middle, second level	0.3	6.1	0.02	0.00
Arkhangelsk Region	Middle, second level	-1.5	1.3	0.42	5.9
Orenburg Region	Middle, second level	-0.2	10.8	0.45	2.6
Tambov Region	Middle, second level	0.2	38.4	0.68	18.8
Ryazan Region	Middle, second level	0.6	14.9	0.10	10.5
Stavropol Territory	Middle, third level	-2.4	27.4	1.04	0.6
Smolensk Region	Middle, third level	1.4	7.7	0.63	3.2
Republic of Karelia	Middle, third level	-1.7	1.6	0.29	18.2
Penza Region	Middle, third level	0.2	20.6	0.35	8.6
Tver Region	Middle, third level	0.2	8.8	0.08	3.4
Saratov Region	Middle, third level	0.1	18.1	0.97	2.5
Kemerovo Region	Middle, third level	1.9	3.8	1.09	0.00
Republic of Adygeya	Middle, third level	0.1	20.2	0.07	0.00
Volgograd Region	Middle, third level	0.1	15.1	0.55	3.6
Chuvash Republic	Middle, third level	-0.4	12.6	0.10	14.3
Regional average		0.15	11.1	1.4	6.8

Source: Own calculations.

In the third group of regions with moderate investment attractiveness (Table 3), all indicators, with the exception of the share of gross output in gross regional product (17.4%), are lower than in other groups, which also indicates insufficient volumes of foreign direct investment and the need to improve investment image.

A more detailed analysis of the indicators in tables 1-3 makes it possible to assess the level of investment activity of the regions in comparison with their investment attractiveness [14, 48].

In the group of regions with high investment attractiveness, the Leningrad, Belgorod, Nizhny Novgorod, Tula, Voronezh regions and the Republic of Bashkortostan have low investment activity, despite their significant export and innovation potential. For example, the Belgorod region is the largest agricultural export-oriented region, however, additional investment is required to implement large

investment projects in the field of pig breeding, dairy cattle breeding, and processing.

Table 3. Innovation and investment activity of Russian regions with different production and export potential in the group of moderate investment attractiveness in 2018

Regions of Russia	Investment attractiveness category	Direct investments in Russia as% of gross regional product	Share of gross agricultural product in gross regional product,%	Share of the region in the export of food and agricultural raw materials,%	Share of agricultural organizations implementing technological innovations,%
Orel Region	Moderate, first level	0.6	31.3	0.36	6.3
Omsk Region	Moderate, first level	0.7	13.8	0.66	5.7
Komi Republic	Moderate, first level	1.9	1.5	0.00	16.7
Pskov Region	Moderate, first level	0.1	22.5	0.11	2.5
Bryansk Region	Moderate, first level	0.1	25.9	0.38	2.4
Kostroma Region	Moderate, first level	7.9	8.8	0.01	5.3
Altai Territory	Moderate, first level	0.0	24.0	0.80	5.1
Ivanovo Region	Moderate, first level	0.2	8.1	0.02	9.5
Republic of Mordovia	Moderate, second level	0.0	28.0	0.06	9.6
Kirov Region	Moderate, second level	0.0	12.4	0.04	7.6
Republic of Khakassia	Moderate, second level	2.3	5.9	0.02	0.00
Chechen Republic	Moderate, second level	0.0	14.4	0.01	0.00
Republic of Altai	Moderate, second level	0.0	23.1	0.03	0.00
Republic of Mari El	Moderate, second level	0.0	24.3	0.05	8.7
Jewish Autonomous Region	Moderate, second level	2.6	10.3	0.16	0.00
Trans-Baikal Territory	Moderate, second level	0.0	7.0	0.08	7.7
Republic of Daghestan	Moderate, third level	0.0	19.9	0.10	0.3
Republic of Buryatia	Moderate, third level	0.0	7.2	0.07	0.00
Kurgan Region	Moderate, third level	-0.2	18.5	0.07	3.6
Republic of Ingushetia	Moderate, third level	0.0	18.7	0.00	0.00
Republic of North Ossetia – Alania	Moderate, third level	0.0	18.6	0.17	0.00
Kabardino-Balkarian Republic	Moderate, third level	0.0	33.9	0.07	0.00
Karachayevo-Circassian Republic	Moderate, third level	0.0	38.3	0.03	0.00
Republic of Kalmykia	Moderate, third level	0.4	36.0	0.00	0.00
Republic of Tuva	Moderate, third level	-5.9	8.9	0.00	3.9
Regional average		0.43	18.4	0.13	3.8

Source: Own calculations.

In the Kaluga region, despite the high rank of investment attractiveness and production and export potential, it should be noted that there is insufficient investment activity in terms of technological innovation. But in terms of the level of investment activity among the regions of the district, the absolute leader is the Krasnodar Territory: about a third of the district's investments fall on it. The priority spheres of the Krasnodar Territory for the investing countries are: transport and communications, agriculture, fishing and fish farming, food and processing industries, mechanical engineering, metalworking.

In the group of regions with medium investment attractiveness, the Rostov Region and the Stavropol Territory stand out, which, according to the pilot rating of the Russian Agricultural Bank, are in the top 10 regions with high investment attractiveness in the agricultural sector [40].

The high export potential of the Rostov region is determined by the location of the region as a logistics hub; the priority area of investment

is the development of terminal infrastructure on the Sea of Azov. At the same time, investment activity needs to be stepped up. The Stavropol Territory has great potential for increasing the yield of the main export crops. A further increase in the production of agricultural products will also require the use of additional sources of investment, including foreign direct investment. A similar conclusion applies to the Novosibirsk region, which is experiencing a lack of investment in the creation of production facilities for the production of products with high value added.

Most regions of the third group with moderate investment attractiveness have low investment potential, which does not allow to overcome the technological backwardness of agriculture. This trend is most clearly seen in the regions of the North Caucasian Federal District.

The attraction of direct foreign investment in the agricultural sector of Russia remains relevant soon since internal sources of investment do not yet allow solving the problems of structural restructuring of the economy and the formation of export-oriented agriculture [45]. However, at present, foreign investments account for no more than 10% of the total investment in fixed assets in agriculture. Foreign investors are attracted by the scale of the Russian market and the prospects for expanding sales markets. At the same time, non-transparent regulation, peculiarities of the banking system, poorly developed infrastructure, and a shortage of qualified personnel act as significant limiting factors.

The investment strategy should be aimed at a gradual reduction in the volume of foreign loans and an increase in direct investment. The most important conditions for the formation of a favorable investment image are the presence of a package of investment projects; an appropriate legal framework for attracting and efficient use of foreign investment; governmental support.

Spheres of application of foreign capital should be points of economic and innovative growth in

the agricultural sector; effective models of agro-industrial production in the form of high-tech industries (for example, industrial and innovative entrepreneurship), developed based on interregional and regional projects and programs [43, 44].

One of the ways to stimulate regional investment activity can be providing the constituent entities of the Russian Federation with independence in identifying opportunities to reduce investment barriers; the formation and provision of benefits; the selection of promising areas of economic activity with the participation of foreign capital. For example, in the Far East, a simplified visa regime has been introduced for citizens of the countries of the Asia-Pacific region.

Improvement of the investment guarantee and insurance system at the federal and regional levels, the development of new forms and mechanisms of investment activities are associated with assessing the needs of the agro-industrial complex in foreign investment, identifying sectoral and regional priorities; using competitive approaches in financing investment projects with the participation of foreign investors; coordination of government bodies at the federal and regional levels to attract foreign investment in the agro-industrial complex.

CONCLUSIONS

Studied foreign and domestic theoretical and methodological approaches to assessing the conditions, opportunities, and limitations of foreign direct investment, macroeconomic, and globalization effects from their use. The stages of the investment dynamics of Russia are determined by the provisions of the theory of the development of the investment path of J.H. Danning and R. Narula. It is concluded that Russia is at the stage of transition from the third to the fourth phase of the investment path, which predetermines the need to use foreign capital in the economy, especially in agriculture and other sectors of the agro-industrial complex. The structure of foreign direct investment by certain types of activity has been investigated; an insignificant share of agriculture in the volume of foreign direct investment with practically zero dynamics has been revealed.

Methodological approaches to the study of the relationship between the scale of foreign direct investment and the investment attractiveness of Russian regions are proposed, taking into account the innovative parameters and export opportunities of agriculture. The selected groups of regions have significant differences in the level of investment activity, innovation profile, and production and export potential of agriculture, which predetermines the specifics of approaches to stimulating the attraction of foreign investment. The analysis of the distribution of foreign direct investment and the revealed strong differentiation of foreign investment flows across the territory of Russia - with a predominance of a high degree of their concentration, predetermines the need to make adjustments to the national investment program with the fixed possibility of redistributing foreign investment to export-oriented regions with an established agricultural specialization. One of the criteria for choosing regions can be the indicator of the share of foreign direct investment in their total volume or a regional product, both in the economy as a whole and in the context of individual types of activity, reflecting the level of investment activity. In the calculations of the authors, it is proposed to differentiate regions by the level of investment activity, depending on the value of the indicator "Direct investment in the Russian Federation as a percentage of the gross regional product." The necessity of increasing the inflow of foreign investment in agriculture to activate the process of innovative structural transformation of the Russian economy has been substantiated.

An empirical assessment of the scale of foreign investment in agriculture has been carried out, measures are proposed to stimulate the attraction of foreign investment in agriculture.

The practical significance of the results of the study is to develop measures to improve investment policy about foreign direct investment.

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ADDED VALUE OF CLIMATE AND ENVIRONMENTAL INFORMATION FOR AGRITOURISM

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Abstract

Capitalizing on the natural, cultural and anthropogenic potential for tourism in rural areas represents an important chance for local economy in Romania. Some of the main assets of a rural touristic destination are weather and climate conditions along with overall quality of services provided. Therefore, including climate and other relevant environmental information (e.g. on the greenness of the vegetation, low level of pollution etc.) in the promotion of agrotourism may contribute to a faster uptake of potential consumers/tourists and increase of overall success of the agritourist activity. In this line, we present a selection of such information tailored for tourism and customizable for specific locations which may positively contribute to building the image of the agritourist destination. The information, developed by the National Meteorological Administration, is currently available for 160 touristic locations in Romania, free of charge, through the web-based application WECTOU (Weather and Climate for Tourism) http://wectou.meteoromania.ro/ . Personalized information is available as well as a larger palette of climate and environmental products, such that to answer efficiently the specific requirements of the user.

Key words**:** *rural tourism, agrotourism, weather and climate, Romania, WECTOU*

INTRODUCTION

Rural tourism has gained popularity in the last years as well as its subtypes like the agrotourism. Marian (2017) considers rural tourism as "an important form of sustainable tourism" [13]. Ana (2017) states that agrotourism is a newer term compared to rural tourism, the farm being "the main place for tourism", thus satisfying a specific need of those tourists interested to feel the pulse of living in this environment [2].

Jensen *et al*. (2014) consider that agritourism have a double role for potential tourists - "recreational… and educational" and for the farmers to "diversify and add income" [11].

Lopez and Garcia (2006) appreciate that agrotourism is a way for the families living in rural areas to increase their income and, thus, develop their business [12]. The importance of agrotourism for the residents of the rural regions visited by tourists is also highlighted by Petrović *et al*. (2017) who mention as the main advantage for farmers having "more money to spend" [19].

Ammirato *et al*. (2020) conducted a documentary analysis on the relationship between agrotourism and sustainability, showing that most literature they reviewed highlight the numerous benefits by this type of tourism for the sustainable development of that region, benefits that are in line with the goals of Agenda 2030: "reduction of poverty", new jobs for people who could work in this domain, "gender equality" and the infrastructure development in the area [1].

The Farm-Based Education Network, Shelburne Farms, University of Vermont Extension (2019) published a guide for farmers working in agrotourism in order for them to be "successful". Among the factors that influence their success, such as the quality of the products and services they offer, their competitive prices, marketing is also very important [28]. A marketing strategy that takes into account the 4 P's of marketing

mix (product, price, promotion and placement) should be implemented by all these businesses that develop their activity in agrotourism in order to succeed. The role played by weather (which can influence the satisfaction received by the customers) is emphasized by the publication along with risk management.

Taking into consideration the role of weather in the number of people vising a rural area with touristic potential, farmers should pay more attention to the climate and weather information tailored for tourism. These can provide valuable information that could be used in the promotional campaigns to attract visitors in the most convenient months, to schedule some activities for enhancing the satisfaction of tourists and also for implementing risk management activities to reduce unforeseen damage caused by changes in the weather.

Bagi and Reeder (2012) evaluate the factors that influence the decision of farmers to develop agrotourism activities within their facilities [5]. Among others, authors mention the importance of having access to weather information. Mpiti and De la Harpe (2014) conducted a research in which they showed that many "farmers... do not have access to... technologies" specific for this type of tourism [15]. In the last years, the climate and weather data became more easily available and distributed to the public in a friendly way on various websites or through mobile apps. These data can be useful for farmers to better plan their activities, to mitigate some risks and also better advertise their facilities to the potential tourists.

Local authorities should also be interested in developing agrotourism and support farmers investing in these activities because a rural region can thus become a brand well known among tourists.

Anabestani (2016) suggests a few guidelines for creating a brand from these regions: i) pay "attention to certain products" for which the region is known and also to farmers' initiatives; ii) develop facilities and infrastructure; iii) maintain traditions and promote them among tourists [3].

The present paper introduces a series of climate and environmental information customized for all tourism actors (tourist, investors, local authorities) which may be incorporated in the touristic products by entrepreneurs in rural regions, potentially helping them to promote their facilities and attract visitors in a more efficient way. The research presents a free source of such information for Romania namely WECTOU web-based platform [30] that provides climate and environmental information tailored for tourism purpose in a friendly interface and an easy-to-understand language and developed by National Meteorological Administration (Meteo Romania).

Agrotourism in Romania

According to Ciobanu and Turek-Rahoveanu (2016), agrotourism in Romania has "the highest possibility of development", because it is a new type of tourism that gained the attention of tourists in the last years, people wanting to try a form of tourism that connects them more with nature. The authors came to the conclusion that this important potential is not enough capitalized, there being problems related to the lack of financial resources that could be used to develop the rural regions, their infrastructure, create more facilities for tourists at a higher standard and have marketing budgets to promote it [6].

Sima (2018) explains why "rural tourism is not considered a representative product" for Romania, despite its high potential: factors at a macroeconomic level like the lack of vision regarding this subsector of tourism, the lack of communication between the actors involved and also the lack of funds for promoting this type of tourism, most people in these regions not having the resources or the knowledge for developing a marketing campaign that could increase the income by raising the number of tourists coming to that region [24].

Sima (2019) considers that the solution for the development of agrotourism in Romania would be more investments to create more entertaining activities for the tourists and still preserve the culture of the region (traditions, clothes, food, music) and marketing programs

to reach the potential tourists and grasp their attention and interest [25].

Avram (2015) also mentions the potential of this sector, highlighting that this is not sufficient and there is a need for implementing more projects in these regions and invest in the human resources that are employed in the facilities for tourists [4].

Nicula and Spânu (2015) appreciate that agrotourism should incorporate the principles of sustainable development and maintain the "natural and cultural heritage" of the beautiful regions in rural Romania [17].

Pop *et al.* (2017) notice the increase of the units and rooms in rural areas but emphasize that this is not a guarantee of reaching the important potential of agrotourism in the country. The solution mentioned by the authors is represented by a higher quality and more "entertainment activities" [20].

National Institute of Statistics (2019) published a report in which they show the number of agritourist accommodation facilities between 2016 and 2018 [16]. (Table 1).

Table 1. Evolution of agritourist facilities between 2016 and 2018

Agritourist accommodation facilities	2016	2017	2018
Number of units	2,028	2,556	2,821
Number of beds	37,394	44,499	48,574

Source: National Institute of Statistics (2019). Turismul Romaniei. Breviar Statistic. Bucharest: National Institute of Statistics Publishing House [16].

We notice an important increase of the number of units and beds between 2016 and 2018 - 39.1% and, respectively, 29.89%. This evolution proves the potential of this type of tourism in Romania but as Avram (2015) mentioned, this potential should be capitalized through investments [4].

Tenie *et al.* (2018) conducted an analysis of data between 2000 and 2016 regarding agrotourism in Romania and reached the conclusion that there is "an increase of 30 times in the number of arrivals" in agrotourism locations and the agrotourism units increased "more than 5 times". The authors highlight the role played by marketing and financial resources for the development of this subsector of tourism that has a great potential [27].

Furthermore, in the last year, due to the COVID-19 pandemic situation, agritourism attracted even more interest, as shown by the evolution of touristic overnights in 2020 compared to 2019 (Figure 1).

Slusariuc (2018) states that "relief, landscapes…weather", among others, are variables that should be considered when creating a touristic product, contributing to the "authenticity" of the product [26].

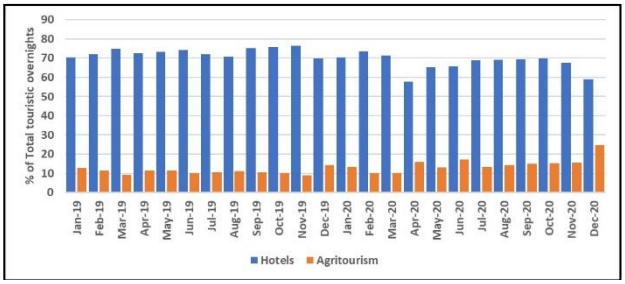

Fig. 1. Monthly data for touristic overnights in hotels (blue) and agritouristic accommodation facilities (orange) as percent from the total number (country level) during January 2019-December 2020.
Source: TEMPO - National Institute of Statistics database [28].

Ministry of Agriculture and Rural Development (2015) presented in its journal 'Romania rurala' an interview with Klaus Ehrlich who mentioned that the main weakness of the rural tourism in Romania is represented by the poor communication and marketing that fail to promote it to international markets [14].

The "weak promotion" is also mentioned by Răbontu et al. (2017) who give examples of good practices from the other European countries where rural regions are well known for their food, wine, traditions, music and so on and this should be the strategy for Romanian agrotourism too [21]. Gherasim and Gherasim (2017) highlight the importance of marketing courses for creating a better touristic product in rural areas as well as the need to invest in infrastructure, "preserve" culture and "offer leisure activities" and objectives of interest for the tourists [10].

Marketing is an important tool that can be used by owners of these facilities to promote

their products. Also, an important attention should be offered to other products or services that can enhance the satisfaction received by the tourists if used complementary.

WECTOU -A Web-based Platform for climate and environmental information for tourism

The idea of a single place, easy to access, that offers climate and environmental information targeting the four main types of touristic locations started from common questions one asks when planning the next holiday: 'If I go in December in this location, the kids will have the chance for snow plays/use the sleigh?', 'I want to go to a new/'un-discovered'/not so crowded place this year, but where ?', 'My colleague went last year in July in this small, delightful village, with a lot of green areas, and she enjoyed an excellent weather for walking. If I go in April, what are the chances for such a nice holiday?'.

WECTOU was built with such questions in mind and strives to help tourist in enjoying the beautiful touristic places in Romania. The application puts on the map 162 locations, out of which 50 are in rural area, 50 are urban locations, 45 are localities oriented more toward mountain tourism and 17 localities are situated at the seaside or in the Danube Delta. The information is derived from state-of-the art climatological and environmental data from COPERNICUS Programme and it is based on 12 indices covering aspects like bio-meteorological conditions, long-term climate information, touristic conditions.

MATERIALS AND METHODS

WECTOU application offers three main types of information:

- information based on the weather of the last years (2000-2018) from Copernicus Climate Data Store (CDS) [7]. The climate information refers to thermal stress, number of days with pleasant/acceptable weather for outdoor activities, snow cover and snow depth, green cover, respiratory comfort and frostbite risk. This information is aggregated at monthly scale, using the data for the entire period considered.
- information updated daily or up to 10 days, using observations from meteorological satellites available from Copernicus Marine Monitoring Services (CMEMS) and Copernicus Land Monitoring Service (CLMS), for sea temperature, green cover and snow cover.
- forecast information for pollen and pollution (PM10) concentration levels and sunburn risk, available from Copernicus Atmosphere Monitoring Service (CAMS). The information presented through WECTOU is based on the numerical forecast for 'tomorrow' being aggregated in the form of daily mean, from hourly data, for the second day of the forecast.

More detailed information on the indices used is available in the WECTOU application under 'Climate and environmental information -Description of indices' section or by contacting the authors.

The choice of indices included in WECTOU was underpinned by potential users/tourists' preferences, which are provided by several sources like the results of the questionnaire used in the market analysis prior and during the application development, scientific literature or results from European research projects targeting the tourism sector like EU-MACS, which show, based on interviews with stakeholders in European countries, highlight that information contained in indices like those on human comfort or useful in evaluation the climate suitability of a certain destination (e.g., HCI; snow information) are of interest [8]. Furthermore, studies at European level [9] highlight that tourists from the first five countries with the highest numbers of residents making outbound trips in 2015 list 'nature' and 'sun and beach' among the 5 top reasons for travelling, suggesting that additional environmental information (e.g., on scenery, certain vegetation type growing season etc.) may be relevant for tourism. For the rural tourism in particular, no specific indicator – either climate-based or environmental – has been identified as a practice, as the rural tourism is an emergent but still not well-defined type of tourism. Nevertheless, based on the scarce information available, general interests of tourists in the rural areas are closely linked to

the natural beauty of landscape (abundant vegetation/ crops/ forests/ snow cover during winter); thus, a specific indicator (Green Cover Index) has been built based on satellite-derived biophysical information provided by Normalized Difference Vegetation Index (NDVI) and it is provided through WECTOU.
The application has been released on 30 June 2020 and it is currently in the market trial phase. The sustained communication and marketing campaign developed so far through social media, written and online press or personalized contacts with tourism investors (e.g., managers of accommodation units, local authorities, tourism agencies) made the application known to a large pool of potential users. Unfortunately, the limitations imposed by the COVID-19 situation brought a strong decrease in all tourism-related areas, all over the world. In Romania, in particular, as shown by National Institute of Statistics [17] in their report from 2021 that the number of overnight stays decreased by 51.6% in 2020 compared with 2019 (45.3% the decrease for Romanian tourists and 81.1% for the foreign tourists). The sanitary and socio-economic situation imposed strong limitations for tourism but also led to a much lower interest of the people in subjects/news related to tourism. In this context, the potential success of the WECTOU application, in terms of user uptake or its impact on touristic circulation or business outcomes, could not be evaluated so far.

RESULTS AND DISCUSSIONS

One of the climate information oriented on tourism and provided by WECTOU refers to the number of days with good/fair weather for outdoor activities. This information is derived from the HCI (Holiday Climate Index) indicator [22]. The index takes into account thermal aspects (i.e., thermal stress), precipitation, wind speed and cloud cover for every day; the combination of these weather parameters allows to compute a complex index which quantifies how pleasant is the weather for leisure activities outdoor. WECTOU application presents this information at monthly scale, in the form of number of days with good and very good or acceptable/fair weather conditions for outdoor activities.
Figure 2 presents an example of this information for two rural localities- Săcelu (Gorj county) and Cheia (Prahova county).

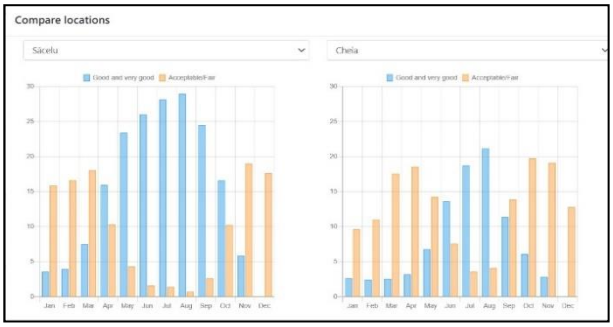

Fig. 2. Comparison of the index 'Weather for staying outdoor' for rural localities Săcelu (left) and Cheia (right) (comparison option is available for registered users of WECTOU application).
Source: [30].

The comparison shows that in April there are about 16 days with pleasant weather for outdoor activities at Săcelu, while at Cheia there are only 3 such days; similarly, during August at Săcelu almost all days are characterized by at least acceptable weather for staying outdoor, while at Cheia there are only 26 such days (about 5 days are characterized by 'bad' weather - not at least acceptable, e.g., too windy or too much rain for outdoor activities). This type of information may be used by the tourism investors in these areas either by adding the information to the 'image' of their product (e.g., 'The nice weather lasting from April to October allows relaxing activities outside') or by covering the 'bad weather' days with offers for indoor activities (e.g., wine testing; cooking demonstrations etc.).
Another potentially interesting information for tourists is the Snow Cover, which is provided through WECTOU at climatic scale (as average over the period 2008-2018, based on data available in CDS) and in Near Real Time (as average over 10 days and available from CLMS). This information is provided for cold season only– from October to April, in the form of number of days with at least 50% or 100% snow cover with respect to a 10x10km area including the locality of

interest (in climatic mode) or as 500 m in NRT regime.

We show in figure 3 an example of Snow Cover information for localities Moisei (Maramures county) and Soveja (Vrancea county).

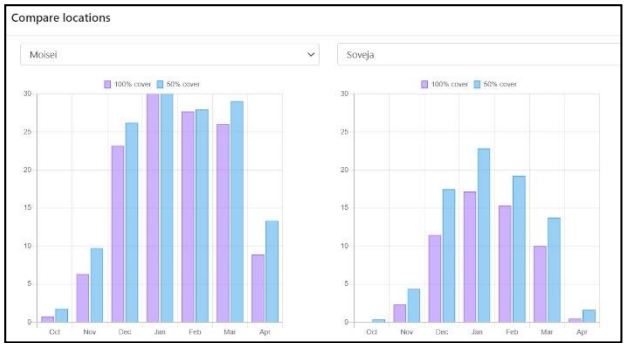

Fig. 3. Comparison of the index 'Snow Cover' for rural localities Moisei (left) and Soveja (right).
Source: [30].

At Moisei, during January, the entire area including the locality is, as based on 2008-2018 data, fully covered by snow; even in April there may be encountered up to 13 days with at least 50% snow cover, from which 9 days are characterized by 100% snow cover. At Soveja, January is also the month with most days with at least 50% snow cover (23 days), but in general during the cold season there are less days with snow cover, each month, than at Moisei. For both localities, the information may be used to promote the natural conditions of the touristic destination, either as e.g., 'white winter' (at Moisei) or as e.g., 'days when you can taste the old white winters'.

An example of environmental information provided by WECTOU is the Green Cover Index (GCI), defined as the degree of greenery of the vegetation. GCI is a newly developed index within WECTOU aiming to provide environmental information for rural area. The underlying justification is based on the scarce information available regarding the rural tourism, which shows that general interests of tourists in the rural areas are closely linked to the natural beauty of landscape (abundant vegetation/crops/forests/snow cover during winter). Scientific literature exploring the user-knowledge from 'ScenicOrNot' crowdsourcing data (http://scenicornot.datasciencelab.co.uk/) also shows that 'nature' (e.g., vegetation extent, orography) is one important element for the subjective perception of a 'scenic' image, although it highlights that some built elements (e.g., building with historical or emotional load like castles or cottages) also have a contribution to the 'scenic' attribute of an image [23]. These findings suggested that satellite-based information regarding the vegetation characteristics -in particular the presence of green vegetation and its extent – may be used to derive environmental information of interest for touristic purposes in rural areas.

GCI indicator is based on Normalized Difference Vegetation Index (NDVI) which is derived from satellite observation and provided through WECTOU at climatic scale (as average over 2008-2018 period, based on data available in CDS) and in Near Real Time (as average over 10 days) based on data available from CLMS. NDVI index is used to assess whether or not the target being observed contains live green vegetation. In WECTOU, the NDVI is used to derive information on how much green vegetation is found in a certain area, defined as the area of the locality plus a 1km buffer around it. The GCI index is intended primarily for rural areas but at the moment it is provided for all localities included in WECTOU application.

In figure 4 we present an example of Green Cover index based on NRT information for period 1April- 3 October 2020 for localities Călacea (Timis county) and Balvanyos (Covasna county).

It may be easily seen that at Balvanyos from June to September the vegetation is green in the entire area of the locality, while at Călacea the maximum area of green vegetation (about 23%) may be expected during the last decade of July, the rest of the summer more greenish (e.g., less dense/dryer natural vegetation) is encountered. Just as in the previous example, this type of information may be used either to promote directly the advantages of the greenery for that locality or to mitigate the shortcoming of the scenery by highlight other alternative opportunities (e.g. spa facilities).

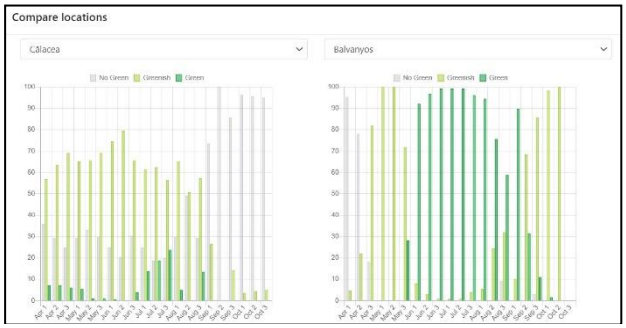

Fig. 4. Comparison of the index 'Green Cover' for rural localities Călacea (left) and Balvanyos (right).
Source: [30].

The information may be incorporated in the general description of the locality/facility or as part of promotional materials offered to tourists, as shown in example in figure 5 or even used to prepare/extend the offers for leisure activities (e.g., taking into account days with unpleasant weather for outdoor activities or with strong thermal stress).

These are just few examples of information available through WECTOU application, which may be exploited by investors and local authorities to strengthen the agritourism in their area of interest.

These types of information are freely available through WECTOU application. Additionally, more detailed information may be accessed through premium packages (e.g. adding your locality if not already in the application, climate data at sub-monthly scale, use original photos and descriptions linked in WECTOU to the host localities) depending on the package, these being customized for advanced users, investors and local authorities, as described in the 'Premium' section of WECTOU application.

Although the COVID-19 pandemic strongly affected tourism and decreased people motivation for travel, there is still interest for these activities. The market research revealed that WECTOU gave ideas to the users for choosing more isolated locations where they can spend their holidays of utmost importance during these times. Also, social-media (Facebook) promotion campaign taking place in February 2021 highlighted the users' interest in the information provided by WECTOU, as shown by the audience monitored through Google Analytics (Figure 6).

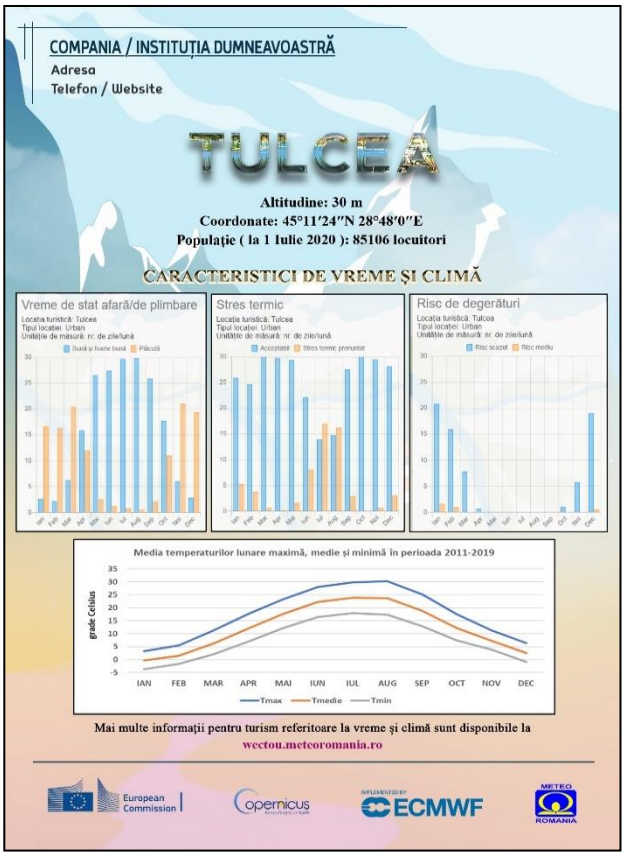

Fig. 5. Example of promotional material (in Romanian) using climate and environmental information from WECTOU application, developed by Meteo Romania. The flyer presented is customized for Tulcea city (urban destination).
Source: [30].

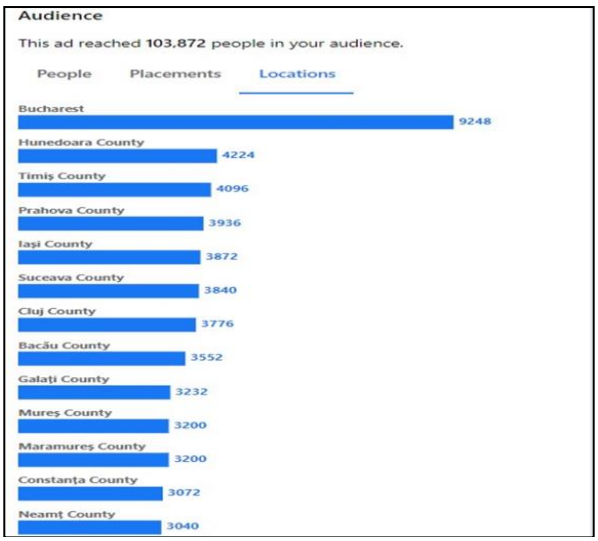

Fig. 6. Audience on Facebook – Locations, on Day 27 (during period 1-28 February 2021) of the Facebook Ad campaign.

It may be noticed that the main location of those that were interested in the ad promoting the WECTOU application is represented by Bucharest, followed by Hunedoara, Timis and Prahova counties which are important regions in Romania from a touristic point of view.
The interest on the information provided by WECTOU application is visible also from the current (and increasing) number of followers on social media channels Facebook (318), Instagram (44) and Twitter (12).

CONCLUSIONS

WECTOU can be used to enhance the value provided by agritourist structures by incorporating it in the marketing mix strategy. The main advantages come from the facts that this application is free and it is developed by Meteo Romania - the national responsible authority in Romania for weather and climate information.
Local authorities and owners of agritourist pensions can use the information provided by this application to better advertise their offer and, thus, attracting more visitors. For those who want more data, tailored for their specific location, there is the solution of using one of the premium packages available for this application or contact Meteo Romania for a personalised offer.
The possibilities are numerous. When defining their services for the tourists, they can include information regarding the indices provided by WECTOU to help tourists better schedule their holiday or their activities during their stay in that location. In this way, the touristic product has a greater value for the tourists and the satisfaction felt can be increased. On the log-term, income may increase too.
Entrepreneurs in agritourist locations or local authorities can incorporate data provided by WECTOU in their flyers or other promotional materials in order to include aspects related to weather and climate when promoting the village or the accommodation facility. Using a product developed by Meteo Romania can contribute to the reputation and image of the agritourist structure in the community but also at a local, regional and national level.
Weather is a factor considered by many tourists when choosing a location so helping them to choose wisely by being more knowledgeable regarding some indices like *weather for staying outdoor, thermal stress, respiratory comfort, snow cover, green cover, sea water temperature* and other indices that are offered by WECTOU is a great way to enhance the value of the touristic product offered in agrotourism.

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RESULTS OF CROSS-BORDER COOPERATION - SWOT ANALYSIS ON EURO-REGIONS

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Abstract

The paper analyses the effects of cross-border cooperation. We have in view the cross-border cooperation between Romania, Rep. of Moldova and Ukraine. Some of the results of this cooperation are the present Euro-regions created between all three countries. We identified the main determinants of development, as well as the main barriers that influenced socio-economic development. The SWOT analysis performed shows the strengths, weaknesses, opportunities and threats for these countries. There were used data from national institutes of statistics, divided into several categories like population and labour force, social and cultural dimensions, agriculture and forestry, other economic activities, transport and technical infrastructure, also there were used results from different publications in this field, including the previous research of the authors. The results show that, at present, there are many differences in the investigated Euro-regions caused by the different national policies applied or the institutional strategies implemented. Each country and each Euro-region has its own opportunities and constraints, also common objectives and they can be the basis for future common inter-state projects or governmental, regional or local economic scenarios.

Key words**:** *cross-border cooperation, euro-regions, SWOT analysis*

INTRODUCTION

Cross-border cooperation between Romania, the Republic of Moldova and Ukraine, in its current form, was launched in 1997, when the "Lower Danube" Euroregion was created. The initiative was followed by the creation of the "Upper Prut" Euroregion in 2000, and later, in 2002, the "Siret-Prut-Dniester" Euroregion. Nowadays, the importance of the Euro-regions mentioned above is greater than the beginning of the cooperation process, from different points of view. Of these, we would like to mention the fact that, at present, the border between Romania and the other two countries represents the eastern border of the European Union (EU). At the same time, we mention the Association Agreement between the EU and the Republic of Moldova and the Eastern Partnership signed in 2014 between EU and both countries. Also, at present, the political conditions are different given the political options in Ukraine and the Republic of Moldova. Another particularity is the length of the borders between states which is considerable, and the characteristics of the territory which is mostly rural. In addition, the North-East Region of Romania is one of the poorest regions in the EU. On the other side of the border, the Republic of Moldova is one of the poorest countries in Europe, and Ukraine has been in deep economic crisis for many years. Of course, there are many other arguments that support the importance of the analysed area in the current international context.

Euro-regions are usually organized to promote common interests across borders and to cooperate for better standard of life for border populations. Cooperation shall create direct and permanent links between areas and communities on both sides of the border. It is based on:

- trust and tolerance, understanding and good cross-border relations;
- efficiency and capacity of services provided to citizens through public-private partnerships on both sides of the border;
- management and joint responsibilities for issues related to: environment, mitigation and prevention of natural disasters, etc.;
- coordination of regional policies on development, flood prevention, mutual assistance in case of emergency;
- revitalization of joint managing authorities based on transparency and respect in the decision-making process [7], [8] and [4].

First of all, some well-established definitions and clarifications for terms used are needed. During the last years a several definitions for Euro-regions and Cross-border cooperation were created. In the next, we want to highlight some of them.

"Creating a prosperous and secure Europe does not depend solely on cooperation between states; cross-border cooperation between local and regional authorities is also needed, without affecting the territorial integrity of the states involved" [16].

"Euro-regions are forms of sub-regional cooperation that contribute to the development of economic and social cohesion of cross-border geographical areas that include administrative-territorial units from neighbouring states, members and non-EU members" [9].

"Euro-regions can be defined as areas or regions of economic interference and not only, in which two or more states jointly capitalize on material and human resources by initiating and carrying out agricultural, industrial, transport and communications activities and programs, tourism, and trade" [7].

"The Euroregion is the territory of local units, on both sides of a border, which are committed to cooperation in order to ensure the balance of interests and increase the standard of living of the population in the area" [1].

„Euro-regions can be defined as European cross-border and transnational cooperation organizations, more or less structured, which bring together institutions with authority ranging from local to regional, or their equivalent, associated to develop a common set of actions or objectives, based on the common interests of the „project areas" concerned" [5].

However we define the Euro-regions, we can conclude that, they were designed in order to support the population to achieve a higher standard of living, without major differences on both sides of the borders, in order to develop the economy of cross-border areas. This objective must be achieved in close connection with the human right, as it is written in international documents, especially Vienna Declaration [17]: "The international community must treat human rights globally in a fair and equal manner, on the same footing, and with the same emphasis. While the significance of national and regional particularities and various historical, cultural and religious backgrounds must be borne in mind, it is the duty of States, regardless of their political, economic and cultural systems, to promote and protect all human rights and fundamental freedoms." "There is a need for States and international organizations, in cooperation with non-governmental organizations, to create favourable conditions at the national, regional and international levels to ensure the full and effective enjoyment of human rights." "Regional arrangements play a fundamental role in promoting and protecting human rights."

By this study, we identify the main determinants of development, which are characteristics and common for all three countries, as well as the main barriers that over the years have negatively influenced socio-economic development of the areas analysed. We consider them very important for the decision makers, at national, regional or local level, in designing the future scenarios for sustainable development of the regions.

MATERIALS AND METHODS

The paper is based on SWOT analysis. A socio-economic analysis was performed on the following dimensions/indicators: population and labour force, social and

cultural, agriculture, forestry and fishing, other economic activities, transport and technical infrastructure. For each category were used and analysed several main indicators: total population, density, age structure, mobility (changes of residence), birth, birth rate, mortality rate, labour renewal, demographic aging, number of employees, population structure occupied by main sectors, number of schools, number of teaching materials, school population, healthcare units by categories, number of beds, health objects, cultural objectives, historical and ethnographic heritage, number of artists, museums, land structure, total land area and average land area by type of farm, agricultural production, yields, structure and production of animals, structure and quantity of agricultural inputs, mechanization (tractors and agricultural equipment), size of the structure of active enterprises, structure of the business environment, number of tourists, tourist accommodation structure, agritourism pensions, accommodation capacity, tourist movement, length of public roads, modernized communal roads, length of railways, modernized railways, sewerage network, natural gas supply network, drinking water supply network, thermal energy supply, communes connected to public utilities.

The data used were provided by the statistical institutes from the three countries, at the level of NUTs 3.

Also, the results from previous research or papers were useful to reach the objectives proposed. Here, we mention the previous studies, which were identify and used in the present paper. Firstly, the results of the joint Romanian-Ukrainian project RUP 2015 („Regional policies in EU and Eastern Partnership Countries – Case study for rural area in Romania and Ukraine", project between The Institute of Agricultural Economics-Romanian Academy from Bucharest and The Regional Research Institute of the Ukrainian Academy of Sciences from Lviv). In this project, there were identified the common strengths, weaknesses, opportunities and threats for Romania and Ukraine. The results of the study were published and revealed the asymmetry in the levels of social and economic development, namely the difference in terms of wages, of self-realization possibilities and the disparities of workforce distribution, which influenced the growth of migration flows. The competitiveness in the Ukrainian-Romanian cross-border region will be defined by potential possibilities of the territory to create necessary conditions to meet the residents', business and investors' needs, etc. This stipulates activation of cross-border cooperation in order to establish intensive formal and informal cross-border markets of goods, services, capital and human resources.

Secondly, the results of the analyses done by the South-east Regional Development Agency from Romania and North-east Regional Development Agency from Romania were taken into account. Both Romanian development agencies have common border with Republic of Moldova and Ukraine. Here, we mention „South-east regional development plan 2014-2020" (2014) and „North-east regional development plan 2014-2020" (2014), which established the main directions of development for 2014-2020, based on the SWOT analysis.

Thirdly, we used the studies carried out by other researchers, authors from Romania or the Republic of Moldova and Ukraine, and here we mention: Nitescu A. (2016) „The importance of clusters in regional development", Serbanescu S. & al. (2016) „Regional policy in European countries", Hrushko O. O. (2015) „Modern aspects of cross-border cooperation on the example of the functioning of Euroregion Upper Prut", Kravtsiv V.S., & al. (coord), 2015 „Rural areas of the Ukrainian-Romanian borderland: socio-economic development", Negut S. (2018) or the personal research of the authors of this paper: Voicilas DM (2017) „Opportunities and threats in North-east Romania – SWOT analysis in Suceava and Botosani counties", Certan I., Certan S. (2015).

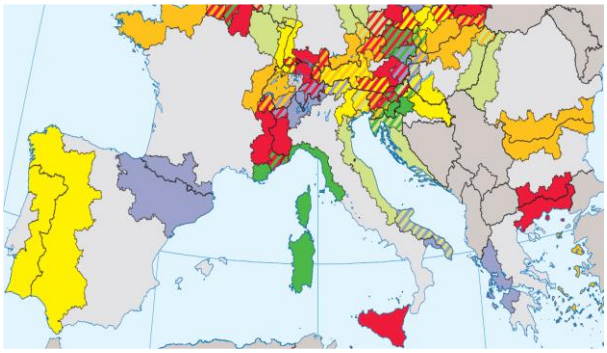
Very useful were the analysis done by Vasylova V. (2012) in the paper "Euroregions in Ukraine-Romania-Republic of Moldova area: Expectations, experience and prospects"

[18]. "The article analyses the phenomenon of Euro-regions and cross-border co-operation in Ukraine, Republic of Moldova and Romania area in a comparative perspective with the Western European practice. It outlines the expected mission of the "Lower Danube" and "Upper Prut" Euro-regions, their general features and particularities, achievements and shortcoming, experience and prospects. The study shows that although the "Lower Danube" and "Upper Prut" Euro-regions did not prove to become self-sustainable structures and after 15 years of their existence reduced their activity, they should be given credit for the positive role in the revitalization of cross-border co-operation between the three neighbouring states on the EU Eastern frontier."

RESULTS AND DISCUSSIONS

From the initial cross-border cooperation, which was based on simple economic relations between states with a common border, in the 70s this concept began to be developed and reached what we now call the Euroregion. Cross-border cooperation emerged in Western Europe, so that later, after the fall of communist regimes, it extended to Eastern Europe, to the current EU border, the border between Romania, the Republic of Moldova and Ukraine. In view of this, cross-border cooperation between the three countries mentioned above can become difficult and different from that between EU Member States. These particularities determined us to consider it important to analyse the development stage of the Euro-regions in eastern Romania, which are the opportunities and the main constraints for the further development of them.

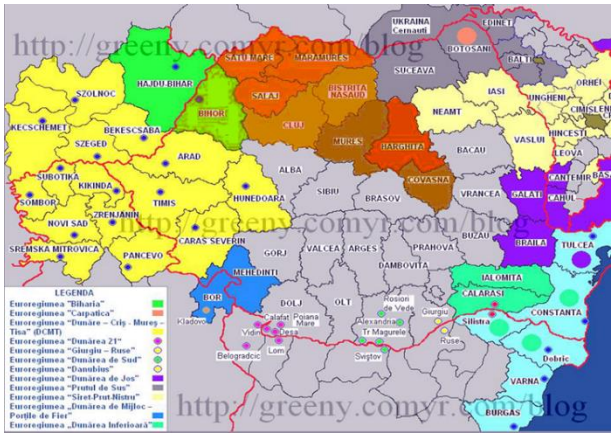
The importance given to cross-border cooperation within the EU is also highlighted by European Commission (EC) documents, through the Directorate-General for the Regions (DG Regio), which supports such initiatives through various measures and funds. Map 1 shows some of the cross-border programs co-financed by the European Regional Development Fund (ERDF), in which every program area is displayed in a certain colour and the shaded areas are simultaneously part of two or more areas of the program. Obviously, at the level of Romania, the two areas in the DG Regio programs are the southern area (border with Bulgaria) and the western area (border with Hungary), areas neighbouring EU states. The cross-border programs with Republic of Moldova and Ukraine are not represented in this figure.



Map 1. Cross-border cooperation programs 2014-2020 (ERDF)
Source: Processing after [3].

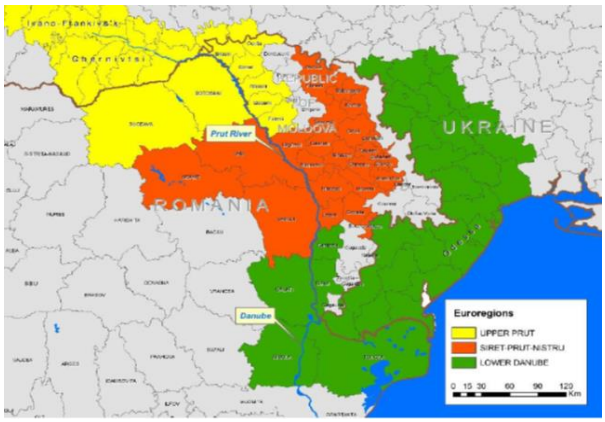
At the same time, the development of the Euroregion concept has also developed cross-border cooperation between EU Member States and non-member states. This is also the case of Romania, as an EU member state but at its eastern border. Unlike Western Europe, where Euro-regions are primarily designed to promote the economic development of peripheral regions, Euro-regions in the eastern EU focus more on education, scientific cooperation, or cultural issues. Emphasis is also placed on the protection of national minorities and efforts are being made to create new opportunities for solving ethnic problems. Another peculiarity of these Euro-regions is that they are based on administrative-territorial units, which is not a general rule in Western European practice.

Now, there are 12 Euro-regions in Romania (Map 2). They are located on all borders of Romania with neighbouring states: Hungary, Serbia, Bulgaria, the Republic of Moldova and Ukraine.



Map 2. Euro-regions in Romania
Source: [16].

Their degree of development and the degree of involvement of the authorities in achieving the objectives set at the establishment are different, depending on the funds available, the intensity of cooperation, the length of cooperation, the interests of the actors involved, traditions, or political factors.
At the eastern border of Romania, the regions that this paper considers for analysis are: Lower Danube, Upper Prut and Siret-Prut-Dniester. These are shown in Map 3.



Map 3. Euro-regions Romania-Republic of Moldova-Ukraine
Source: [10].

The general objective of the Euro-regions between Romania, the Republic of Moldova and Ukraine is to "expand and improve relations between local authorities and authorities in the economic, educational, cultural, scientific, sports and ensuring a sustainable development of the region in the context of European plan" [4].
The objectives pursued can be summarized as follows:

- strengthening democracy and developing territorial administrative units;
- joint resolution of environmental, social and economic threats;
- continuous improvement of transport and communications infrastructure;
- development of cross-border strategic concepts of agricultural marketing, waste recycling, tourism and regional development;
- diversification of activities in rural areas;
- improving the quality of living;
- improving the educational environment;
- preservation of cultural heritage.

The SWOT analysis was built using different information from different authors, also our own findings [5], [11], [13], [14], [15], [19]. We tried to sum up all the results obtained in different studies and present them in a balanced way and putting in evidence only the common aspects for all regions.
Based on the SWOT analysis performed, the main strengths and weaknesses of the Euro-regions were identified and grouped by separate dimensions and indicators.
The strengths identified are presented below.
(1) Population and labour force:
- High population density;
- Balanced age structure of rural active population;
- Availability of skilled personnel in traditional activities;
- Labour force surplus;
- Cheap labour force.

(2) Social and cultural dimensions:
- Hospitality of the population;
- A significant amount of revenues from migrant workers, who are abroad;
- Important cultural-historical and ethnographic heritage represented by numerous cultural objectives (churches, monasteries, museums, memorial houses, mansions, inns and monarch courts);
- Preservation, revival, development and popularization of folk traditions and rituals, massive participation in conducting various folk festivals and professional events.

(3) Agriculture, forestry and fishing:
- Significant agricultural land resources;
- High diversification level of agriculture;
- Significant forestry resources;

- Availability of raw materials for further processing of agricultural products;
- Private ownership of land
- Rich hydrographical network by the presence of rivers: Dnister, Prut, Siret, Suceava and Moldova.

(4) Other economic activities in rural areas:
- Rich natural and anthropic resources (variety and diversity of objectives of national and international interest, with special landscape areas, with natural reserves and protected areas and diverse therapeutic factors);
- The number of tourist accommodation units is on the rise (most of them are represented by agro-tourism boarding houses and chalets);
- The tourist accommodation capacity increased;
- Availability of raw materials for the production of building materials.

(5) Transport and technical infrastructure:
- TEN-T road network;
- TEN-T railway network;
- The sewerage networks increased;
- The natural gas supply networks increased;
- The drinking water supply networks increased;
- The presence of the international airports;
- Significant coverage of the area by mobile communications of various operators.

Among the weaknesses, the most important and common for all three Euro-regions are mentioned below.

(1) Population and labour force:
- Demographic decline of rural population;
- Demographic ageing of population and labour force;
- Strong external migration;
- Elderly population feminization;
- Population mainly employed in the primary sector;
- Low living standards;
- Low salaries.

(2) Social and cultural dimensions:
- Descending trend of educational units;
- Descending trend of the qualified teaching staff;
- School population decreased (school abandonment increased);
- School performance decreases;
- Deficient healthcare staff;
- Precarious remuneration in the healthcare system;
- Inadequate endowment of public units with healthcare equipment;
- Lack of health care units and hospital beds in rural areas.

(3) Agriculture, forestry and fishing:
- Preponderantly agricultural region;
- Presence of (semi-) subsistence household farms;
- Low productivity of crops, as a result of relatively low use of modern inputs, carriers of technological progress;
- Structure of agricultural production is slightly imbalanced (crop production prevalence in total agricultural production);
- Soil degradation emerged as a result of inadequate utilization of fertilizers;
- Weak integration of agriculture to the market.

(4) Other economic activities in rural areas:
- Advanced degradation of many buildings that are historical monuments;
- Lack of programs and financial resources for the renovation of historical buildings;
- The relatively low development level of SMEs in rural areas;
- The disparity in the development of SMEs both in terms of sectoral and territorial structure;
- Lack of infrastructure to support SME development;
- Low levels of communications infrastructure in recreational areas.

(5) Transport and technical infrastructure:
- Low modernization level of highways;
- Low modernization of regular roads in some areas;
- Poor existing infrastructure of local border crossing check-points.

Following the SWOT analyses performed by the authors of this paper, but also by other authors, several opportunities were identified, as well as common threats, which target the analysed Euro-regions.

Thus, the opportunities can be grouped taking into account the dimensions and indicators mentioned at the beginning of the study, as follows:

(1) Population and labour force:

- Regional partnerships for the development of education, employment and social inclusion;
- Thematic objectives related to the Europe 2020 Strategy dedicated to human capital.

(2) Social and cultural dimensions:
- European Structural Funds dedicated to improving educational, transport and technical infrastructure;
- EU funds dedicated to regional development and human resources development in the health system;
- EU funds and government programs dedicated to culture and heritage conservation;
- Cross-border cooperation;
- Cultural exchange programs with other localities;
- Promoting old customs, traditions, crafts and customs;
- Outsourcing the old ethnographic and folkloric traditions.

(3) Agriculture, forestry and fishing:
- Diversified agricultural practices;
- Tradition in raising animals;
- Rich forest resources;
- Great fishing potential.

(4) Other economic activities in rural areas:
- Tourism.

(5) Transport and technical infrastructure:
- Presence of trans-European roads and rail networks;
- European funds dedicated to TEN-T road and rail networks.

The following common threats were identified in the analysed Euro-regions:

(1) Population and labour force:
- Birth;
- Migration.

(2) Social and cultural dimensions:
- Increasing the number of children with parents who went to work abroad;
- Decreasing individual and collective school performance;
- The state budget allocated to health care.

(3) Agriculture, forestry and fishing:
-The polarized structure of agriculture;
-Perpetuation of (semi-) subsistence farms;
-Maintaining the unbalanced structure of agricultural production;
-Intensive exploitation and poor industrialization of wood;
-Reduced use of fish potential.

(4) Other economic activities in rural areas:
-Valorisation of the natural and anthropic resources of the region from the tourist point of view;
-The correlation between the natural potential and the developed infrastructure.

(5) Transport and technical infrastructure:
-Use of EU funds;
-Continuation of the economic crisis.

Unlike other EU Euro-regions, those on the EU's eastern border have encountered a number of difficulties over time. First, the ambiguous wording of the first agreement concluded in 1997 complicated the promotion of Euro-regional projects [18]. Thus, internal organizational difficulties prevented their implementation, affecting their efficiency. There were differences of opinion on the role and purpose of setting up Euro-regions.

Then, other difficulties encountered were related to the economic situation in the participating countries, which limited the possibilities of implementing mutual economic projects. Thus, Ukraine, the Republic of Moldova and Romania were not mutually economically attractive countries at that time.

The projects in the Euro-regions analysed depended to a large extent on donor countries and organizations, primarily European funds, which significantly limited the development of cross-border projects.

Last but not least, other problems were related to the imperfections and discrepancies existing at national level, regarding the legislation of the three states, the lack of clear concepts and strategies for reform and sustainable economic development, high customs duties, high prices for transport, inadequate tax regulations, lack of real competition in the market, bureaucracy or corruption.

Difficult relations between central and local/regional authorities, specific to post-communist states, have generated additional problems for cross-border cooperation in the initial stage of their existence.

CONCLUSIONS

The analysis carried out lead us to some conclusions that we summarize below.

The development of these Euro-regions and implicitly the increase of the living standard of the regional population depend on several factors, such as the political, geopolitical, administrative and business ones. They have their origin in the history, culture or traditions of the analysed areas. But, beyond these aspects, we believe that purely economic interests must prevail, and the socio-economic development of Euro-regions depends on public and private initiatives, the investment climate, the desire of administrations, the will of politicians.

In other words, the development of Euro-regions can be achieved through industrial parks and the development of cross-border business infrastructure (agriculture, forestry and fish farming are prerequisites for better exploitation, production and export; population density and availability of qualified staff in traditional local activities recommend areas analysed for policies oriented towards local development based on business with traditional origins; business partnership). Also, the emergence of small and large power plants and the provision of trans-regional connections of national networks can be a factor in Euro-regional development.

Last but not least, the development of cross-border tourism (for the capitalization of natural and anthropic heritage), but also the development and modernization of transport networks and the opening of new border crossing points, can contribute to achieving the objectives of the Euro-regions.

Our findings show that the Euro-regions analysed are very divers and different from each other. The analysed Euro-regions are different not only from each other but also within the same Euro-regions there are differences, either from one country to another, or even within the same country from one area to another. There are many positive aspects which characterize the areas analysed, but negative aspects, as well. They interact permanently and they are, sometimes, very divergent. These characteristics make the process of construction of fair and solid strategies or policies very difficult.

In other words, the cross-border cooperation and the Euro-regions development have multiple implications, as was written by Hrushko, O. O. (2015), “it was determined that the cross-border cooperation projects implementation not only positively affects the development of the region, but also is an effective mechanism for the formation of public opinion on the movement of Ukraine towards the EU.

It is concluded that trans-regional cooperation today is looking for new models of national infrastructures, which includes power systems, transportation and communication network.

The development of a common policy on technogenic and ecological safety, prevention of pollution of river basins, and the development of tourism and recreational activities also must be included in such new model. The implementation of joint strategies must be established and have to include the equalization of socio-economic and political development of border regions”. These conclusions are valid for Republic of Moldova and its policies, as well. Taking into account these principles, we can say that the Euroregion analysed have potential and they will acquire consistency and will develop solidly.

In conclusion, the Euroregion is the future form of international and cross-border cooperation. Cultural, linguistic and traditional links are prerequisites and welcome for strengthening Euro-regions (expression of identity and roots). Pragmatically, in the next stage, these premises are replaced by economic interests. The economy becomes the premise for the future structure of Europe, based on Euro-regions.

Thus, the future Europe can be understood not as a Europe of countries, but a Europe of regions with common economic, social, political and military interests on the international stage.

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CAPITALIZATION OF INTERNAL RESERVES TO INCREASE SALES REVENUE IN AGRICULTURAL ENTERPRISES IN THE REPUBLIC OF MOLDOVA

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Abstract

Sales revenues are considered the determining factor of economic and financial performance of agricultural enterprises in the Republic of Moldova. Their ascending evolution during the period 2005 - 2019 is analyzed by the authors in the light of the polynomial trend of the second degree. The statistical tests performed demonstrated the validity of the model to make predictions. At the same time, the performance of enterprises, which carry out activities in agriculture, hunting and related services, expressed by the financial result before taxation, shows that performance is influenced by other factors, which need to be analyzed at the level of the agricultural entity. The size of sales revenue depends largely on internal factors, specific to the field of activity of the enterprise. These include the quantity sold of products, the unit cost of sold products and the ways in which production is marketed. These factors can be considered as internal reserves to increase sales revenues, which the authors want to demonstrate in this research paper. Internal reserves capitalized to increase sales revenues are analyzed based on the activity of an agricultural enterprise in the Republic of Moldova - LLC „Lemisona". In order to highlight reserves to increase production capacity, the correlation between sales revenues and fixed expenses is analyzed, emphasizing the importance of fixed expenses in reflecting the productive potential of agricultural enterprises.

Key words**:** *sales revenue, expenses, reserves, unit cost, selling price, polynomial trend.*

INTRODUCTION

The fundamental purpose of agricultural enterprises in a market economy is generation of income. An enterprise's income is the financial basis of its activity and one of the main factors influencing the final financial result of the enterprise.

Thus, revenue is the direct formation source for the financial result of an enterprise. In this context, the analysis of income is considered decisive for assessing the place and role of the enterprise in the field of activity, its market position, ability to attract new investment and to develop profitable business [8].

For an efficient activity, the enterprise's income must be correlated with its financial result (profit or loss). In this context, income represents increases during the reporting period in the form of inflows or increases in assets and/or decreases in debt. These increases or decreases influence the net result (profit/loss) of the current reporting year [4].

The revenues of enterprises are classified by types of their activities into two groups (Figure 1).

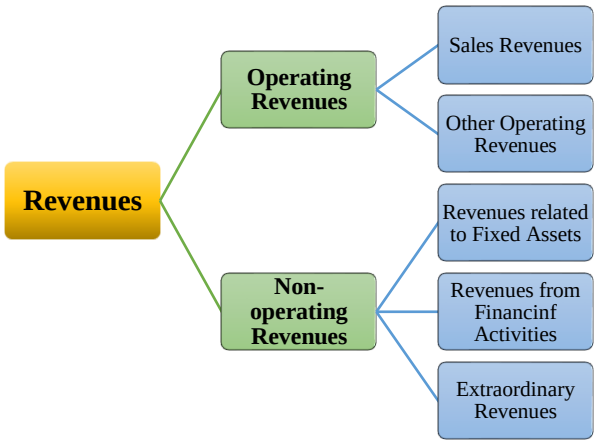

Fig. 1. The structure of an enterprise's revenues
Source: Authors' representation based on National Accounting Standard „Presentation of Financial Statements".

An important component of the eterprise's revenues are sales revenues.

Sales revenues represent inflows of economic benefits generated during the reporting year as a result of the sale of products and goods, the provision of services, the performance of contracts etc. These advantages can take different forms: cash receipts, inflows of fixed assets, receipts of services provided by the thirds etc. [3].

Sales revenues are a fundamental element of profit formation. In addition, both sales revenues and profit are the main economic indicators that characterize the efficiency of the economic and financial activity of the company, as well as its position on the market. [5].

The role of sales revenue as a premise for economic growth and profit maximization come from the following functions they perform [9]:

1. The function of stimulating economic activity. Getting the highest sales revenues is the fundamental goal and a constant trend of all businesses. The higher the revenues, the more profitable business can be.

2. *The function of economic growth.* Sales revenues are one of the main sources of investment, which in turn leads to the growth and economic development of enterprises.

3. *The function of a funding source*. Sales revenues is an important source of funding, as it directly participates in the formation of budget revenues.

4. *The control function over the activity of the enterprise*. The level and dynamics of sales revenues is an important indication of the efficient development of the activity of economic agents. The higher are the revenues, the higher are the qualities and abilities of an enterprise's manager.

Conceptually, sales revenues can be analyzed using the following indicators [6]:

1) *Total sales revenues* - are calculated by summing the revenues obtained from the sale of goods/commodities, the execution of works and the provision of services, as well as other operating revenues.

2) *Net sales income* - is an indicator of the Profit and Loss Statement that includes the amounts from the sale of goods and services that fall into the category of operational activities of the enterprise, after deducting trade reductions, taxes and fees.

3) *Received revenues from sales* - represents the total value of the enterprise'e revenues in a certain period of time, as a result of sales of products and goods.

4) *Revenue from minimum sales* - is the sum of sales that allows to cover all expenses of an enterprise, both variable and fixed. It is determined by the formula:

$$\mathrm{VV_{min}} = \frac{\mathrm{Ch_f}}{1-\overline{\mathrm{CV}}} \quad (1)$$

where:

$\mathrm{VV_{min}}$ – Revenue from minimum sales;

$\mathrm{Ch_f}$ – the amount of fixed expenses;

$\overline{CV}$ - average variable expenses for 1 lei of sales revenues.

5) *Sales revenues made under restrictions.* Restrictions refer to the size of the share capital, the dividend rate, the net profit's distribution rate for self-financing, profit tax rate, the rate of return on the consumed resources. The calculation relation of sales revenues made under restrictions is as follows:

$$\mathrm{VV_r} = \mathrm{K_s} \times \frac{\mathrm{R_d}}{100} \times \left(\frac{100}{100-\mathrm{P_{af}}}\right) \times \left(\frac{100}{100-\mathrm{P_i}}\right) \times \left(1+\frac{100}{\mathrm{R_{rc}}}\right) \quad (2)$$

where:

VV_r - Sales revenues made under restrictions;

K_s – share capital;

R_d – the rate of dividend;

P_{af} – the rate of net profit's distribution for self-financing;

P_i – profit tax rate;

R_{rc} – rate of return on the consumed resources.

6) *Revenues from sales per unit of product or service* - is equivalent to the average selling price per product or the average tariff per unit of services. It is determined as follows:

$$\overline{\mathrm{VV_i}} = \frac{\mathrm{VV_p}}{\mathrm{q_p}} \quad (3)$$

where:

$\overline{\mathrm{VV_i}}$ - revenues from sales per unit of product or service;

VV_p – revenues from sales per type of product or service;

q_p – volume of production sold or number of services provided.

7) *Marginal Sales Revenue* - represents the income related to an additional unit of

product/service that is sold/provided. Thus, it is determined as follows:

$$VV_m = \frac{\Delta VV_i}{\Delta qv_i} = \frac{VV_{i1} - VV_{i0}}{qv_{i1} - qv_{i0}} \quad (4)$$

The revenues at the aggregate level of activity in the field are analyzed through the prism of their evolution in dynamics.

The importance of sales revenues' analysis results from the need of enterprise's management and external users of Financial Statements' information (investors, creditors, suppliers, competitors, tax authorities, etc.) to have detailed information on the enterprise's activity for decision-making. The analysis of sales revenues offers the possibility to assess the following aspects [2]:

- the size and evolution of sales revenues in recent years;
- main sources of revenues depending on the profile of the enterprise (specialization, field of activity);
- stability of revenues' sources;
- diversification of the operational activity of the enterprise;
- the main causes that influence the change in sales revenues.

So, the need to analyze sales revenues results from the importance of analytical information for the enterprise's management and external users of the information from Financial Statements for decision-making.

Thus, regardless of the field in which the enterprise operates, revenue generation is the most important indicator, the main decision criterion for continuing or discontinuing the business. Thus, following the dynamics of revenues and supervising their balanced structure, as well as developing policies to adapt to the external economic environment, becomes an essential requirement in the face of strong competition between agricultural enterprises in the Republic of Moldova. The analysis of sales revenues for agricultural enterprises is a necessity, because the level of the enterprise's expenditures, profit and profitability, as well as its financial situation depend on the size, evolution, structure and stability of sales revenues.

In the context of the above mentioned, the study aims: 1) to analyze the ways to capitalize reserves to increase sales revenues of agricultural enterprises in market economy conditions, and 2) to research the trend of the evolution of sales revenues of enterprises which carry out activities in agriculture, hunting and related services in the Republic of Moldova in the period 2005-2019.

MATERIALS AND METHODS

The researches were carried out based on the data of LLC „Lemisona" from Edineț district, Gordinești village, Republic of Moldova. This agricultural enterprise carries out the following types of activity:

- production and selling of organic agricultural production;
- providing mechanized services in agriculture;
- providing camping services and other short-term accommodation possibilities.

The main type of activity of the enterprise is the cultivation of agricultural crops.

The enterprise delivers agricultural production to processing companies or to markets in the region. At the same time, the company offers mechanized services to local farmers, in case of need.

As practical ways to determine the internal reserves to increase agricultural enterprise's sales revenues, that is the object of this study, the following were taken into account:

a) increasing the quantity of sold products, as the product between the reserve to increase the quantity of each sold product *(R↑Qe)* and the actual size of sales revenues per unit:

$$\Delta V_{Qe} = R \uparrow Q_e \times \frac{V_v}{Q_e} \quad (5)$$

b) reducting the unit cost of the products sold, by multiplying the reserve of cost reduction on each product (*R↓CP*) by its possible sales quantity (V_p):

$$\Delta V_{cp} = R{\downarrow}CP \times Vp \quad (6)$$

c) increasing the average selling price and selling production on more favorable markets determined as follows: the deviation of the share of products sold through different sales channels *(ΔPV%)* is multiplied by the selling price (P_V) established for each channel. The result that is obtained is multiplied by the possible sales quantity of the product (Q_p):

$$\Delta V_{pv} = (\Delta PV\% \times P_v) \times Q_p \quad (7)$$

In order to determine the evolution trend of the sales revenues of enterprises, which carry out activities in agriculture, hunting and related services in the Republic of Moldova, the authors applied the method of analytical adjustment of time series. The time function was selected based on the graphical representation criterion. The time chart of the series of sales revenues for the period 2005 - 2019 shows an increasing curve towards a maximum point. This has led to the conclusion that series change over time in the form of a parabola of a second degree, whose equation is a second degree polynomial.

$$y_{t_i} = a_2 \cdot t_i^2 + a_1 \cdot t_i + a_0 \quad (8)$$

The values of the parameters of the second degree polynomial regression function result from Fermat's equations (3).

$$\begin{cases} N \cdot a_0 + a_1 \sum_{i=1}^{N} t_i + a_2 \sum_{i=1}^{N} t_i^2 = \sum_{i=1}^{N} y_i \\ a_0 \sum_{i=1}^{N} t_i + a_1 \sum_{i=1}^{N} t_i^2 + a_2 \sum_{i=1}^{N} t_i^3 = \sum_{i=1}^{N} t_i \cdot y_i \\ a_0 \sum_{i=1}^{N} t_i^2 + a_1 \sum_{i=1}^{N} t_i^3 + a_2 \sum_{i=1}^{N} t_i^4 = \sum_{i=1}^{N} t_i^2 \cdot y_i \end{cases} \quad (9)$$

RESULTS AND DISCUSSIONS

The evolution of the sales revenues of the enterprises, which carry out activities in agriculture, hunting and related services indicate a clear growth trend (Figure 2).

At a first sight, in the analyzed period, a linear trend is given by equation:

$$y_{t_i} = 1{,}024.598 \cdot t_i + 1{,}055.262 \quad (10),$$

but the approximation error (14.05%) exceeds 7%, which shows that the linear model (10) is not recommended as a trend equation. Also, from the data of the Durbin Watson distribution, it can be stated with a 95% probability that the error autocorrelation is present in this model, respectively this function is not recommended as a function of the trend.

An approximation close to the evolution of the analyzed indicator is given by polynomial function of the second degree (8).

The intermediate data for determining the parameters of the trend equation of sales revenues of enterprises, which carry out activities in agriculture, hunting and related services in the Republic of Moldova are presented in Table 1.

By introducing the intermediate values presented in Table 1 in these equations a system of equations was obtained.

$$\begin{cases} 15 \cdot a + 0 \cdot a_1 + 280 \cdot a_2 = 138780.75 \\ 0 \cdot a + 280 \cdot a_1 + 0 \cdot a_2 = 286887.57 \\ 280 \cdot a + 0 \cdot a_1 + 9352 \cdot a_2 = 2833442.93 \end{cases} \quad (11)$$

Fig. 2. Evolution and polynomial trend of sales revenues of enterprises, which carry out activities in agriculture, hunting and related services in the Republic of Moldova, 2005 - 2019

Source: developed by the authors based on data from the National Bureau of Statistics.

Table 1. Initial and calculation data for determining the parameters of the trend equation of sales revenues of enterprises, which carry out activities in agriculture, hunting and related services in the Republic of Moldova, thousand lei

T	*y*	t^2	y^2	$t \cdot y$	t^3	t^4	$t^2 \cdot y$
-7	4,304	49	18,521,833	-30,126	-343	2,401	210,881
-6	4,003	36	16,025,610	-24,019	-216	1,296	144,115
-5	4,038	25	16,309,482	-20,192	-125	625	100,962
-4	5,476	16	29,982,195	-21,902	-64	256	87,609
-3	4,677	9	21,878,070	-14,032	-27	81	42,097
-2	6,867	4	47,158,435	-13,734	-8	16	27,469
-1	8,119	1	65,918,161	-8,119	-1	1	8,119
0	7,042	0	49,588,355	0	0	0	0
1	8,682	1	75,384,069	8,682	1	1	8,682
2	10,478	4	109,786,388	20,956	8	16	41,912
3	11,495	9	132,130,656	34,484	27	81	103,453
4	14,084	16	198,357,084	56,336	64	256	225,343
5	15,613	25	243,764,519	78,065	125	625	390,324
6	16,826	36	283,105,190	100,954	216	1,296	605,726
7	17,076	49	291,607,535	119,536	343	2,401	836,749
Total	**138,781**	**280**	**1,599,517,589**	**286,888**	**0**	**9,352**	**2,833,443**
	9,252	**18.67**	**106,634,506**	**19,126**			

Sourse: authors' calculation.

It follows that:

a_2 = 58.873, a_1 = 1,024.598, a_0 = 8,153.096

The theoretical model that was obtained has the following form:

$$y_{t_i} = 58.873 \cdot t_i^2 + 1{,}024.598 \cdot t_i + 8{,}153.096 \quad (12)$$

and will be considered a framework for empirical verification of the hypothesis that the sales revenues of enterprises, which carry out activities in agriculture, hunting and related services in the Republic of Moldova have a growth trend, which will be maintained durring the next 3 years.

The analysis performed by the least squares method allowed to find that the free term of the model a = 8,153.096 has a positive value and demonstrates the existence of additional factors in addition to the time factor, which influences the dynamics and whose overall impact is positive.

Analyzing the coefficients of the estimated regression model (11), we note that time has a positive influence on the dynamics of sales revenues of enterprises which carry out activities in agriculture, hunting and related services in the Republic of Moldova.

The coefficient of determination (*R-Square*) was determined according to the calculation formula:

$$R^2 = 1 - \frac{\sum (y_i - y_x)^2}{\sum (y_i - \bar{y})^2} \quad (13)$$

The value of the coefficient of determination is 0.977 and expresses that 97.7% of the variation of the turnover of enterprises which carry out activities in agriculture, hunting and related services in the Republic of Moldova can be explained by the time variable, so in 97.7% of cases the change of variable *t* conditions a change of the resultant variable.

$$R^2 = 1 - \frac{7{,}268{,}273.317}{315{,}511{,}151.368} = 0.977$$

We can deduce that the obtained model largely explains the evolution of sales revenues of enterprises which carry out activities in agriculture, hunting and related services in the Republic of Moldova. In about 2 percent of cases their change is explained by random factors, which were not included in the model, as well as by specification errors.

The quality of the trend model was assessed using the criterion „average approximation error" estimated by the formula:

$$\bar{A} = \frac{\sum |y_t - y_i| : y_i}{n} \cdot 100\% \quad (14)$$

$$\bar{A} = \frac{1.1826}{15} \cdot 100\% = 7.88\%$$

The obtained value of 7.9% is an indication that the model can be used to make predictions (a model is considered to fit the analyzed time series well if the model approximation error does not exceed 12%).

In order to test the hypothesis of mismatch of the revenues'evolution model and to estimate the value of the error or the predicted accuracy of the resultant indicator, the mismatch Theil index (*Theil Inequality Coefficient*) was calculated according to the formula [7, p.63]:

$$K_T = \frac{\sqrt{\sum (y_i - \bar{y})^2}}{\sqrt{\sum y_i^2}} \quad (15)$$

$$K_T = \frac{7{,}268{,}272.317}{1{,}599{,}517{,}589.4} = 0.00454$$

This index takes values between 0 and 1. The more its estimated value tends to 0, the more appropriate the model is to make predictions, as is the case under analysis.The validity of the model is also confirmed by the Fisher test.

$$F = \frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m} \quad (16)$$

$$F = \frac{0.977}{1-0.977} \cdot \frac{15-2-1}{2} = 254.4563$$

The value of the *F* test is 254.45, and F_{tab} *(2;12;0.05)*= 3.89. The inequality *ratio (F> Ftab)* demonstrates that the model is valid.

Another criterion for assessing the quality of the regression model is the autocorrelation coefficient. A model is considered relevant for forecasting in the absence of autocorrelation. Such a situation is met if the value of the autocorrelation coefficient (r_{ei}) takes values lower than 0.5.

$$S_{eY} = \frac{1}{\sqrt{n}} \quad (17)$$

$$S_{eY} = \frac{1}{\sqrt{15}} = 0.258$$

In order to establish that the first degree autocorrelation is missing, it is checked whether the value of the autocorrelation coefficient falls within the range

$$-2.56 \bullet 0.258 < r_1 < 2.56 \bullet 0.258$$

Respectively, this value falls in the range: -0.661 <r_1 = -0.0948 < 0.661, so the autocorrelation is missing.

Another test for autocorrelation of residual variables was the Durbin-Watson test:

$$DW = \frac{\sum(e_i - e_{i-1})^2}{\sum e_i^2} \quad (18)$$

$$DW = \frac{14{,}438{,}154.44}{7{,}268{,}272.32} = 1.99$$

The value of the DW_{calc} = 1,99 was compared with the critical values d_1 and d_2 for 15 variables in the Durbin-Watson distribution table with a significance threshold of 5%.

The lack of autocorrelation of the residual variables is found, if the following condition is met: $d_1 < DW$ și $d_2 < DW < 4-d_2$.

Without referring to the Durbin-Watson distribution tables, we could assume *the lack of autocorrelation of the residual variables*, because 1.5 < *DW* < 2.5, and whereas 1.5 < 1.99 < 2.5.

However, for a relevant conclusion, DW_{calc} = 1,99 was correlated with the values of the *DW* distribution table for *n* = 15 and *k* = 1 (significance threshold 5%).

So, d_1 = 1.08; d_2 = 1.36.

Because 1.08<1.99 and 1.36 < 1.99 < 4 - 1.36, we can say that *the errors are independent.*

The error normality hypothesis was verified using the *RS* criterion:

$$RS = \frac{\varepsilon_{max} - \varepsilon_{min}}{S_e} \quad (19)$$

The residue study shows that the value of the *RS* criterion is 2,866 and falls in the range (*2.7 - 3.7*):

$$Se = \sqrt{\frac{\sum e^2}{n-1}} = \sqrt{\frac{7{,}268{,}272.317}{15-1}} = 720.529$$

$$RS = \frac{931.63 - (-1{,}133.52)}{720.529} = 2.866$$

Therefore, the condition of the normal distribution of model residues is observed. Respectively, the model is suitable for forecasting according to the principle of normal distribution of the residual component. The results of the analysis confirm that the assumptions underlying this model are valid, and the tests performed confirm the quality of the model.

Table 2. Sales revenue forecast based on the second degree polynomial model

Year	Lower confidence limit	Forecast (sales revenue, mil. lei	Upper confidence limit
2020	17,850.27	20,117.73	22,385.19
2021	19,823.16	22,143.16	24,463.16
2022	21,909	24,286.34	26,663.68

Sourse: authors' calculation.

The interpretation of the parameters of the second degree polynomial trend model highlighted the extent to which the time variable can be considered decisive for the evolution of sales revenues, providing a useful forecasting tool for the next 3 years.

The size and evolution of sales revenues require special attention from the enterprise's management, as they are the main source of self-financing. That attention involves the subsequent monitoring, analysis and planning of financial performance indicators [1].

It is important for an enterprise to be able to generate sufficient sales revenues to cover costs and expenses, as well as to generate profits in order to be successful.

In order to do so, it is necessary to examine how much the sales revenues cover the financial results of the company. The results of the analysis allow the assessment of the sufficiency of sales revenues in dynamics, especially in the conditions of operational activity's fluctuation (Table 3).

Table 3. Analysis of the sufficiency of sales revenues of LLC „Lemisona"

Indicators	Year 2017		Year 2018	
	Thousands lei	Share, %	Thousands lei	Share, %
Sales revenues	2,528.5	100.0	3,585.8	100.0
Cost of sales	1,593.0	63.0	2,435.4	68.0
Gross profit (gross loss)	935.5	37.0	1,150.4	32.1
Administrative expenses	255.77	10.1	256.1	7.1
Other operating expenses	101.55	4.0	54.16	1.5
Result from operational activity: profit (loss)	578.15	22.9	840.2	23.4
Result from other activities: profit (loss)	152.17	6.0	-	-
Profit (loss) until taxation	730.31	28.9	840.2	23.4

Sourse: authors' calculation based on Profit and Loss Statement of LLC „Lemisona".

The data presented in the table reflect the insufficiency of sales revenues generated by LLC „Lemisona", its reduced capacity to cover its expenses. There was an insignificant reduction in operational expenses in relation to the size of sales revenues from 77.1% (63.0 + 10.1 + 4.0) to 76.6% (68, 0 + 7.1 + 1.5) compared to the previous year.

This fact influenced the increase of the share of the profit from the operational activity in total sales revenues from 22.9% to 23.4%. As a result, the net profit was formed, which in 2017 made up 28.9% of sales, and in 2018 it decreased to 20.6% of sales.

Enterprise costs can be reduced by reducing production losses, making a more rational use of material resources, production capacity and space, labor and working time.

The main areas for identifying the reserves for reducing expenses at LLC „Lemisona" are:

- reduction of raw material purchase prices;
- reduction of production costs;
- improving the quality of services;
- search for new categories of consumers, access to new markets.

Those costs are closely linked to all the activities of the agricultural enterprise. Thus, it is important to reduce production costs, improve product quality and use production factors as efficiently as possible.

A special role is played by fixed expenses, which are characterized by an index of variability equal to zero, being determined by the production capacity of the enterprise and its field of activity.

The share of fixed costs calculated per unit of product depends on their total amount and the physical volume of the company's production or sales. The study of expenses' behavior in relation to the evolution of sales revenues has special economic and methodological implications [6].

From an economic point of view, fixed expenses express the exploitation of machinery and equipment, including the production areas of an enterprise. Thus, in order to obtain lower fixed expenses per unit of product, an optimal exploitation of the production capacity of the enterprise is necessary.

The relationship between fixed and variable expenses, as well as the ratio between the production expenses and production cost is the basis for making decisions about the enterprise's production capacity. Companies that register high administrative expenses need to charge high prices or achieve a higher production volume.

In assessing the efficiency of fixed expenses, it is important to highlight the correlation between the increase in sales revenues and the increase in fixed expenses. In the case of LLC „Lemisona" there is a decrease in fixed expenses to 1,000 lei of sales revenues in 2018 compared to the previous year by 29.74 lei or 70.6% (Table 4).

The increase in sales revenue by 41.8%, due to the increase in the volume of production sold, denotes the use of a high level of production capacity.

Table 4. Analysis of changes in sales revenues under the influence of fixed expenses at LLC „Lemisona"

Indicators	2017	2018	Relative deviation, %
Sales revenues, thousand lei	2,528.5	3,585.8	141.8
Amount of fixed expenses, thousand lei	255.77	256.07	100.1
Fixed expenses per 1000 lei of sales revenues	101.15	71.41	70.6

Sourse: authors' calculation based on Profit and Loss Statement of LLC „Lemisona".

The favorable effect of the increase of sales revenues is expresed by the reduction of fixed expenses to 1,000 lei of sales revenues. Although the amount of fixed costs increased insignificantly - by 0.1%, - the analysed enterprise must still identify the causes that led to that increase.

Obtaining a financial result, positive or negative, requires a comparison of actual expenses incurred during a reporting period with actual revenues obtained in the same reporting period. Consequently, the financial result obtained allows the assessment of the increase or decrease of the company's assets, thus expressing the gain or loss produced by the enterprise's activity.

At present, in the context of the development of market relations, it is very important for any enterprise to determine the factors that influence the increase or decrease of revenues, as well as to identify all possible reserves to increase sales revenues. Using the example of LLC „Lemisona" we will determine the main reserves for increasing the revenues of agricultural enterprises with ecological profile.

The calculation of sales revenues growth reserves is advisable to start with the worst business scenario (optional) when it is possible to lose part of the market due to competition, difficulties in supplying raw materials, rising fuel prices etc.

The next calculation option should focus on maximum sales volume in the context of market expansion, elimination of competitors, improving product quality etc.

When estimating domestic reserves to increase sales revenue first of all it is necessar to determine the possibility of increasing revenues due to increasing the quantity and quality of agricultural sold products, reducing the unit cost of products sold, increasing the selling price, selling products on more attractive markets. Internal reserves to increase sales revenues are determined for each item.

In order to determine the internal reserves to increase sales revenue due to the increase in the quantity of agricultural products sold, it is necessary to multiply the reserve for increasing the quantity of each product sold by the actual (current) size of income per unit of product (Table 5).

Table 5. Calculation of internal reserves to increase sales revenues due to the increase in the quantity of sold products of LLC „Lemisona"

Products	Internal reserve to increase the sales quantity of the product, q	Sales revenues of the reporting year per unit of product, lei	Reserve for increasing sales revenues due to the increase in the quantity of sold product, lei
Wheat	103	1,523	156,869
Sun flower	126	2,140	269,640
Vege-tables	98	1,051	102,998
Total	327	4,714	529,507

Source: Form No. 21-SALE „Sale of agricultural production" of LLC „Lemisona".

The obtained results show that if the quantity of agricultural products sold by the enterprise will increase by 327 q, then the sales revenues will also increase by 529,507 lei.

The calculation of the internal reserve for increasing sales revenues due to reducing the unit cost of sold products is determined by multiplying the cost reduction reserve for each product by its possible sold quantity. (Table 6).

It is found that, if the unit cost of wheat will decrease by 380.45 lei, and the quantity sold of this product will increase up to 226 q, then sales revenues will increase by 85,981.70 lei.

Table 6. Calculation of internal reserves to increase sales revenues due to the reduction of the unit cost of sold products of LLC „Lemisona".

Products	Internal reserve to reduce the unit cost, lei	Possible sales quantity of the product, q	Reserve to increase sales revenues due to the reduction of the unit cost of sold products, lei
Wheat	380.45	226	85,981.70
Sun flower	412.01	329	135,551.29
Vege-tables	168.72	201	33,912.72
Total	961.18	756	726,652.08

Source: Form No. 21-SALE „Sale of agricultural production" of LLC „Lemisona".

Also, the decrease of the unit cost of sunflower by 412.01 lei will lead to the increase of sales revenues by 135,551.29 lei; the decrease of the unit cost of vegetables by 168.72 lei will lead to the increase of sales revenues by 33,912.72 lei. The reduction of the unit cost for the main agricultural products cultivated by the analyzed enterprise will increase the sales revenues by 726,652.08 lei. One of the reserves to increase sales revenue is to increase the average selling price of marketed products (Table 7).

Table 7. Determining the internal reserves to increase the sales revenues due to the modification of the wheat selling ways at LLC „Lemisona"

Ways of selling the product	The average selling price of the previous year, lei	Quantity of product sold in the reporting year, q	Possible sales quantity, q	Structure of sales, %			Deviation of the average level of the sale price, lei
				In reportind period	posible	deviation	
Perm-anent customers	6,200.3	72	188	69.9	83.2	+13.3	+824.6
Dealers	500.1	10	12	9.7	5.3	-4.4	-22.01
By other means of sale	730.0	21	26	20.4	11.5	-8.9	-64.97
Total	x	103	226	100.0	100.0	x	+737.7

Source: Form No. 21-SALE „Sale of agricultural production" of LLC „Lemisona".

Following the modification of the ways of selling wheat production, the average level of the sale price will increase by 824.64 lei, and the amount of sales income will increase by 186,368.64 lei (824.64 × 226).

In conclusion, we will generalize the reserves to increase the revenues from the sale of agricultural products within the agricultural enterprise analysed in this study (Table 8).

Table 8. Generalization of reserves to increase sales revenues at LLC „Lemisona"

Reserves to increase sales revenue	Amount, lei
Increasing the quantity of sold products	529,507
Reducing the unit cost of sold products	726,652.08
Increasing the selling price of sold products	186,368.64
Total	**1,442,527.72**

Source*:* calculations reflected in tables 3, 4, 5.

Calculations show that if the enterprise will increase the quantity of agricultural production for sale, will decrease the unit cost of the sold production and will increase the average selling price, then the revenues from sales will increase by 1,442,527.72 lei.

In conclusion, we mention that as reserves for increasing the value of the sales revenues of the analyzed agricultural enterprise can be:

-increasing the production's and sale's amount of basic products;

-access to direct contacts with suppliers and, therefore, obtaining a higher discount rate;

-saving materials, labor and financial resources;

-improving the commercial and marketing activities of the enterprise.

CONCLUSIONS

Sales revenue is a fundamental indicator needed to assess the economic and financial activity of the company. This indicator can specify the place of the company in the sector of activity, its position on the market, as well as the capacity to launch and develop profitable activities.

The analysis of sales revenue is closely linked to the strategic position of the company. Thus, an enteprise with a favorable strategic position is usually more dynamic and profitable than other enterprises in the same

sector.

Concluding on the presented analyzes regarding the achievement of the objective of increasing sales revenues of the agricultural enterprise LLC „Lemisona", we can mention that the enterprise recorded positive financial results. This result helped to form an efficient financial statement with the registration of a profitable activity.

The generalization of the data allows us to conclude that LLC „Lemisona" is a profitable enterprise. This conclusion results from the fact that the financial result for the analyzed period is positive because the sum of total revenues exceeds the sum of expenses.

Durring the performed analyses options to increase the performance of LLC „Lemisona", especially by increasing sales and lowering costs, seeking more profitable markets and increasing the productivity of production capacity, were offered. These components are the most significant reserves for increasing the revenues of an agricultural enterprise.

In order to increase the future sales revenues of the analysed enterprise, it is recommended, in particular, to expand the sales market. In the last five years, the enterprise has focused on growing organic crops (corn and sunflower), so its activity must be aimed at determining the market potential; adapting to market requirements, the structure and character of demand; increasing sales by establishing direct contracts with consumers; changing the assortment according to market requirements.

The growing trend of sales revenues in the period 2005-2019 indicates a fluctuation in them over time, with decreases or stagnation in dry years. This fact highlights the need to diversify the activities of agricultural farms by focusing on related activities, such as agro tourism, as well as other areas: growing aromatic and medicinal plants. The orientation towards a new management model of agricultural farms is an imperative for the development of the agricultural sector in the Republic of Moldova.

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