Information technologies of HR management in safety-oriented systems

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***Abstract*—This study considers the solution of the scientific and practical problem of creating automated expert information support systems for decision-making in the field of project team formation in a safety-oriented system (SOS). The purpose of the study is to increase the efficiency of formation of project teams of safety-oriented systems by HR services, as well as to improve the procedure of recruitment and selection of personnel using modern information technologies. A conceptual model-scheme of the life cycle of the development of a specialized intelligent recruitment system for higher education applicants with special training conditions based on the index method of candidate evaluation is proposed. The structure and architecture of the information product are formed. The system consists of many components of HRIS support, which is developed for the information needs of the experts of the admission campaign of higher education institutions with specific learning conditions with subsequent management decisions. Automation of the selection process will provide rapid collection, processing, analysis and reproduction of information, development of human resources, improving the quality of education of applicants in higher education institutions with specific learning conditions. Information systems provide high speed data processing, information retrieval, recruitment optimization and candidate analysis. Automation of HR processes helps to reduce the complexity and cost of resources to perform tasks. The expediency of using artificial intelligence during the heuristic activity of experts is substantiated. The use of information resources, development and integration of information system functionality into a single module to optimize management and decision-making will allow the organization to more quickly and efficiently implement strategic goals and mission. New models, methods and technologies for processing materials and data of applicants for their evaluation in order to further include them in the project team of the safety-oriented system will contribute to the sustainable development of the organization.**

Keywords—information systems, human resources management, project team formation, safety-oriented system

I. INTRODUCTION

In today's world, information and people are among the most important resources. With the development of society and the growing use of knowledge, the amount of information resources is growing, respectively, information technology is increasingly used in various fields. Modern technologies have a wide range of applications, in particular in the process of automating human resource management through the use of information systems (HRIS). Thanks to these technologies, organizations of various forms are able to more effectively plan projects, programs and project portfolios, achieve strategic goals and unleash their potential. Therefore, they should be taken into account in the management of projects, programs and portfolios of projects in the field of human safety and safety-oriented systems, as an important component of critical infrastructure of the state whose purpose is to protect the state.

Safety-oriented system (SOS) is a complex socio-technical system, combined with a number of target components: national safety, civil protection, internal order, protection of public interests. A team of qualified specialists ensures the interests of the state. The team is the basis of effective activity of substructures of the organization and the organization as a whole.

The issues surrounding team building are extremely relevant. Creating a team is the most progressive strategy of the organization. For their preparation, bases for the training of applicants for higher education (HEI) with special training conditions are used.

Special conditions of study in higher education institutions include military service (round-the-clock duty, internships in combat units in conditions of uncertainty) and the educational process (lectures, seminars, independent work, preparation for exams and tests).

All these components determine the high requirements for the standards of training of applicants - future officers. Therefore, an important subfunction (element) of human resources management in safety-oriented systems is recruiting, onboarding and formation of project teams in SOS causation.

High-quality personnel should be selected for educational teams in a higher education institution with specific training conditions that train future specialists in the field of human safety. The project environment of higher education institutions with specific learning conditions operates in changing, turbulent and dynamic conditions, decisions have to be made in conditions of high risk, multicriteria, so we should take into account the best

practices of leading countries in using modern information technologies.

The trend of organizations future development is digitalization and digitization of human resources management processes. The information environment (flows) in safety-oriented systems are often carried out rather slowly due to conservatism in management methods of organizations, complex organizational structure of hierarchical form, and also through its structural and functional links as the general system in which the processes of are realized by regulation, management and information conversion. Accordingly, the implementation of innovations, new ideas and principles of Kaizen (continuous development) is becoming more difficult.

Existing project management methodologies such as PmBOK, P2M, Prince 2 and others are important in practice, but they do not take into account the features and components of special training conditions for applicants in higher education with specific training conditions for safety-oriented systems and the complexity of formalizing system elements.

To reduce the complexity of tasks and resource costs, it is advisable to integrate modern information technology, namely the information system to support the formation of project teams in a safety-oriented system.

II. Analysis of recent research and publications

A theoretical analysis of existing research in the field of project management, programs and portfolios of HR projects and applied IT, showed that this issue is partially described in the works of leading domestic and foreign scientists, including S. D. Bushuev, I. V. Chumachenko, I. V. Kononenko, V. M. Piterska, V. M. Molokanova, V. D. Gogunsky, V. A. Rach, N. S. Bushuyeva, Y. P. Rak, O. B. Zachko, etc.

Professor Bushuyev's scientific school deals with the development of strategic models of entropy management of the organization; an entropic approach to modeling the "infodemic pandemic" system in the case of COVID-19; emotional contamination of managerial innovations in projects, which are described in [1-6]. In [7-8] are developed the coordination of configurations of project products of community development of fire extinguishing systems with the project environment and the model of creating projects of fire extinguishing systems in the community, which is relevant in the context of training applicants in higher education institutions with specific learning conditions.

The issues of intelligent information technologies for providing human resources for projects in a multi-project environment, the use of human resource management tools in a multi-project environment and the application of the method of forming a project management methodology are described in [9-11].

Research of models and methods of project team formation using precedent theory, use of information systems in personnel management, life cycle models as a basis of project management and methods of human resources management of educational projects of higher education institution is described in [12-15].

Problems of functioning of safety-oriented systems in infrastructure projects and training of applicants in higher education institutions with specific learning conditions are considered in [17-20]. However, despite the existing research and standards [16] on project and programs management, the use of information technology in the selection and formation of project teams for the operation of safety-oriented systems is still unresolved.

Research methods. Using system analysis, theoretical and practical aspects (empirical) and project management methodology, as well as basic methodological principles of scientific research, it is possible to describe the life cycle (LC) of develop HRIS in a complex dynamic safety-oriented system (SOS).

III. Results of research

Human resource management is aimed at the effective formation of teams in the organization and their coordination. Today, there are many different digital tools that can make life easier for the HR department. The current trend in the activities of commercial and non-commercial bodies is the use of artificial intelligence, namely decision support tools Enterprise resource planning ERP and human resource management system (HRMS). According to a survey of IBM, conducted among 6 thousand managers of large, medium and small enterprises, 66% of managers agree with the need to introduce intelligent technology in personnel management and other internal processes of the company.

Artificial intelligence contains algorithms that help to quickly collect, process, analyze and organize data. This is software that is specifically designed to automate the processes of forming teams, functions and processes of the organization. The applied solution allows to automate the activities of large firms with a complex structure. The product is developed taking into account the specifics of the organization. When choosing an ERP for HR, it is important to choose one that offers as many opportunities as possible. Here are some of the most common: employee database management (storage, processing, distribution and management of personal data of team members), recruitment: (processes of selection of applicants to project teams). Below is a comparative table of ERP and HRM system functionality.

TABLE I. Comparative table of ERP functional and HRM systems

Features	Features of ERP modules	Features of HRMS
Recruitment	+	+
Basic employee database management	+	+
Evaluation of effectiveness	-	+
Workflows	-	+
Portal for employees	-	+
Reports and analysis	+	+
Training and development of employees	+	-

The main processes of selection of candidates for higher education institutions with specific training conditions that

train specialists in the field of human safety are: submission of applications; collection of primary data; their verification; processing by methods and models of expert assessments followed by medical; psychological and physical testing. Routine data processing tasks consume time and are time consuming for human resources.

The HR department of SOS performs many tasks related to the formation of the project team, namely:

- defining the goals of team building
- deciding on team leadership;
- selection of team members;
- establishing communication between team members;
- distribution of functional responsibilities between team members;
- development of team interaction.

Time in a safety-oriented system is a critical parameter, so the automation of manual processes through information technology unleashes the potential of the organization. The advantage of information systems is to ensure high speed data processing, fast information retrieval, access to information sources regardless of their location, fast information retrieval, reducing the complexity of the use of information resources. All information about applicants is stored in a database. Queries are made by the database management system of the database. For the HRIS SOS (AH) architecture, it is advisable to use a "client-server" (presented in equation 1).

$$AH = \{RDB, DMS, KB, AS, OS, TM\} \qquad (1)$$

It consists of a relational database system (*RDB*) together with a database management system (*DMS*), a knowledge base (*KB*) of subject matter experts, application software (*AS*), organizational and methodological (regulatory) software (*OS*) and hardware (*TM*).

This expert system combines manual control, project evaluation by experts and information processing by means of artificial intelligence. Aggregate data and reports are provided to experts to support the decision to include a candidate in the project team.

Due to the architecture of the information system "client-server" the accumulation of information about entrants and test results (medical, psychological, physiological) will be entered into the database, which will allow rapid processing and issuance of information to experts through the database management system. This system is an interconnected set of tools, methods, models and personnel for processing large amounts of information to achieve this goal.

The HRM information system needs to provide: mathematical, informational, linguistic, software, technical, organizational, legal and data safety (see Fig. 1). The system of requirements is aimed at meeting the information needs of stakeholders of the introductory campaign and the strategic goal of SOS.

HRIS SOS includes subsystems:

- information support;
- technical (information processing means), mathematical (methods and models);
- organizational and methodological (regulatory) support;
- personnel (IT department, financial and HR services) software.

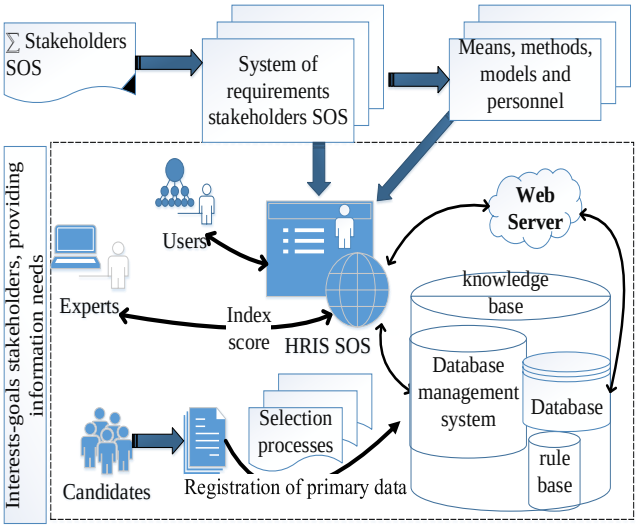

Fig. 1. Structure of safety-oriented system of HRIS

The implementation and integration of the information system requires the training of HR managers with further testing and evaluation of the results of the project product. The development of innovative products uses flexible Agile methodologies and an iterative approach (I), which helps to effectively implement projects taking into account all requests from stakeholders. They minimize risks due to short product development cycles. It is important to consider all stages of the project life cycle: initiation (i), planning (p), implementation (r), completion (z).

$$\Sigma(LC) = \{In\ (p,r,z), AH, CD, R,C, T, O, Vn, tn\} \qquad (2)$$

where, *C* – collection of stakeholder requirements; *R* – evaluation; *CD* – conceptual design; *T* – testing; *O* – operations; *Vn* – product version; *tn* - iteration time.

Thus, we have generalized the conceptual model-scheme of the HRIS SOS development of information system (see Fig. 2).

The conceptual stage of the HRIS project includes the following tasks:

- identification of stakeholders;
- formation of requirements to the system;
- modeling of processes in the organization to achieve goals;
- model of organization;
- information system design.

Due to the architecture of the information system "client-server" the accumulation of information about entrants and test results (medical, psychological, physiological) will be entered into the database, which will allow rapid processing and issuance of information to experts through the database management system.

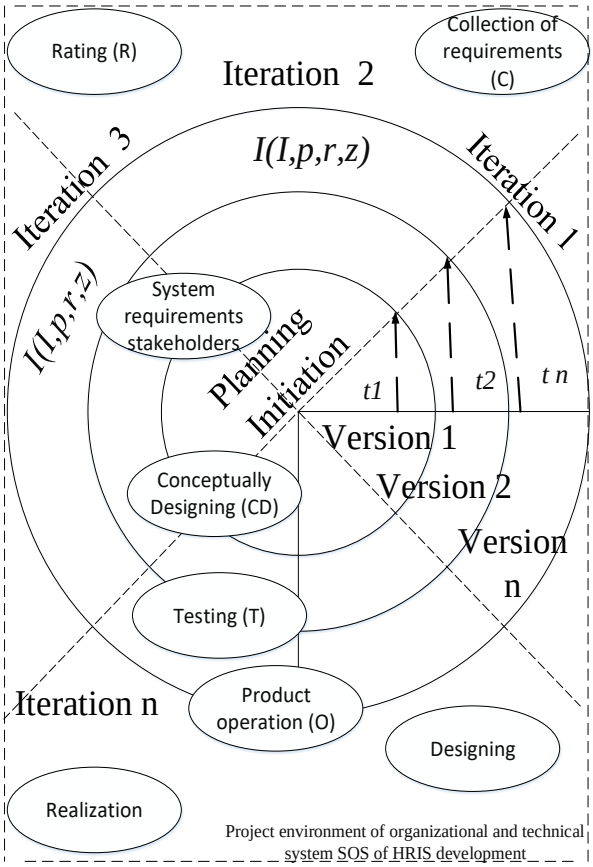

Fig. 2. Conceptual model-scheme of HRIS SOS development of information system

This system is an interconnected set of tools, methods, models and personnel for processing large amounts of information to achieve this goal. An information system to support decision-making in the field of recruitment of higher education applicants with specific learning conditions will help automate the collection of primary data of candidates.

CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCHES

Therefore, on the basis of the conducted research we formed the following results:

1) The possibilities of automation of HR processes and integration of information expert decision support system at the stage of formation of project teams in a safety-oriented system are considered.

2) The model-scheme of the iterative approach to development of information system of management of human resources for establishments of higher education taking into account parameters of special conditions of training is developed.

3) The structure of the intelligent system of the automated selection process HRIS SOS is offered.

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