HR Decision-Making Support System Based On The CBR Method

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***Abstract*–The modern world is filled with an extraordinary amount of information that continuously comes to us from various sources and in various forms. In such an information flow, decision-making becomes a complex task that requires competence, speed and accuracy. One of the effective tools to support this process is decision support systems based on the method of precedents. This work is devoted to the study of the problem of forming precedent models of the software project planning process. The use of such models makes it possible to predict the execution time of a given software development project planning process based on data on the execution of implemented software projects. The method of precedents consists in the analysis and use of similar situations from the past to make decisions in modern conditions. This strategy makes it possible to use the experience and knowledge accumulated earlier to achieve optimal results. It is especially important in fields where it is important to avoid mistakes and ensure the best result, such as medicine, finance, engineering and others. This article is devoted to the consideration of the principles of operation of decision support systems based on the method of precedents and their application in various fields. We will consider the advantages and disadvantages of this method, as well as provide examples of its successful use in practice. In particular, it will be highlighted how systems based on the method of precedents help doctors in making diagnostic decisions, financial analysts in forecasting market trends, and engineers in solving technical tasks. In addition, we will discuss current trends in the development of decision support systems based on the method of precedents, including the use of artificial intelligence and machine learning to improve their functionality and efficiency. This article aims to increase readers' understanding of the importance and application of precedents in decision support systems. After getting acquainted with the material, readers will be able to better use this method to achieve better results in their professional and personal activities, overcome difficult tasks and make more deliberate decisions in the conditions of constant growth in the amount of information and challenges of the modern world.**.

Keywords – project approach, safety-oriented system, project team, CBR life cycle, development of project team members, performance criteria, decision support system, the method of precedents

I. INTRODUCTION

The modern world belongs to the information era. The amount of data that is generated and accumulated every day is growing exponentially.

This endless flow of information requires us not only to store and process it, but also to be able to make the right decisions in conditions of constant growth of data volumes. To achieve this goal, it is important to have effective tools, and one such tool is modern project management methodologies and decision support systems based on the method of precedents.

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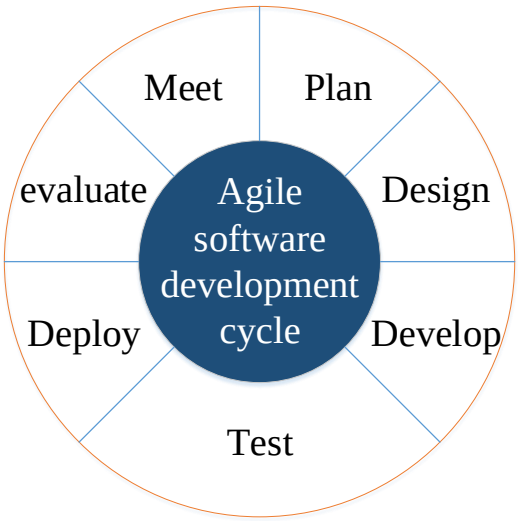

Fig. 1. Agile software development cycle

Agile methods usually promote an orderly process of project management, which involves frequent checks and adaptations, teamwork, self-organization and reporting. It is a set of advanced design methods designed to rapidly release high-quality software and a business approach that ties product development to customer needs and company goals. Agile development refers to any development process that aligns with the concepts of the Agile Manifesto. The manifesto was developed by a group of fourteen leading figures in the software industry and reflects their experience of what approaches promote quality in software development.

The method of precedents is an approach to decision-making based on the analysis and use of similar situations from the past. It allows you to take into account the experience and knowledge accumulated earlier to effectively

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solve modern tasks. This method is especially important in fields where it is important to avoid mistakes and ensure the best result, such as medicine, finance, engineering and many others.

In the article, we will consider the principles of operation of decision support systems based on the method of precedents, their advantages and disadvantages. We will also consider examples of successful use of this method in various industries and tell about modern trends in the development of such systems.

Decision support systems based on the method of precedents (SPPRMP) are a relevant and important component of modern information technologies and management processes. This method allows you to use the experience of past decisions to make optimal decisions in new situations. In this literary analysis and review of sources, we will consider the key aspects of SPPRMP, its application in various fields and prospects for development.

II. ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

The problems of project-oriented management in complex systems have been studied by many scientists, in particular Novikov D. A., Bushuev S. D. [2], Chumachenko I. V. [7], Archebald R. D. [11] and others. In the work of S. D. Bushuyev [2], the processes of project knowledge management were studied. A conceptual model was developed, which contributes to the structuring of data with subsequent transformation into a knowledge base. These developments should be taken into account when developing new models of assessment and selection of higher education applicants with specific study conditions in the civil defense system.

Doctor of Technical Sciences I. V Kononenko [4] in his work "Formation of a project team for the development of information and communication technologies" more meaningfully considers an important aspect of the requirements for the competencies of project members. This contributes to the level of performance and satisfaction of the stakeholders and the life cycle is not fully addressed.

This, in turn, requires the study of a group of life cycle processes in the future.

V. V Morozov [5] achieved significant achievements in the life cycle issues in his work "Functional role approach to the description of the life cycle of projects of project-oriented corporations". In his work, he focuses on development project corporations and identifies the key eight lifecycle stages and their relationship with the formation of key documents, defining the organizational structure, functions and roles of project members as a basis for successful implementation and achievement of goals. But given the specifics of real estate development projects and programs, we cannot fully utilize this methodology in a security-oriented system.

The work "Model of the life cycle as the basis of project management" VM Molokanova [10] systematized the scientific and theoretical aspects of project management methodology to improve the state of the economy. Considerable role is given to the issues of the financial management lifecycle, not to team members. Therefore, based on this work, it is necessary to consider the life cycle model in complex systems for managing the members of the BOS project teams.

It is also advisable to consider the work of Candidate of Economic Sciences Y. S. Grysyuk [17] “Modeling the life cycle of a project team (Life cycle design project team). The author points out the importance of the stage of project stakeholders determination, methods of project team management. It describes all stages of the project team lifecycle and provides examples for the successful functioning of the organization. This work needs further investigation and has been analyzed to describe the life cycle of a Safety Oriented System (LC BOS).

Modern models of planning software projects based on precedents only partially solve the problem of determining the time of execution of processes, due to the discrepancy between the real process "As It Is" and the a priori determined process "How It Should Be".).

To solve this problem, it is necessary to develop an improved model of the software project planning process based on precedents, which allows dynamically specifying the execution time of processes in the work plan based on existing precedents to reduce the time for software development.

RESULTS OF RESEARCH

Thanks to the automation of the HR sphere, we can get up to 90% of routine tasks, in particular:

- Enter data on new specialists
- Track birthdays daily
- Issue wages
- Send newsletters and more

Decision support systems based on the method of precedents have numerous advantages.

They make it possible to increase the efficiency of decision-making, reduce risks and improve the quality of results. In addition, they can work in real-time and provide users with quick access to recommendations and solutions.

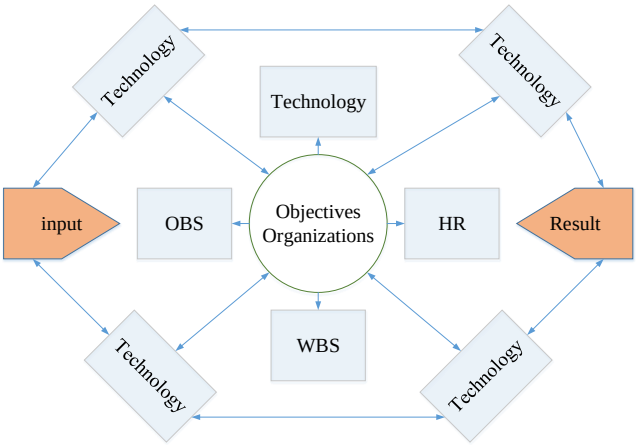

Fig. 2. Objectives organizations

However, there are also disadvantages. SPPRMPs may be limited by the amount of available information and the accuracy of the results, as they are based on historical data and cannot always predict new, unpredictable situations. In addition, the implementation of the SPPRMP may require

significant effort and resources for data collection and processing.

Building an effective project team is a critical aspect of any project's success. Using the theory of precedents can contribute to the improvement of this process. Here are some models and methods of project team formation using the theory of precedents:

Analysis of precedents when forming a team. Start by analyzing similar projects that have been implemented before in your organization or in similar companies. Study which teams were successful and which were not. Consider aspects such as the composition of the team, the role of the leader, cooperation between team members and others. This analysis will help you understand which precedents can be useful in building your team.

Creating a team based on similar abilities and experience. Use information from case studies to select team members with similar abilities and experience. If previous projects have been related to specific technologies or industries, look for specialists with relevant skills and knowledge.

Consideration of roles and resources. Use the theory of precedents to define team roles based on what roles have been effective in past projects. For example, if you know that a previous project required effective risk management, include a risk management expert on the team.

Joint work with the founders of precedents. If you can get access to founders or team members of previous projects, try to bring them on board as consultants or members of your team. Their knowledge and experience can be extremely helpful.

Case-based change management. If your project involves changes to the organization's structure or processes, examine what precedents may indicate the potential risks and benefits of implementing such changes. Feedback with precedents. Do not forget about feedback from teams of previous projects. Once your project is complete, you may set a precedent for future teams. The joint exchange of information and experience can improve the quality of decision-making on both sides.

By applying the theory of precedents to the formation of project teams, you can increase the probability of project success and reduce risks. This approach helps to take into account experience and knowledge from past projects, which can be a key factor in achieving your goals.

Processing – extraction of the most similar precedent for the current task from the library of precedents; Reuse – reuse of a precedent to solve a problem; Adaptation – review and adaptation, if the problem turned out to be somewhat different from the received precedent; Storage – storage of a new decision as part of a new precedent.

The definition of ontology as a formalized subject area built on the basis of concepts involves the allocation of certain components, for example O = (X, R, F), where X is a finite set of concepts (concepts, terms);

R is a finite set of relationships between concepts;

F is a finite set of interpretation functions defined on concepts and relations.

Building precedents based on structural mapping theory:

(SMT – structure mapping theory) allows you to formalize a certain set of implicit constraints using such concepts as analogy and similarity.

According to SMT, analogy is assumed to be a mapping of knowledge from one domain to another domain based on the system of relationships that exist between objects of the base domain and objects of the target domain. Also, an important point is that the expert prefers to rely on a holistic system of interdependent relationships, rather than a set of superficial and loosely connected facts.

Building a precedent using process mining methods. In this case, when building a precedent, ready-made logs of a specific subject area are used, which in the future can be transformed into a full-fledged project plan along with the indication of the time of execution of individual processes, necessary for the implementation of resources and features that arose during each implementation. Thanks to this approach, process models of precedents are built in the work.

TABLE I. MODELS OF PRECEDENTS

№	Model name	Characteristic
1	An ontology-based model.	Such models highlight a set of concepts, terms, relationships between them and their interpretations to obtain the desired description of the subject area.
2	Case diagrams using the UML language	The first approach to modeling includes models designed to display the structure of the object, the sequence of interaction between system elements, the sequence of task implementation, etc. Unified Modeling Language (UML) diagrams greatly facilitate the maintenance of project documentation and increase the effectiveness of communication, as they demonstrate a practical version of the operation of a certain system or process.
3	Process model	It is represented by a graph showing possible sequences of works. Such models determine the permissible sequence of works with the determination of the relevant resources.

TABLE II. AN APPROACH TO BUILDING PRECEDENTS BASED ON EVENT ANALYSIS

Stage 1.	Refinement of the precedent model and formation of a set of restrictions. The goal of this stage is to reduce the number of alternative implementations. This increases the accuracy of the calculation of the completion time of the processes
Stage 2.	Selection of the most profitable precedents with the least delays by performers. At this stage, precedents from the database are compared with precedents from the log.
Stage 3.	Formation of sets of selected precedents for further analysis. This stage allows you to select similar precedents with the necessary indicators into sets for further analysis using the process mining method.
Stage 4.	Processing of sets of subsets of precedents due to the use of the method of intelligent data analysis. The main idea of the stage is to select the most profitable set of precedents in terms of execution time relative to given constraints.
Stage 5.	Isolation of causal relationships from the most profitable set of precedents for building an updated work plan. This step allows you to separate the structure and relationships between the precedents and build a similar refined model according to the input information.
Stage 6.	Arrangement of the updated work plan.
Stage 7.	Adjustment of the time used for the implementation of the existing work plan relative to the selected set of precedents.

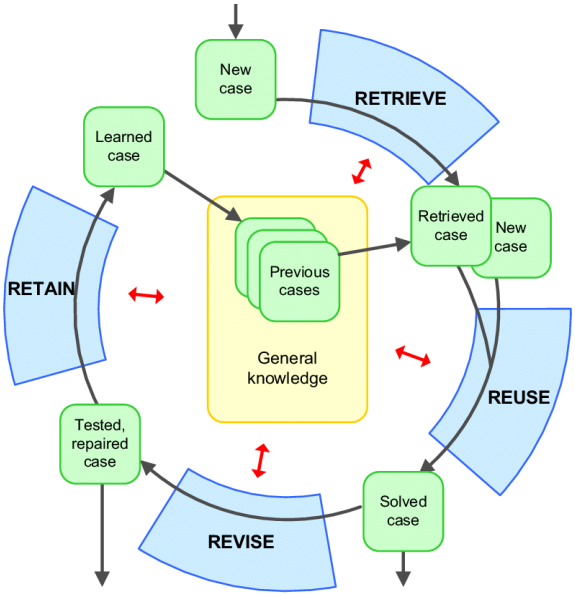

Fig. 3. CBR life cycle

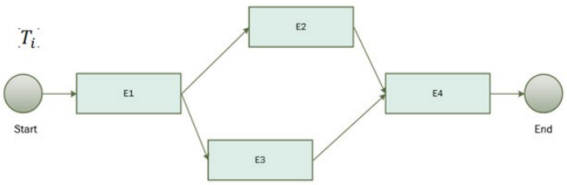

Fig. 4. CBR life cycle

The process precedent contains a sequence of actions for the execution of the process recorded in events E1, E2, E3 and E4 of the log (event log). With the development of artificial intelligence and machine learning technologies, SPPRMP are becoming more powerful and accurate. They can use deep learning to analyze data and provide more accurate recommendations. In addition, with the growth of the amount of data in the virtual environments of the Internet of Things, SPPRMP can become an integral part of "smart" housing and cities.

ACKNOWLEDGMENT

Having reviewed and analyzed decision support systems based on the method of precedents, the reader will be able to better understand their potential and applicability in the modern world, and will also have the opportunity to use this method to achieve better results in their own activities.

Decision support systems based on the method of precedents are a powerful tool for various fields of activity. They allow you to use the experience and knowledge of the past to make effective decisions in modern conditions. Despite some limitations, the development of technologies such as artificial intelligence and machine learning provides new opportunities and prospects for SPPRMP.

Thanks to the use of the developed model, it is possible to reduce the time for planning the project and drawing up technical documentation due to the use of precedents from this project. In the course of the work, the process of planning a software project was investigated and it was shown that the use of precedents makes it possible to increase the efficiency of planning and implementation of software projects based on the use of known practices by executors. Publications on precedent planning were studied and a conclusion was drawn about the need to improve the precedent model taking into account the possibilities of building precedents by means of intellectual analysis of processes.

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