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DEVELOPMENT OF INFORMATION TECHNOLOGY FOR INTELLIGENT PLANNING OF THE IT PROJECT TEAM'S WORK BASED ON A FLEXIBLE METHODOLOGY

The subject of the study is the development of information technology for intelligent planning of the IT project team. The purpose of the study is to reduce project risks associated with the perception of tasks and their distribution among team members within the project sprint by introducing methods and models for intelligent planning of the IT project team. The information technology is developed on the basis of a set of methods and models, namely: a method for intelligent planning of the IT project team; a model for evaluating a textual description of a task; a method for improving textual descriptions of project tasks; a model for distributing sprint tasks among performers; a method for generating recommendations when planning the work of an IT project team. The use of models related to the processing of textual descriptions of project tasks provides a better understanding of the tasks by the team and increases the efficiency of project implementation. The use of artificial intelligence, including large language models, and stable distribution algorithms in management processes contributes to the automation and efficiency of working with project sprint tasks, increases productivity and team cohesion. The result of the study is an information technology based on the integration of artificial intelligence into sprint planning, task allocation, and risk management. The application of the proposed information technology has significant potential to increase project flexibility, efficiency, and overall success. The developed information technology takes into account the project context and expert opinions, which makes it flexible and adaptive to the specifics of a particular project and team characteristics, which is important for further improving project management processes. The information technology for intelligent planning of the IT project team's work will you to assess and reduce the negative impact of factors that threaten the timing and quality of the project by analyzing historical data and modeling team behavior.

Keywords: intelligent planning, information technology, large language model, method, model, IT team, project management, stable

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РОЗРОБКА ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ ДЛЯ ІНТЕЛЕКТУАЛЬНОГО ПЛАНУВАННЯ РОБОТИ КОМАНДИ ІТ-ПРОЄКТУ НА ОСНОВІ ГНУЧКОЇ МЕТОДОЛОГІЇ

Предметом дослідження є розробка інформаційної технологій для інтелектуального планування команди ІТ-проєкту. Мета дослідження – знизити проєктні ризики, які пов’язані зі сприйняттям завдань та їх розподілом між членами команди в рамках проєктного спринту, шляхом впровадження методів і моделей інтелектуального планування команди ІТ-проєкту. Інформаційна технологія розроблена на основі набору методів і моделей, а саме: метод інтелектуального планування команди ІТ-проєкту; модель оцінювання текстового опису завдання; метод удосконалення текстових описів проєктних завдань; модель розподілу завдань спринту між виконавцями; метод генерації рекомендацій при плануванні роботи команди ІТ-проєкту. Використання моделей, які пов’язані з обробкою текстових описів завдань проєкту, забезпечує краще розуміння завдань командою та підвищує ефективність виконання проєкту. Використання штучного інтелекту, що включає великі мовні моделі, і стабільні алгоритми розподілу в процесах управління, сприяє автоматизації та ефективності роботи з проєктними завданнями спринту, що підвищує продуктивність і згуртованість команди. Результатом дослідження стала інформаційна технологія, яка заснована на інтеграції штучного інтелекту при плануванні спринту, розподіл завдань і управління ризиками. Застосування запропонованої інформаційної технології має значний потенціал для підвищення гнучкості, ефективності та загального успіху проєкту. Розроблена інформаційна технологія враховує контекст проєкту та думки експертів, що робить її гнучкою та адаптивною до специфіки конкретного проєкту та характеристик команди, що важливо для подальшого вдосконалення процесів управління проєктами. Інформаційна технологія для інтелектуального планування роботи команди ІТ-проєкту дозволить оцінити та зменшити негативний вплив факторів, що загрожують термінам і якості проєкту, шляхом аналізу історичних даних і моделювання поведінки команди.

Ключові слова: інтелектуальне планування, інформаційні технології, велика мовна модель, метод, модель, ІТ-команда, управління проєктами, стабільний.

Introduction. When managing IT projects, agile or adaptive management methodologies are the most common. Agile methodologies have become the main approach to IT project management due to their ability to adapt to changes, increase team efficiency, and deliver quality results. The agile approach is based on an iterative model that focuses on constant communication between team members, customers, and other stakeholders. Flexibility in planning and adaptation allows teams to cope more effectively with the challenges of the modern IT environment. Scrum is one of the most popular agile methodologies [1]. Scrum is widely used due to its ability to quickly adapt to changes, increase transparency in team work, and focus on delivering value to the customer. The Scrum methodology provides flexibility, promotes effective collaboration, and helps teams adapt to changing project conditions and requirements. However, even within Scrum, there are factors that can affect project success. These include unclear task formulation, insufficient team communication, and problems with task distribution among performers. These factors significantly affect the quality of project planning and implementation, so it is important to create a mechanism for planning the work of the IT project team when applying an agile project management methodology. By implementing this mechanism, the project team will be able to reduce the impact of these factors on project performance and increase team productivity.

Literature review. Information systems and task management tools are used to implement Agile principles. These tools are based on agile methodologies and provide effective communication, progress monitoring, and flexibility in IT project management. The choice of a particular tool depends on the project needs, team size, task complexity, and budget. Let's take a look at the most popular systems.

Jira [2], developed by Atlassian, is a powerful project management tool in the context of Agile methodologies. It allows teams to plan sprints, track

progress, manage tasks, and integrate with other development tools. Jira offers the flexibility to customize workflows and generate reports, making it ideal for a variety of projects.

The visual tool Trello [3], also from Atlassian, allows a team to manage various projects and workflows, as well as track tasks. Trello uses a visual approach to task management with boards and cards. It's easy to use and convenient for smaller teams and projects.

Another product and project management tool designed for effective collaboration between teams is Asana [4]. With the help of this tool, teams plan, track, and manage work when managing projects and tasks. The functionality includes the creation of projects, tasks, subtasks, as well as the ability to comment and attach files, which facilitates collaboration.

Microsoft Teams is a communication and collaboration tool integrated with other Microsoft products [5]. It supports video conferencing, chats, file sharing, document collaboration, and other IT team management tools, making it a popular choice for corporate environments.

The analysis showed that, despite their popularity, the considered information systems lack a mechanism for generating recommendations for the qualitative selection of project sprint tasks and effective distribution among project executors. On the other hand, such systems offer the possibility of accounting for work performance, time tracking, which allows you to collect a lot of data on the project management process.

Many researchers have studied the issues of IT team planning. Some of them address the issue of high-quality planning and execution of project tasks by analyzing surveys of project team members. Based on a Grounded Theory study involving 21 participants from six different companies, [6] presented the challenges and limitations associated with the practice of agile project management in the context of a self-organized team. The study identified eight key project management challenges that arise from self-organized Agile teams at different levels.

The authors of [7] conducted a study based on the grounded theory method using a mixed-methods approach. The key contribution of this study is the creation of a mixed-methods grounded theory on the role of the project manager. Data was collected from a variety of sources, including over 45 hours of interviews with 39 software development professionals, as well as quantitative data from questionnaires completed by 57 respondents. This research highlights the continued presence of the project manager role in agile software projects as part of the shift from traditional to agile ways of working.

Researchers [8] conducted a survey of 477 respondents from 71 Agile teams in 26 companies, and the data were analyzed using structural equation modeling. A positive impact of teamwork quality on team productivity was found when assessed by team members and their leaders. However, there was a negligible effect when team performance was assessed by product owners. The impact of teamwork quality on learning and job satisfaction of team members was significant and positive, but was assessed exclusively by team members themselves.

Some researchers are improving and developing additional features in existing project management systems to improve the quality of project planning and communications. The authors of [9] proposed the Emotimonitor application for Trello, which is designed to collect information about the emotional states of team members in the context of their technical tasks through a user-friendly interface. Emotimonitor allows team members to better express their emotional states through emoji reactions on Trello cards, and provides team leaders with a dashboard that summarizes these reactions in the form of visualizations and statistics. The tool is extensible and has the potential to become a channel for team members working in Agile environments to better express their emotional states.

The results of the study [10] emphasize the need to integrate flexible methodologies (Agile, Scrum) and information systems such as JIRA, Trello, and others to ensure effective project management in the context of BANI (Brittle, Anxious, Nonlinear, Incomprehensible). It highlights the importance of continuous learning and competency development of both technical and soft skills for successful IT project management. The study provides important practical recommendations for IT project managers working in a BANI environment, helping to improve their ability to adapt to new challenges and achieve successful results.

Information technology allows not only to successfully perform project management tasks but also to ensure effective communication between project members. This is due to the fact that many different unforeseen situations, challenges, and threats arise during communication between project team members that require a response from the project manager and team leaders. In [11], the authors propose improving information technology with Jira Software, Jira Service Desk, and Confluence tools, as well as suggestions for improving the structure of internal project communications by optimizing its time performance.

Other authors in their studies focus on the importance of the social aspect when planning the work of a project team.

Paper [12] study focuses on examining the relationship between personality traits and favorable team climate in the context of a telecommunications company. In two replication iterations across geographically dispersed divisions of a telecommunications company, the researchers interviewed members of 19 teams (12 teams in the first iteration, seven teams thereafter). Using correlation analysis and meta-analysis, the survey data were used to identify relationships between personality traits and team climate factors. The authors used regression analyses to determine which personality traits were significant predictors of team climate factors. They suggest that organizations provide support and training to increase the level of integrity of team members. Increasing integrity should promote persistence in achieving team goals and completing tasks.

Based on the theory of social interdependence, the authors of [13] developed a model to study team behavior in the context of Enterprise Systems (ES) implementation. In particular, the interdependence of goals across multiple ES projects promotes inter-team behaviors such as monitoring between ES project teams and adaptability of ES project teams, which in turn leads to higher levels of implementation effectiveness. The model is supported by data from a sample of key stakeholders in recent ES implementations in small and medium-sized Chinese enterprises. Interdependent goals allow for a certain degree of functional independence while achieving goals that are important to the organization as a whole

The global virtual team has become the basis for collaborative work in the modern work environment, which is characterized by cross-border collaboration through digital technologies. The study examines the mechanisms of effective teamwork through information and communication technologies (ICT), while not taking into account the important social context in which this collaboration takes place. To fill this research gap, the study [14] proposes the use of social capital as a multidimensional mediator between ICT use and team effectiveness.

Some researchers consider the activities of an IT project team based on requirements and competencies. Collaboration and teamwork is a unique form of human activity that involves interdependence and shared responsibility for achieving goals and accomplishing tasks, as well as the ability to perform tasks and communicate effectively. Article [15] discusses the selection of a project team, including a project manager, based on an accepted profile of requirements and competencies on the example of an international project.

Article [16] proposes a method of multi-criteria ranking of candidates for a project team, which, unlike existing methods, uses fuzzy ideas about the preferences of candidates when assessing the generalized competence of each candidate based on comparisons with the reference competence, which allows improving the ability to evaluate candidates. Article [17] discusses an example of using the proposed method to solve the problem of selecting candidates to further solve the problem of forming an IT project team under conditions of uncertainty.

The authors of [18] propose a conceptual model of competencies for the success of IT projects, which consists of four interrelated competencies, namely: the emotional state of the project team; social status; cognitive and managerial abilities. To analyze the success of an IT project, a benchmark assessment is used to identify problematic competencies and plan the necessary corrective actions to develop the missing project competencies at the project initiation stage. The typical work structure presented in the article allows for the successful implementation of IT projects.

The analysis of the conducted research has shown that existing approaches to planning the work of an IT project team mainly focus on improving project management information systems, using survey methods, and assessing the competencies of team members. At the same time, shortcomings in the formulation of sprint tasks or errors in the distribution of performers can lead to misunderstandings and failures in the implementation of project tasks. Therefore, it is necessary to take into account the uncertainties and risks inherent in agile methodologies by applying an integrated approach using natural language processing techniques. The development of information technology that uses large language models (LLMs) and stable distribution algorithms will automate management processes, increase task efficiency, and contribute to the coordinated and productive work of the IT project team.

Purpose and objectives of the study. The purpose of this study is to reduce the impact of project risk factors on the successful completion of the project by introducing information technology for intelligent planning of the IT project team's work based on the Agile methodology. This technology will provide an opportunity to improve the formulation of tasks performed during sprints and optimize their distribution among project team members. The technology will automate the analysis of information, identify possible problems, and generate recommendations for describing and distributing tasks to the project team. The introduction of this information technology can reduce risks and increase the efficiency of project management.

Research methodology. The information technology for intelligent planning of the IT project team's work, which is being developed in this study, allows, based on the collection and processing of information from project documentation and data collected in the project management tracking system, to ensure the timely completion of sprint tasks and reduce the risks of ambiguity in the perception of tasks and mismatch of the team's qualifications and interests. The proposed information technology implements a set of data processing functions based on the models and methods proposed in the authors' previous works, namely:

1. A method of intelligent planning of the IT project team's work that facilitates faster and more accurate sprint planning by analyzing retrospective data and using an artificial intelligence model to provide recommendations to the project manager and team [19
2. Model for evaluating the textual description of the project sprint task [20].
3. A method of improving textual descriptions of tasks that allows to increase the accuracy of task perception and reduce the risk of task failure by using machine learning and LLM models to evaluate and improve the text [21].
4. Models for distributing sprint tasks between performers based on the task of determining stable mappings that take into account the specifics of the agile project management methodology and improve the distribution of tasks among project team members [22].
5. The method of generating recommendations for planning the work of an IT project team defines recommendations for describing tasks and assigning tasks based on the intelligent processing of retrospective data,

textual data, and project context and allows you to take into account the risks inherent in projects with an agile methodology [22].

The conceptual model for planning the work of an IT project team is shown in fig. 1.

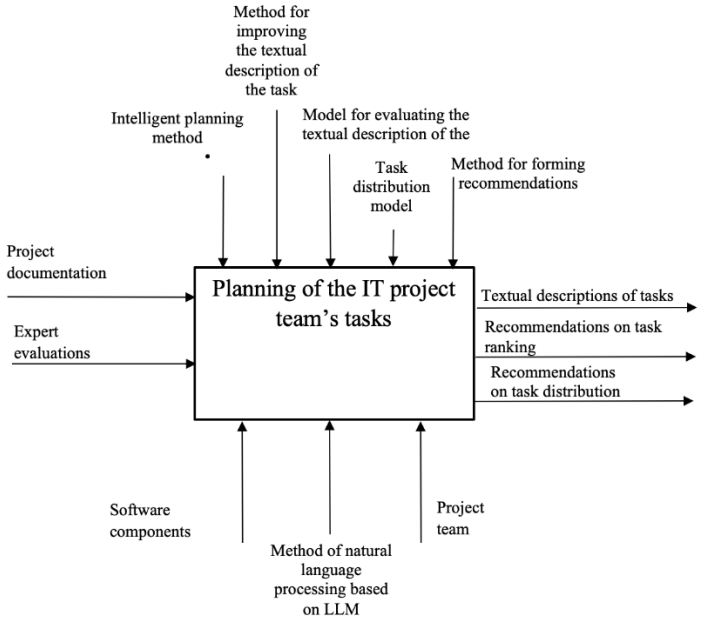

Fig. 1. Conceptual model for planning the work of an IT project team

The input data in the conceptual model are: project documentation and expert opinions. The project documentation includes, among other things, retrospective data on project sprint task descriptions downloaded from the task management system and the project task hierarchy [20]. Expert assessments are used to evaluate the quality of sprint task formulations and the distribution of tasks among project performers, taking into account information about performers' competencies, qualifications, skills, and preferences.

The initial data for information technology are:

- a textual description of the tasks that satisfies the project team (with an assessment of the text's perception);
- recommendations for ranking sprint tasks to prioritize the further distribution of tasks among performers;
- recommendations and options for distributing sprint tasks for the project team.

The main functions of the information technology for intelligent planning of the IT project team are related:

- with collecting, cleaning, and storing project sprint data;
- improving the description of tasks;
- creating options for describing tasks for the project team;
- providing recommendations on the distribution of tasks among executors.

These functions are realized with the help of software components that implement complex algorithms for classification and clustering, natural language processing, generative intelligence, sustainable matching, etc.

The decomposition of the conceptual model for planning the work of the IT project team is presented using the IDEF0 functional modeling methodology [23, 24] and is shown in fig. 2.

Let's look at the key functions of information technology. First of all, let's pay attention to the function related to the implementation of collecting, cleaning, and describing tasks in the task management system. This process is important for organizing and controlling project development processes. Fixing all the information in the tracking system creates a convenient environment for teamwork, improves communication, and ensures that all project participants fully understand the tasks. To increase the perception of task descriptions by the project team, textual task descriptions are processed using machine learning algorithms and expert assessments. The tasks are evaluated by experts, which allows for independent labeling of the data set for binary classification. Positive tasks include tasks with high quality descriptions that are understandable to the expert and the time estimate for them is most likely to be adequate. Tasks that are incomprehensible to the expert receive negative marks. The assessment of the quality of the wording is determined by the level of the expert's awareness of the specifics and context of the project, while increasing the number of experts has almost no effect on the result [20]. Adding wording assessments during the sprint retrospective to train the classifier model and involve project team members as experts is appropriate.

The results of experiments [20] indicate the need to include experts with a deep understanding of the project to develop an effective classification model aimed at assessing the quality of textual descriptions of sprint tasks. The effectiveness of such a model largely depends on the correct choice of the vectorization method and the adaptation of the classification model [25] to the specifics of the data obtained from the tracking system.

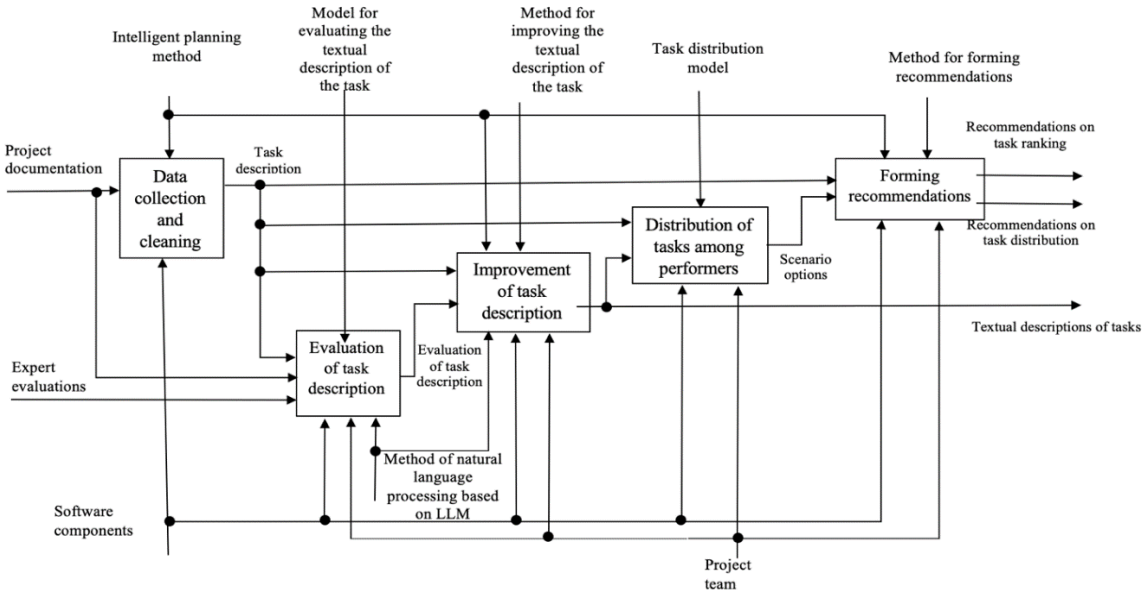

Fig. 2. Decomposition of information technology functions for intelligent planning of the IT project team based on an agile methodology (IDEF0)

Based on the results obtained in [21], we can conclude that some tasks can indeed be dramatically improved for understanding with the help of LLM. They can be used in the work of a project manager to formulate sprint tasks and improve team efficiency through the linguistic features of tasks. With this approach, the project manager chooses the wording options for the task description, which the LLM evaluates and assigns points based on its clarity and comprehensibility. The project manager can use these recommendations to improve the task description for the project team [22]. When creating a project product backlog or project sprint, the project manager is given two options to choose the most favorable task description. To do this, they need to review and reformulate the task descriptions of the sprint to reduce project risks and increase the quality of project execution.

The distribution of tasks in a project sprint between performers can affect the fulfillment of project sprint tasks. This may be due to a lack of qualified performers or switching performers to other specific tasks. To avoid these situations, methods of finding stable pairings are used. According to the research results, the algorithms of stable pairings EADAM [26] and SOSM [27] are the most effective. They ensure the distribution of tasks in a sprint, meet the requirements of developers, and are characterized by low computational complexity. Based on these algorithms, the project manager receives a stable mapping based on the prioritization of tasks and the qualifications of performers, which allows them to successfully complete the project sprint tasks.

The functions related to the formation of recommendations to the project team on prioritizing project sprint tasks and their effective distribution allow to increase the efficiency of project implementation, taking into account the risks of inaccurate task assessment or understanding of their essence.

The developed information technology takes into account the project context and expert opinions, which makes it flexible and adaptive to the specifics of a particular project and team characteristics, which is important for further improving project management processes.

To analyze the impact of the risks associated with the failure to complete tasks in a project sprint, the failure rate per unit of time is used to assess the reliability and efficiency of the workflow [28]. The recommendations applied by the project manager help reduce the number of failures, increase the stability and accuracy of tasks, and ensure the successful completion of the project. The use of a failure rate indicator allows you to track changes in risk exposure and evaluate the effectiveness of implemented management measures. Thanks to this indicator, it is also possible to analyze the effectiveness of using the proposed information technology for planning the work of the IT project team in the face of uncertainty and risks arising during project management.

Analysis and discussion of results. The developed information technology is aimed at improving the efficiency of task management and increasing the productivity of project teams. This technology interacts with existing task tracking tools, such as JIRA, and provides two main functions:

- checking, evaluating, and improving the tasks planned for the sprints;
- recommendations on how to effectively distribute tasks among team members based on their skills, using LLMs to analyze project sprint task descriptions.

Previous studies [19-22] have shown that the risks associated with task ambiguity and skill mismatch can hinder project success. By implementing information technology that improves task clarity and offers task allocation, these risks can be reduced, increasing employee satisfaction and project team productivity.

A project by the company Dominet was considered to assess the effectiveness of implementing information

technology. To evaluate the results of the information technology implementation, performance evaluation experiments were conducted for a small team (up to 5 developers) and a medium team (6-15 developers) during four sprints. The project involved the development of a standard e-commerce platform, which ensured consistency and controllability of the experimental conditions.

The obtained data on key indicators before and after the implementation of the developed technology are shown in tab. 1-4. Metrics for a small team (up to 5 developers) are shown in tab. 1.

Table 1 – Metrics results for a small team

Metric name	Value before	Value after implementation
Defect rate (defects per task)	0,08	0,05
Schedule performance index (SPI)	1,00	1,03
Productivity (tasks for the developer)	5	6
Acceptance rate of recommendations (%)	N/A	75
Acceptance rate of task distribution (%)	N/A	85

Changes in metrics during the four sprints for a small team (up to 5 developers) after the introduction of information technology shown in tab. 2.

Metrics for a medium team (6-15 developers) are shown in tab. 3.

Changes in metrics during the four sprints after the introduction of information technology for a medium team (6-15 developers) are shown in tab. 4.

Table 2 – Changes in metrics during the four sprints of information technology implementation

Sprint number	The level of defects	SPI	Productivity	Acceptance rate of recommendations (%)	Acceptance rate of task distribution (%)
1	0.07	1.01	5.5	65	80
2	0.06	1.02	5.8	70	83
3	0.05	1.03	6.0	77	86
4	0.04	1.04	6.2	80	90

Table 3 – Metrics for a medium team before and after the implementation of information technology

Metric name	Metric value before implementation	Metric value after implementation
Defect rate (defects per task)	0.12	0.09
Schedule performance index (SPI)	0.97	0.99
Productivity (tasks for the developer)	4	4.5
Acceptance rate of recommendations (%)	N/A	65
Acceptance rate of task distribution (%)	N/A	78

Table 4 – Changes in metrics during the four sprints after the introduction of information technology

Number sprint	The level of defects	SPI	Productivity	Acceptance rate of recommendations (%)	Acceptance rate of task distribution (%)
1	0,11	0.97	4,2	55	72
2	0,10	0,98	4,4	60	75
3	0,09	1,00	4,6	68	80
4	0,08	1,01	4,8	75	85

An analysis of the dynamics of defect rates and project team productivity leads to the following conclusions. The indicators have significantly decreased in both cases, which indicates a positive impact on the quality of the tasks performed. The teams improved their schedule adherence, which indicates effective planning due to the introduction of technology. The number of completed tasks per developer increased in both teams. The adoption rate increased over time, demonstrating the teams' adaptation to the technology.

Thus, we can conclude that the proposed information technology has been successfully tested, which makes it possible to recommend its implementation for planning the work of small and medium-sized IT project teams.

Conclusions. Thus, in this paper, we have developed an information technology for intelligent work planning of an IT project team based on the principles of an agile methodology. This technology provides the project team with a mechanism for effective management in the face of risks. It uses data from the project management tracking system, applying LLM-based natural language processing techniques that provide recommendations for formulating sprint tasks, as well as stable matching algorithms that offer recommendations for effective distribution among project team members. The use of modern approaches to natural language processing, including LLM, automates and improves task processing, which in turn increases productivity and team cohesion. The developed information technology for intelligent planning of the IT project team's work allows assessing and reducing the negative impact of factors that threaten the project's timing and quality by analyzing historical data and

modeling team behavior. The proposed models can be easily integrated into popular task tracking systems (Jira, Trello), allowing you to automatically identify problematic tasks and achieve efficiency gains.

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