Considerations in Selecting and Applying Project Management Software for Optimizing Resources in IT Projects: Practical and Educational Aspects

Olena KOPISHYNSKA
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Yurii UTKIN
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Igor SLIUSAR
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Khanlar MAKHMUDOV
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Olena KALASHNYK
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Dmytro ROMANOV
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

Viktor SKRYL
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian University
Poltava, 36003, Ukraine

ABSTRACT

The theory of IT project management largely utilizes general methods, methodologies, and conceptual frameworks. However, with the advent of projects often executed under conditions of uncertainty and task variability, other methodologies, such as Agile, have emerged, influencing the further development of project theory itself. The relevance of this work is considered in several dimensions and is related both to the need to study the features of planning and implementing IT-projects and to the selection of specialized software for implementing modern and effective planning and management methods and tools for IT projects. The work presents the results of practical cases applying various IT project management systems, such as MS Project, Jira, and Trello, during university education. The theoretical study of the formation of the concept for choosing project support systems is based on summarizing feedback from IT company teams that use different tools, as well as on the analysis of annual reports from analytical companies.

Keywords: IT-project, project management system, resource planning, team work management, PMS comparison

1. INTRODUCTION

The theory of project management originated in the mid-20th century when there were objective conditions and needs for the generalization and systematization of the main principles and definitions of project activities. The emergence of international institutions such as the Project Management Institute (PMI) and the International Project Management Association (IPMA) contributed to the development of standards, new methods, and approaches to managing projects, project products, and project teams. Essentially, a new global culture emerged, uniting millions of people around the improvement of the surrounding world, technologies, and knowledge [1].

Under the auspices of PMI, the first version of the collective work "Guide to the Project Management Body of Knowledge" (PMBOK) was published, which has undergone seven editions with updates [2]. This work reflects the evolution of the definitions of all project components, from the very concept of a project, project goals, methods, and life cycle models, to resources, implementation approaches, and realization models, among others.

Evidently, the popularity and value of PMBOK lie in its timely, clear, and comprehensive depiction of all new phenomena and technologies that influence project management methods and techniques. Specifically, the latest edition places more emphasis on the importance of stakeholder engagement, analysis of the project's internal and external environment, and types of project teams. The role of information systems in project management is also particularly acknowledged:

"Over the past 10 years alone, the advancement of software into all types of products, services, and solutions has grown exponentially. What software can enable continues to change as artificial intelligence, cloud-based capabilities, and new business models drive innovation and new ways of working. Transformed organizational models have yielded new project work and team

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structures, the need for a broad range of approaches to project and product delivery, and a stronger focus on outcomes rather than deliverables. Individual contributors can join project teams from anywhere in the world, serve in a broader array of roles, and enable new ways of thinking and working collaboratively. These changes and more have created this opportunity to reconsider perspectives to support the continued evolution of The Standard for Project Management and the PMBOK® Guide."

Changes in terminology, methods, and models have been significantly influenced by the characteristics of IT projects related to software development and implementation since the early 2000s. The Agile Manifesto proclaimed a new philosophy and values in managing IT software development projects [3]. Agile methodologies have profoundly impacted the working style of teams and approaches to implementing IT projects. Moreover, elements of Agile management, such as Scrum, backlogs, and sprints, have enriched the theory and practice of project management itself.

A distinct class of specialized information systems has emerged in the software market to address specialized project management tasks, much like CRM systems, electronic document management, and others. However, in classical treatises, we do not find recommendations on criteria for selecting specialized project management software and methods for their use and quality assessment.

This paper presents the results of practical cases applying various project management systems based on the aggregation of feedback from IT company teams using different tools and verified during practical sessions at the University while studying IT project management methods and tools. The mechanisms of forming the concept for selecting project management systems depending on team types and project types are highlighted.

2. CHARACTERISTICS OF IT PROJECTS AND KEY CHALLENGES IN SOFTWARE PROJECT IMPLEMENTATION

By definition, IT projects are related to the implementation in the field of information technology (IT). The special characteristics of IT projects include a high level of uncertainty, active use of IT technologies, information security measures, and the use of agile project management methodologies [4]. The primary product of an IT project is software. The main processes of such projects can be considered either software development or the implementation of an information system as part of the reengineering of the business processes of the client company.

The features of ERP system implementation projects have been discussed in works [5-6]. Key methods of project implementation were identified, including the incremental project life cycle model, the specific application of WBS and OBS methods, and recommendations for selecting project management systems.

The most significant difference between software and products of other types of projects is that it is not a physical object. Software consists of ideas, designs, instructions, and formulas. The creation of software is almost entirely a cognitive activity. What we can see and measure, such as code files, is only a representation of the real objects, not the objects themselves. However, software only has value when it manifests as something real [7]. When comparing the management of different projects, the first trap that many people fall into is not distinguishing between technology management and project process management.

Software development is a cornerstone of technological advancement, yet it faces numerous challenges and difficulties during implementation. Whether dealing with mobile apps, local applications, SaaS, or web development, the consequences of a software project failure can be devastating and costly. Research conducted by the Standish Group in the Chaos Report provides a comprehensive understanding of why software development projects fail. Published since 1994, the Chaos Report is a snapshot of the state of the global software development industry. For instance, the 2021 report studied 50,000 projects ranging from small improvements to large-scale global IT projects.

According to statistical research [8], the proportion of projects delivered on time by professional service organizations in software development companies ranges between 71.4% and 78.2% (with an average of 74.66%), indicating that one in four projects is delivered late. Recent studies [9] show that only 29% of projects were successful, 52% faced challenges, and 19% were complete failures (Figure 1).

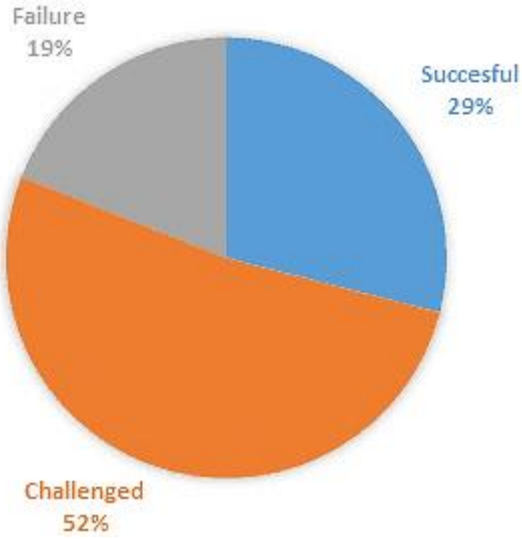

Figure 1. Distribution of IT project success rate [9]

Summarizing the main reasons for failures, the analytical company (Escrow) identifies the following:

1) **Ineffective Budget Control**: Unrealistic expectations regarding time and budget. Research indicates that most software development projects exceed their time and cost estimates [10]. The average cost overrun across all companies is 189% of the initial cost estimate. In terms of time, the average overrun is 222% of the initial time estimate. To mitigate the effect of time and cost overruns, expectations must be carefully managed by the developer.
2) **Poor Communication**: Custom software development projects require clear and transparent communication between the client and the developer. This communication channel should be established from the outset and include every phase of the project, from planning, development, and testing to final implementation. For the best chance of project success, the client must be involved at every stage.
3) **Frequent Changes**: One of the biggest challenges in IT project management is related to frequent changes. According to research, 48% of developers cite frequent changes or poorly documented requirements as one of the main reasons for software development project failures.
4) **Issues with Coordinated Operation of Multiple IT Components**: Another specific problem faced by IT project

development teams is the complex dependencies between IT components: hardware, software, networks, and data. In practice, IT projects inevitably encounter errors and issues in their interactions, not to mention numerous updates, versions, and software releases.

Each year, hundreds of billions of dollars are invested in IT projects. In 2022, the global software market revenue exceeded $600 billion, and it is forecasted to reach $800 billion by 2027 [11]. Reducing the risks of delayed IT projects can thus save enormous amounts of money. However, this task is not trivial, as it is influenced by numerous and quite diverse aspects of IT project management.

These identified problems correlate with the responsibilities of a project manager, which include gathering and structuring project goals, project planning, team formation, coordinating the project team, resource management, documentation, and project closure [12]. One of the primary tools for a project manager is the so-called management triangle to establish a balance among the main project constraints. The sides of the triangle are time (set deadlines), resources (material, financial, and non-material—team), and tasks (all project activities), which together affect the quality (success) of the project. According to analysts, an average of 12% of the project budget is spent on inefficient management. This figure can be significantly reduced: maintaining balance and control over the interrelated management elements (in the triangle) is possible with the help of specialized project management systems. These systems enable the calculation and reduction of risks of project delays within the set budget while accomplishing all project tasks.

3. RESULTS OF STUDYING PROJECT MANAGEMENT SYSTEMS AND FORMULATING SELECTION CRITERIA FOR STUDY AND PRACTICAL ACTIVITIES

The market for information systems offers a wide variety of specialized software products designed for project management. The prototypes of Project Management Systems (PMS) were the PERT (Program Evaluation Review Technique) method, which used network diagrams for project planning and control, and the CPM (Critical Path Method), which determined the critical (longest) path for project execution to determine the total project duration. One of Microsoft's earliest and most well-known products is MS Project [13]. However, today, it competes with hundreds of new programs. Identifying the best one is quite challenging. When referring to ranking reviews presented by analytical or commercial companies, the results are quite subjective and depend on the survey method and ranking compilation. For example, Table 1 shows the results of a search for the top 10 systems as of 2024, taken from various sources.

Table 1. Results of PMS Popularity Ranking Search Based on Internet Sources as of 2024

Rank	**Source A** [14]	**Source B** [15]	**Source C** [16]	**Source D** [17]	**Source E** [18]
1	Trello	Monday.com	Monday.com	Jira	Jira
2	Asana	ClickUp	Asana	Worksection	Microsoft Project
3	Jira	HubSpot	Wrike	Asana	Airtable
4	Microsoft Project	Wrike	Trello	Trello	Smartsheets
5	Basecamp	Basecamp	ClickUp	Monday.com	Trello
6	Monday.com	Microsoft Project	Airtable	Wrike	Asana
7	Notion	Asana	Microsoft Project	Zoho Projects	Kanban

By applying these criteria, organizations can better determine which project management system aligns with their needs and enhances their project management practices.

Data from Table 1 show a high level of competition among PMS providers. Identifying a single leader is challenging; however, the top five systems frequently include Jira, Monday.com, Trello, Asana, Wrike, and Microsoft Project.

Ideally, the use of a PMS aims to enhance productivity and efficiency for both individuals and teams by simplifying and visualizing planning processes, improving coordination, minimizing scheduling conflicts, managing resource availability, and increasing client satisfaction. Therefore, to ensure project success, it is crucial to define a list of requirements for the project management software.

The main criteria and decision-making factors for implementing specialized information systems, as presented in Table 2, have been developed over the past 5 years of teaching disciplines related to IT project management at Poltava State Agrarian University [19]. They are also the result of surveys and consultations with numerous IT companies that are stakeholders of the university and hold leading positions in both domestic and international software markets [20]. This includes both product and service companies.

As seen from Table 2, the university and real companies have different criteria and often end up choosing different systems.

Based on the available key functions and additional capabilities, an integrated data table for the selected 5 systems has been created, which simplifies the choice for use in project activities as well as in the educational process (Table 3).

Functions embedded in the standard version of the system are marked in black. Semi-black indicates that the function is available through third-party providers. A white circle means that the function is either not available or the proposed solutions are unsatisfactory.

When discussing the capabilities of different systems, it is important to note that the presence or absence of certain features is not always a drawback or an obstacle to recommending the implementation and use of a system. For example, the success of Trello and Asana can be attributed to their user-friendly interfaces and high-quality execution, the visualization of the most demanded features – task management, Kanban boards, the ability to integrate personnel, manage multiple projects simultaneously, and the availability of mobile apps.

Ultimately, it is correct to categorize systems into ‘light’ and ‘heavy’ categories. Light systems like Trello and Asana are suitable for teams working on short projects, are easy to implement, and are used in the cloud. For managing complex projects, considering important components such as resource management, resource availability and cost, and reporting, it is advisable to use Jira or MS Project.

Table 2. Alignment with Requirements Criteria for Project Management Systems Implemented by IT Companies and Universities

Criteria	Using PMS Selection Criteria for Teaching Project Management in University	Criteria for Selecting PMS for IT Companies to Support Project Implementation
Rating, Popularity	The system should be popular among universities in similar disciplines and have practical usage reviews available.	Positive feedback from project managers and teams, high ratings in analytical reports
Access to Software	The developer company collaborates with universities and offers discounted licensing packages for students, or provides a free online version.	Availability of cloud-based versions at different tiers, availability of a free trial period, and training materials provided by the developer
Functionality	The system should include essential features for managing projects at all stages, such as task management with dependencies, time and resource planning, financial monitoring, and critical path analysis. Emphasis should be placed on tools and functionalities that align with classical project management theories and practices.	Selection based on advertising, ratings, previous experience, competitor reviews, emphasis on several popular features, and the ability to integrate with existing software for other business processes (such as HR, document management, development environments, etc.)
Addressing System Limitations & Alternative Solutions	The advantages and disadvantages of PMS are the subject of research. It is advisable to examine case studies based on well-known systems with well-argued reviews. Parallel enrollment in specialized courses such as Prometheus and Udemy is practiced to enhance professional skills and incorporate educational examples based on real experiences.	When limitations or mismatches are identified, the solution involves implementing a new system with corresponding consequences: retraining staff, transferring important data, negotiating new contracts and licenses, etc. The preferred solution is to upgrade to a higher level of the existing system with expanded functionality, if available.

Table 3. Data on the basic functions of the most popular PMS

	Gant Chat	Kanban	Scram	Time Tracking	Calendar View	Mobil Apps	Desktop Apps	API	Resource planning
Trello	●	●	○	●	●	●	●	●	○
Asana	●	●	●	●	●	●	○	●	○
Wrike	●	●	○	●	●	●	●	●	●
Jira	●	●	●	●	●	●	●	●	●
MS Project	●	●	●	●	●	○	●	●	●

4. SELECTION AND SEQUENCE OF USING PMS IN TEACHING IT PROJECT MANAGEMENT AT UNIVERSITIES

With the development of global databases, cloud computing, and the popularization of online learning methods, especially during the COVID-19 pandemic, there are now significantly greater opportunities for applying innovative approaches to studying any disciplines, particularly those related to cloud-based information systems. For a long time, MS Project was considered the gold standard of PMS, and numerous educational examples were developed based on it, which remain relevant today for studying classical approaches to project management.

Based on previous generalizations and identifying common features, strengths, and weaknesses, a balance has been achieved: a more comprehensive study of all project components in their classical form is conducted using MS Project. The work [19] provides examples of project planning, using Gantt charts, linking tasks, resource allocation, and many other functions.

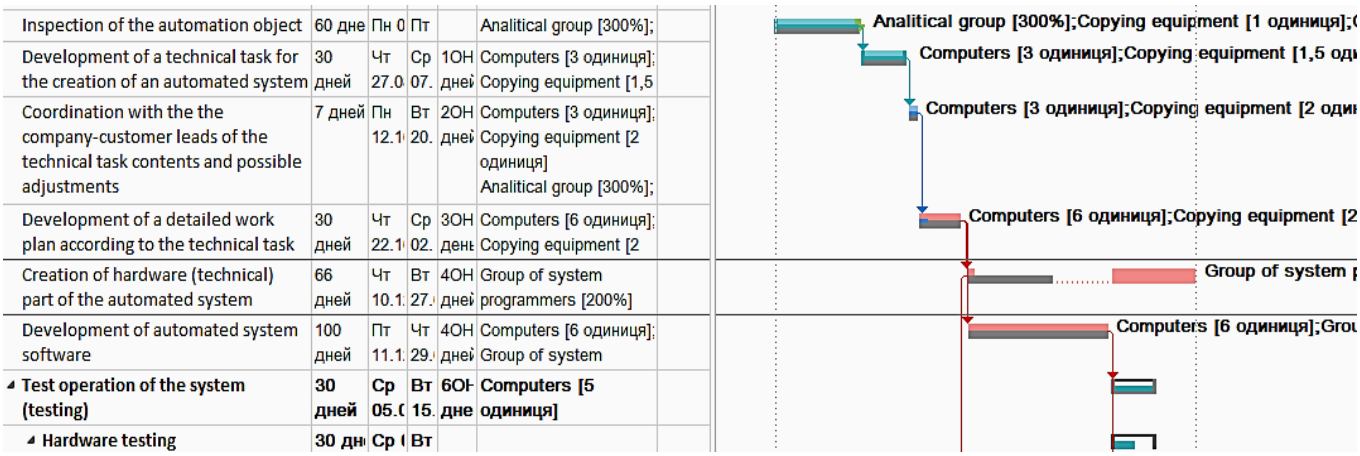

Figure 2. Fragment of project planning in MS Project with resource allocation on the Gantt Chart

However, among the younger professionals in the rapidly evolving IT field, there is a demand for tools that offer more modern features (Table 3).

In the process of studying project management disciplines, the main goal is to develop competencies in future specialists that closely align with market demands [20]. The aim is not to study all possible systems.

When discussing the first case, students practice how, if a given system does not sufficiently visualize team collaboration, makes time tracking quite complex, and lacks the ability for shared access. In real companies, extended features of internet versions of the system are used. In the educational process, it is possible to explore other tools.

To familiarize students with agile project management methods and team collaboration, modern cloud-based solutions are chosen, such as Trello [21] and Jira by Atlassian [22]. Users can easily create an account in Trello and model their project team. Figure 3 shows the interface of the application and its main tool – boards.

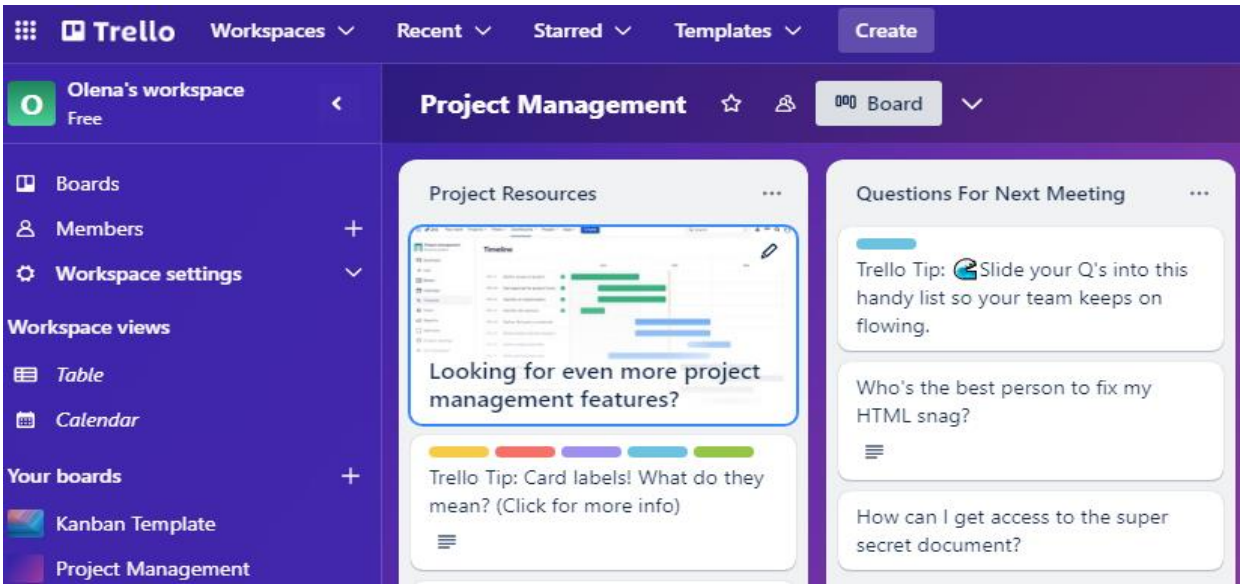

Figure 3. Trello Toolbar and Transition to Project Management System

Task overview, board creation, and communication are conducted conveniently and clearly. However, if there is a need to create a complex project plan involving detailed scheduling and resource allocation, the system suggests upgrading to a more advanced level within the developer's platform – Jira.

In Jira, users can create, just like in MS Project, a detailed project plan, list resources, and assign resources to tasks. An important aspect of resource management is monitoring resource availability and promptly resolving conflicts. A fragment of the training case is shown in Figure 4.

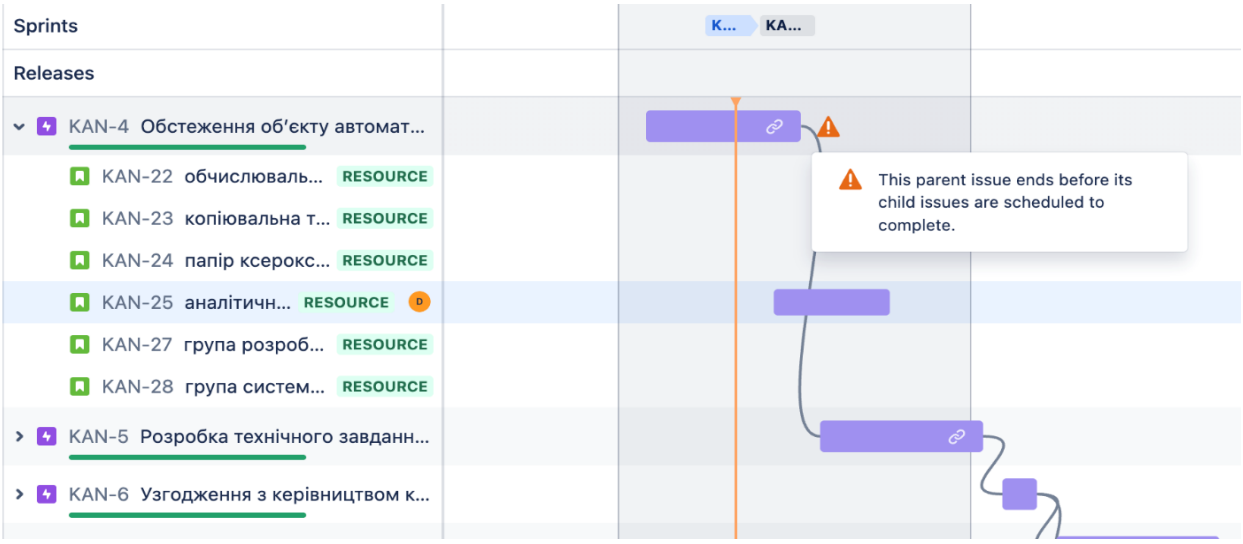

Figure 4. Evidence of incorrect time allocation for a task (problem solving)

As seen in the image, indicating time overruns for subtasks or resources leads to an error displayed on the time chart.

A notable feature of Jira is the ability to integrate additional tools and add-ons as needed. For instance, to create a resource utilization chart (e.g., for room rentals or personnel), Confluence – a product also from Atlassian – may be required. This mechanism slightly complicates project management but allows for the completion of all project management tasks. Clearly, the complexity of the add-on is a barrier that justifies the use of the sophisticated Jira system in complex, long-term projects. In such cases, studying and implementing "heavy" software is justified.

5. CONCLUSIONS

The investigation into the rationale for selecting appropriate software for managing complex projects, particularly in IT projects, reveals that the market for project management and support information systems currently offers a wide range of software products. A common issue is limited functionality in resource management, which should include not only calendar-based personnel scheduling with Gantt charts but also mechanisms for optimizing resource allocation across tasks and calculating resource costs.

Numerous analytical reviews or comments from software developers often fail to facilitate an optimal choice of the required system. When choosing project management systems, teams sometimes base their decisions solely on the cost of the system, perception of advertising, and other marketing efforts, or ease of the interface.

Professionally, the study aids IT managers in selecting appropriate project management tools, optimizing resource allocation, and improving project outcomes. Pragmatically, it addresses common pitfalls in tool selection based on cost or marketing rather than functionality, promoting more informed decision-making.

In university education, to better prepare future project managers for market mobility, it is advisable to consider both classical systems like MS Project and modern cloud solutions such as Trello, Asana, Jira, and others. The availability of online versions allows for the application of case methods and other modern teaching approaches.

The authors hope that the considerations presented in this work will contribute to a deeper discussion and justification regarding the choice and application of PMS both in educational processes and in the practical activities of IT companies.

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