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# Comparative Analysis of the Use of Kanban and Scrum Methodologies in IT Projects

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**Abstract** Modern businesses throughout the world operate in a market characterized by constant changes. These changes are becoming more dynamic from year to year. It is the project-based approach that will allow one to solve problems and ensure high efficiency of project-oriented operations. The purpose of the study is a comparative analysis of the impact of the use of IT project management methodologies of Kanban and Scrum on a company's financial performance. The authors identify the essence of the agile methodology, its conceptual foundations, and explore the key aspects of its efficient implementation. The popularity of the practical application of the agile approach in various business areas is analyzed. The authors also choose the best methodology for a particular IT project for the optimization of such economic and financial indicators as project cost, profit from project implementation, and implementation time. The key differences between the most popular agile technologies are identified. The requirements for forming an agile team are examined considering the main issues during the implementation of agile management technologies. The primary stages in the implementation of an IT project using the Scrum methodologies are defined.

**Keywords** Agile Methodology, Kanban, Scrum, Economic and Financial Indicators, Sprint

## 1. Introduction

Over the centuries, the principles and approaches of the organization and functioning of enterprises have changed. The process of adaptation to external conditions remains unchanged, which predetermines the development of the latest organizational structures. On the verge of millennia, project management has rapidly entered the arena, and within its framework, new functioning models of project teams continue to develop constantly.

The main differences between projects and the day-to-day operations of the enterprise include the following: in contrast to the day-to-day operations which are constant, the project is temporary and unique; projects always have a specific goal, while in the daily life of an

organization such a single specific goal is often absent or not fully understood; due to the presence of a clearly defined goal, projects have a specific and predetermined moment of completion, which is not typical for constantly performed duties in the process of the organization's day-to-day operations; it is typical for projects to combine and unite the efforts of a variety of specialists, while most types of organizational work are divided according to the principle of functional specialization; the project always has some elements of uniqueness; projects are characterized by time and cost constraints and special performance requirements [1, 2].

There are numerous methods of implementing project management in enterprises. Depending on the industry, specialization, the goal that the company seeks to achieve, one should choose the most suitable method for a particular case.

All project management methods can be divided into rigid and agile. Rigid methods are applied in conditions of strict formal project management, with reduced trust and increased responsibility of the customer and the contractor. Agile project management methods are based on the horizontal division of managerial labor: the distribution of specific managers at the head of individual departments. Various techniques are used in these methods.

Choosing the right project management methodology is important because it determines how the team will work on the project. Project management techniques provide structures that can lead to the success or failure of a project. Therefore, when deciding which method to use to manage a project, it is necessary to consider the complexity of the project, the client, the available resources and project constraints (including changes and risk), deadlines, tools, and personnel.

The study of the pressing problem of agile technologies for managing project work is determined by several factors, in particular [3-6]: maximization of labor productivity; optimization of the level of independence and autonomy of teamwork to form a sense of team responsibility for the result; reducing the likelihood of exposure to negative risks of teamwork; forecasting the success of achieving the final product; improving the quality of the product and the process of its creation; acceleration of operational and logistical business processes, etc.

## 2. Literature Review

The authors propose different approaches to forming an efficient project team, in particular: using the Kolbe concept [7], the method of analytical analysis of process hierarchies [6], using the apparatus of fuzzy sets to formalize the process of forming a project team [8]. However, most of these methods and models do not take into account the specifics of the agile methodology which is primarily based on the corresponding values (Table 1).

Research works [13-17] illustrate the main reasons for the transition to agile methodology, namely: acceleration of work in the field of information technology, priority mobility, improving the state of business operations, improving work discipline.

Agile is an umbrella term for many project management methodologies. In agile software development, a project is positioned as a series of relatively small tasks that are performed adaptively as the situation requires, rather than as planned. Agile methodology for small development teams is represented by Scrum and Kanban. These frameworks are used when working on software projects and allow one to complete the assigned tasks as quickly, efficiently, and successfully as possible [18].

Our study relies on works devoted to the impact of financial performance and entrepreneurial potential on business performance in small and medium-sized enterprises in Central Java [19] and management of investments in entrepreneurship at early stages in modern national economies [20].

**Table 1.** Definitions of the agile methodology

| Source | Definition |
|---|---|
| [9] | An agile approach to project management includes some iterative approaches based on the principles of human interaction management and a process view of human cooperation. Agile-based techniques are most commonly used in software development, website development, creative and marketing industries. |
| [10] | An agile iterative-incremental approach to project and product management focused on the dynamic formation of requirements and ensuring their implementation as a result of constant interaction of teams that self-organize and consist of versatile specialists. |
| [11] | An iterative-incremental approach is characterized by a sequence of short iteration cycles, each of which resembles a mini-project. That is why to work in such mini-projects, a team is needed that is capable of self-organization, that is, the team decides how to achieve the goal. One of the special qualities of such a team is the readiness and willingness to take responsibility. Responsibility of "team players" becomes a key performance indicator of an agile team. |
| [12] | The main priorities in project management are people and their interactions to create a product based on cooperation with the customer, considering their open-mindedness as opposed to bureaucratic adherence to plans and constant approvals. |

The purpose of the study is a comparative analysis of the impact of using the Kanban and Scrum IT project management methodologies on a company's financial performance.

Research hypothesis: the choice of the most rational flexible methodologies for IT project management leads to an increase in the economic and financial indicators of project management and the company as a whole.

Research objectives: 1. determine the preferred project management methodologies in terms of labor input and management costs; 2. carry out a comparative analysis of economic and financial indicators when using the Scrum and Kanban methodologies in the implementation of an IT project.

The article consists of an introduction, a literature review, research methods, research results, a discussion of the results, and the conclusion.

# 3. Materials and Methods

### Study design

To achieve the goal set in the study, we have defined an approximate set of theoretical and empirical research methods:

- theoretical methods (analysis, synthesis, comparison, generalization) – for the study of academic literature on the status of the research problem;
- empirical methods (expert survey method) – to select the preferred methodology for IT project management. To solve the problem of choosing a methodology when decision-makers have sufficient knowledge of existing methodologies, a selection method was used based on labor input and management costs;
- numerical methods (project management system MSProject 2007) – to determine the cost of the project, the profit from its implementation, as well as the execution time.

### The procedure and research tools

The IT project for managing which methodology was chosen is a project of creating a computer program designed to carry out marketing analysis at the level of a company. The software contains the following methods: methods for predicting non-stationary random processes; method of optimizing the type of promising products; method of express analysis of the level of product competitiveness.

The software package will provide an extensive user interface. The work on the development of this software was divided into three main blocks: the creation of a graphical interface; software implementation of mathematical methods; development of a module for interaction with the operating system and hardware (Fig. 1).

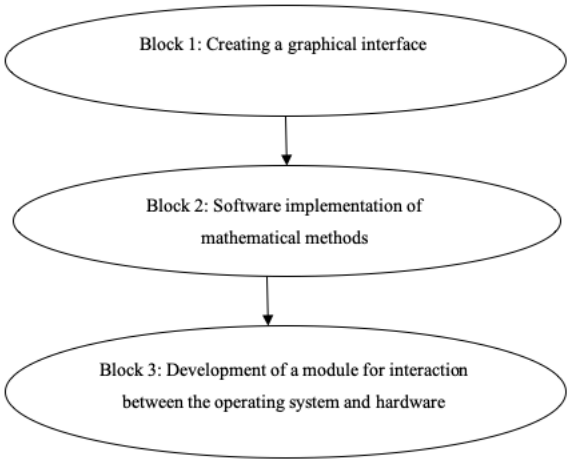


**Figure 1.** Components of a software development process

The entire set of operations is divided into five stages. At the first stage, the algorithmic core of the product being developed is formed. At the second stage, an interface is designed for editing the input data and configuring the execution of methods. At the third and fourth stages, an interface is designed to output the results of the execution of the programmed methods. At the fifth stage, the project documentation is formed and the means for working with external sources of input data are implemented.

### Statistical analysis

We used numerical calculation methods using the MSProject 2007 software, with the help of which the cost of the project, the profit from its implementation, and the execution time were calculated.

# 4. Results

**Table 2.** The results of applying the method of choosing the project management methodology based on labor input and management cost

| Methodology | Project characteristics | |
|---|---|---|
| | labor input, man-hours | management cost, thousand rubles |
| SWEBOK | 2,435 | 1,059.5 |
| PMBOK | 2,260 | 1,020.0 |
| PRINCE2 | 2,150 | 921.5 |
| P2M | 1,385 | 627.25 |
| Kanban | 540 | 249.25 |
| Scrum | 435 | 201.75 |

The experts assessed the labor input and the management cost when using the PMBOK, PRINCE2, SWEBOK, P2M, Kanban and Scrum methodologies. The results are presented in Table 2.

Solving the optimization problem for choosing a project management methodology yielded two efficient solutions that corresponded to the use of Scrum and Kanban methodologies.

The final choice of methodology for managing this project should be made by the decision-maker, based on their own understanding of the situation and priorities. In this case, the experts preferred the agile Scrum and Kanban methodologies.

Based on the information on the IT project, which has five stages, the initial data for solving the problem were formed, obtained through calculations using MSProject 2007:

- the cost of performing operations at each stage and the total cost of the project;
- profit from the implementation of an IT project obtained based on the forecast of demand and the price of the software;
- the time required to implement each stage.

A comparative analysis of the use of Scrum and Kanban methodologies in the implementation of an IT project is presented in Table 3.

As one can see, using the Scrum methodology compared to the Kanban methodology allows one to increase profits by 8.5% and cut expenses by 15.3%. The methodology used will have virtually no impact on the duration of the project.

**Table 3.** A comparative analysis of the use of Scrum and Kanban methodologies in the implementation of an IT project

| Methodology | Indicators | Indicator value |
|---|---|---|
| Kanban | Profit, thousand rubles | 1,311.5 |
| | Expenses (project cost), thousand rubles | 729.25 |
| | Project execution time, days | 116 |
| Scrum | Profit, thousand rubles | 1,422.75 |
| | Expenses (project cost), thousand rubles | 618.5 |
| | Project execution time, days | 118 |

# 5. Discussion

As a result of the study, we can conclude that when using the Scrum methodology, in comparison with Kanban, a greater profit was obtained from the implementation of the project at a lower cost. Thus, relative to the project in question, the Scrum methodology was in the lead.

However, the final choice of the methodology for project management in each case should be made by the decision-maker. In this regard, we will conduct a comparative analysis of these methodologies.

Scrum and Kanban are effective methods, however, there are fundamental differences between them, both conceptual, process-related, and technological (Table 4).

**Table 4.** Comparison of the Scrum and Kanban methodologies

| Criterion | Scrum | Kanban |
|---|---|---|
| Teams | Versatile specialists who interchange their roles | Highly specialized professionals |
| Roles | Product Owner (PO), Scrum Master (SM), Development Team (DT) | A unified team since the process is linear, there are no roles |
| Planning | Priorities are set by the product owner | Priorities are set by the project team |
| Time | The division into sprints (1–4 weeks), time is allocated for daily meetings, each sprint consists of four stages (planning, execution, release, retrospective). Lack of flexibility to make changes to the sprint. | The division into stages for specific tasks. There are no mandatory report meetings. New tasks can be added during execution. |
| Visualizing | Digital or analog boards are used for visualization. The board is divided into columns which are assigned different task states. The Scrum board is cleaned when a new iteration occurs. | Visualization tools are similar to Scrum, but the Kanban board is always filled out. |
| Indicators | The total weight of all tasks performed during the sprint is measured. | The average time for the completion of one task is measured. |
| Application | A large-scale project with a duration of at least three months, with specific requirements before the start of the project. | Small projects that do not require a lot of planning time or, conversely, long-term projects that do not have clear requirements before starting a project, therefore, tasks are formed during development. |

It is evident from Table 4 that each methodology has its advantages and disadvantages. When choosing a methodology, one needs to ask themselves what is needed – constant development or iteration, structured roles or a team without roles, adaptability or stability.

Due to the unique set of advantages and disadvantages, the specific features of the main activities and products/services of each individual IT company, it is advisable to group all IT enterprises according to the criterion of the level of organizational maturity for the production of Agile technologies (the level of organizational maturity can be determined using [21]: team-oriented (sufficiently mature), mature (a sufficient share in the field of IT services), insufficiently mature (or beginners).

Thus, for sufficiently mature IT companies, one can recommend the Scrum method which is iteratively and incrementally implemented in the following stages [22, 23] (Fig. 2).

Stage 1. Determining the composition of the Scrum team. The optimal number of participants is 5–9 people. Each team member must have a wide range of competencies and skills for them to actively assist each other in the product development process. The team itself is responsible for the final quality product. Classic Scrum has three main roles: Product Owner (PO), Scrum Master (SM), Development Team (DT). SM's responsibilities include organizing meetings, monitoring the process efficiency, removing obstacles during the sprint, and motivating team members. PO acts as an intermediary between the team and the customer. The PO's goal is to maximize the value of the product of the team's work. The main tool for this role in the Scrum process is the Product Backlog (PB) – a list that is formed at the beginning of the project and includes tasks that are sorted in priority order.

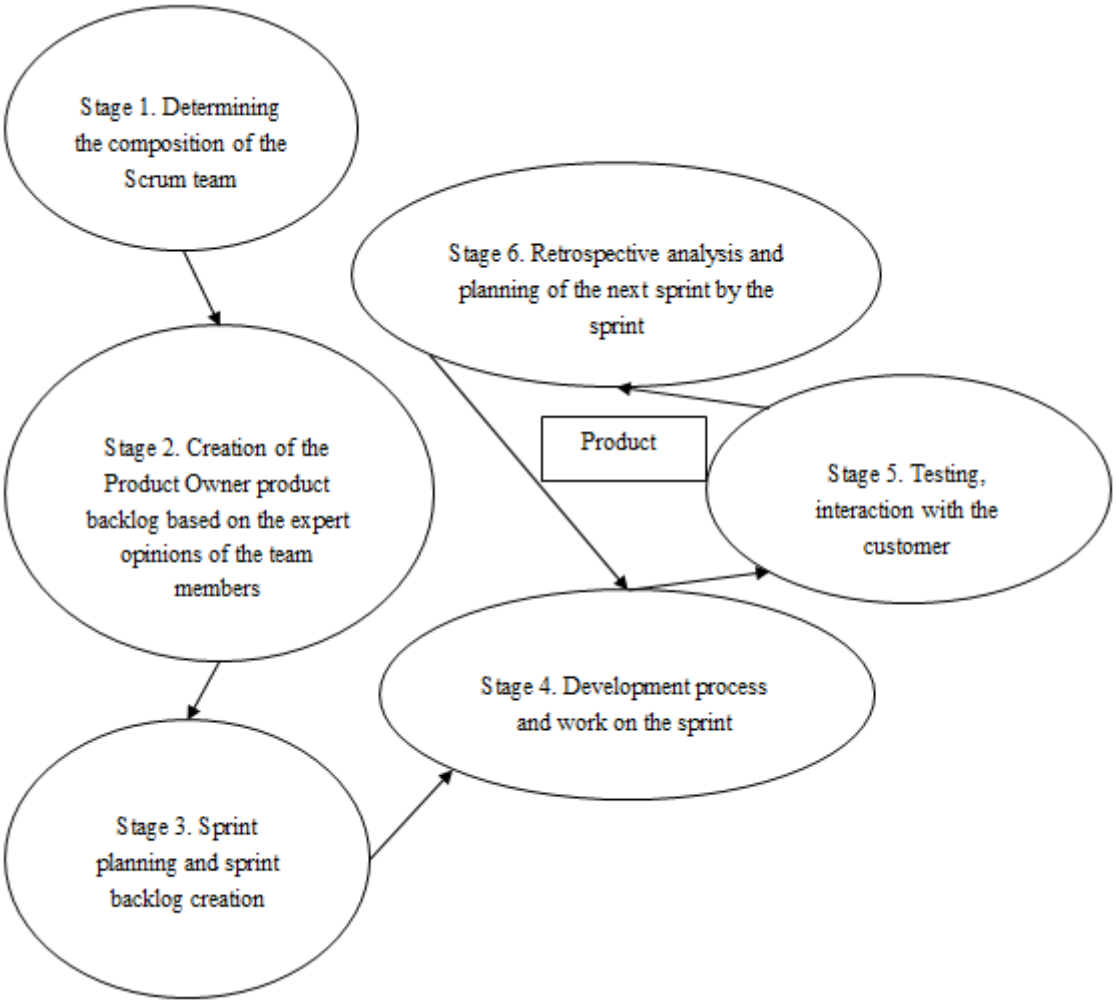


**Figure 2.** Stages of implementing a Scrum method

Stage 2. The Creation of PB. According to [24], each PB element should be described with an appropriate level of detail (the "rolling wave" method, namely: the current elements are detailed and described to complete them as soon as possible, but the removed elements do not need details, the planning horizon is determined situationally) and adequately estimated. For efficient planning, a system of criteria and indicators is used for evaluating both results and processes for achieving them ("quality metrics"), as well as acceptable accuracy limits. During the development of an IT product, PB changes. Required elements of PB are special User Stories, each of which has a special ID-code, and a product description according to the following elements: importance; preliminary estimate; way to demonstrate functionality.

Stage 3. Sprint Planning and Sprint Backlog (SB). During the planning stage, it is necessary to determine and optimize the sprint duration by averaging the selected critical values (the advantages of a short sprint are the ability to quickly receive feedback and identify errors, however, long sprints allow teams to delve deeper into the product creation process; in IT projects, it is recommended to use two-week sprints). One should also define the roles of the project team (each team member has a specific function; SM is responsible for the technical and organizational aspects of holding meetings and ensuring that the team can focus on the most important thing – planning and defining the main tasks). At this stage, the interaction between the management of the IT company (determines the priority of tasks) and the Scrum team (determines the need for resources) is identified. At the same time, PB elements are selected by priority level and transferred to SB in accordance with their duration in Story Points.

Stage 4. Development process and work on the sprint. Every day there are Stand-Up meetings (up to 15 minutes) where the most important aspects of the product development process are discussed. The process can be divided into three blocks: "To Do", "In Progress" and "Done". Sprint assignments are moved from one block to another upon completion. The result of each meeting is a diagram that visualizes the pace of the team's work and allows one to adjust the number of tasks for the next sprint.

Stage 5. Testing. The goal of a sprint is a beta version of an IT product, which is demonstrated to receive quick feedback. The project team must be prepared for constructive criticism during the testing process.

Stage 6. Retrospective analysis and planning for the next sprint. Based on the feedback received at the previous stage, the parameters of the current state are analyzed and recommended corrective and/or preventive actions are developed which will be implemented in subsequent sprints.

The Scrum methodology provides for iterative and incremental planning of sprints and allows one to expand the communication boundaries between team members, provide authority to resolve issues and solve problems internally in a team manner with minimal external influence. However, for this, the team must have the necessary and sufficient level of professional competence.

At the same time, for insufficiently mature IT enterprises, there is the Kanban methodology which is more adaptive and "soft" in implementation and allows one to gradually introduce the concept of "flexible management" into the organizational culture and the employees' consciousness. The operational process is practically not coordinated, little regulated, and the result is 90% dependent on the team and not on the manager. It should be noted that the Kanban system does not form special teams with distributed roles; various internal corporate structures that have the necessary knowledge and practical skills can work on the product [25]. The Kanban technique is implemented in the following stages [26, 27].

Stage 1. Product Backlog Development. The project team is formed by the PO, while there is no separate role responsible for forming a set of tasks.

Stage 2. Optimization and visualization. Tasks are visualized using a special board and are divided into three blocks: "To Do", "In Progress" and "Done". However, unlike the Scrum methodology, the task is limited in the process of execution: the task is minimized in terms of the time it takes to complete; in the process – the execution of the task is optimized according to the criterion of maximizing the predictability of the successful result.

Stage 3. Completion of the assigned tasks. The results are achieved in a single flow, and the process policy is quite formalized.

Organizationally mature IT companies have already made progress regarding the organization and management of teamwork and realized that the process of reorganizing a management system based on the agile methodology requires a certain organizational effort, resources, and time. Meanwhile, organizational barriers to the efficient functioning of a business with team-based operations are possible, in particular, the reluctance of business owners, top management, or employees of the organization to perceive and implement the innovative principles of project team functioning. Thus, there is a certain resistance to reducing the level of bureaucratization and increasing the level of trust and independence of workers. However, the main desired result is an improvement in the quality of IT products; the lack of an adaptive system for the gradual introduction of the functioning principles of flexible teams (for the implementation of the Scrum model, it is necessary to define the roles of SM and PO. At the initial stage, there is a need to introduce mentoring or coaching to implement these roles in the process of functioning of project teams).

## 6. Conclusions

Choosing the best project management methodology is important. This will ensure the success of the project. Therefore, when deciding which project management method to use, one must consider the needs of the stakeholders, the risks associated with the project, the size of the project, the cost, and, of course, the complexity of the project. Project management in an IT company can provide significant assistance in improving the company's economy.

The choice of an IT project management methodology based on the optimization of the project's financial performance was applied for the Kanban and Scrum methodologies. With an almost identical duration of the project, the Scrum methodology allows one to increase profits by 8.5% and reduce costs by 15.3%.

Thus, the results of the study confirmed the hypothesis that the choice of the most rational flexible methodologies for IT project management leads to an increase in the financial and economic indicators of project management and the company as a whole.

The limitation of the study is due to the consideration of only two methods from the arsenal of the Agile methodology, which is due to the limitation of the volume of the article.

The use of agile technologies for IT project management largely determines the speed of creating new products and the success of companies. However, project implementation is associated with risks. Therefore, there is a need for in-depth studies on the methods of assessing project risks. This will be the topic of further research.

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