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Hybrid Management Methodology for Transport Projects Related to Rolling Stock

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Abstract. Dynamic economic development and the fast implementation pace of innovative, economical solutions force companies to continue finding methods of increasing the efficiency of their operations. One of the ways to increase the effectiveness of activities is to use a project approach that allows achieving all the set goals efficiently. The project approach is gaining popularity due to its high efficiency. Also, it is treated as a separate trend called as “projectification” and “project orientation”. The article defines what a project and project management methodology are. The specificity of railway transport projects concerning rolling stock was characterized. The elements of traditional and agile project management methodologies were described, indicating their differences. Project areas were selected in which the implementation of the elements of agile project management methodologies is the easiest and fastest to carry out.

Keywords: traditional project management, agile project management, methodology, methodology elements.

1 Introduction

Technological development, increasing consumer awareness, and the fast pace of changes in the modern world force enterprises to design, construct and develop products, services, and new technologies in the shortest possible time frame, while also reducing costs [9]. The competitive advantage of enterprises is often related to innovative projects, which is closely related to the use of project management methodology. The increasing complexity of innovative projects forces companies to search for more effective implementation methods. At a particular stage of project complexity, traditional project management methodologies become simply insufficient.

Combining traditional and agile project management methodologies and implementing a transport project for rolling stock based on the resulting hybrid methodology, adapted to the specificity of a given company and industry, can increase the efficiency of project implementation. The hybrid methodology combines elements of traditional and agile methodologies, previously regarded as contradictory to each other. Implementing a project based on the hybrid methodology gradually eliminates the antinomies between the two methodologies and ensures a synergistic effect. Combining elements of two seemingly contradictory methodologies can be performed successfully during the implementation of projects in other industries.

2 Literature Review

The concept of a project is commonly used in many fields, e.g., in education, economy, health care, and public administration. A project is virtually any undertaking with a start and end date involving specific resources (human, financial, material) that end with a specific result. The specificity of project undertakings results primarily from their complexity, periodicity, and innovation. Many project definitions indicate conditions that must be met for a given undertaking to be called a project.

According to the definition developed by the IPMA (International Project Management Association), a project is defined as a unique set of coordinated activities, limited in time and costs, aimed at obtaining a set of predefined products (a scope that meets the project objectives), while maintaining quality standards and requirements [1]. According to the traditional PRINCE2 methodology (“PProjects IN Controlled Environments 2”) [5], a project is a temporary organization established for a period, which is created to deliver one or more business products according to an established business case.

Projects are unique undertakings with a high level of complexity, with a defined implementation period (with the beginning and end marked), requiring the involvement of significant, but limited resources

(material, human, financial, information). Projects are carried out by a team of highly qualified contractors from various fields (interdisciplinary) that is relatively independent of the company's regular repetitive activities [4]. They are associated with a high level of technical, organizational, and economic risk, which forces their implementation to be performed using specialized methods and tools. Most often, a project is carried out by people from various departments of any given organization. This allows for the collection and use of the most valuable skills, which, combined with appropriate coordination, allows achieving results that could not be achieved if the project was entrusted to one department of the organization [10]. Trocki [8] similarly defines a project.

The multitude of definitions and, at the same time, some standard features among them allow summarizing that a project as an undertaking whose genesis is an idea that responds to the existing demand. A concrete idea, translated into an action plan, placed in time and with a specific goal, becomes a project. It is a separate undertaking, not related to the routine activities of the company or institution. It is characterized by temporality, high demand, uniqueness, an appropriate degree of complexity, and novelty. The project uses business opportunities and translates them into real benefits for the company, increasing competitiveness and the company's profitability. Project implementation requires the involvement and separate management of interdisciplinary human resources and financial and material resources. An undertaking characterized by the features mentioned above can thus be described as a project.

Project Management Institute defines project management as applying knowledge, skills, tools, and techniques used for project activities to meet the project requirements [6]. This is achieved by applying and integrating project management processes such as initiation, planning, execution, monitoring and control, and project closure.

Project management is a system of achieving goals and tasks and is treated as a subset of activities related to strategic planning [3]. It provides outcomes and results that can be transformed into business value and financial gains. It is currently perceived as a system for achieving strategic business goals. The use of appropriate project management methods by enterprises is a tool for developing their own business and building up a competitive advantage over their competition. The increase in the project's complexity and the emphasis on shortening the project's duration and reducing costs force the project's implementation to be performed using already proven tools. Project management methods are commonly used in cases where there is a need to implement a complex, atypical, comprehensive project with an inherent risk of failure.

Project management should be executed in line with the general management principles of a given enterprise. Integrating project management with other management processes in the enterprise is the key to the effective

implementation of projects. According to H. Kerzner [2], as shown in Figure 1, project management should be integrated with the following management processes of the company: with the management of engineering works (understood as the core business of the company), along with the management of quality, risk, and change. Such management reduces operating costs, reduces the need for resources, minimizes the documentation necessary to develop, and eliminates duplication of efforts.



Figure 1 – Integration of management processes of an enterprise [2]

There is no one universal method of project management suitable for all types of projects. There are general methods that can be used in the implementation of projects in different branches of the economy, as well as sectoral methods adapted to specific departments, e.g., IT, government administration, or construction. The use of a given method depends on the specificity of a given project. One of the most effective ways to implement projects is to combine selected elements from various project management methods and adapt them to a specific project and the company's specifics, thus creating a hybrid method explicitly made for the implementation of a given project. When selecting activities and tools for project implementation and then adapting them to the needs of a specific project, the nature of the enterprise, its organizational culture, work culture, and general principles of the company's operation should be considered.

3 Research Methodology

Transport and railway rolling stock projects are interdisciplinary, complex projects requiring a large project team, often consisting of several dozen people. Due to their complexity, the implementation of these projects takes on an average of 5–7 years. Rolling stock projects belong to the group of capital-intensive projects with an average budget of several million EUR. The need to engage human and financial resources to such a large extent and over such a long time significantly increases the project risk. Efficient and effective implementation of this project type requires using project management methodologies during the implementation process. Rolling stock projects, the effect of which is implementing a new production solution developed as a part of the project, are most often carried out in a

consortium consisting of two or three companies/scientific institutions. This requires a coordination, a collaboration between consortium members and different project teams. As part of the project roles, a Project Manager is designated, whose task is to coordinate the work and ensure day-to-day cooperation of all members of the consortium, and the Research and Development Manager, who is responsible for the substantive scope of the project work. Separation of these two management areas is necessary to ensure efficient project implementation and substantive work progress. The Project Management Office (PMO) plays an essential role in implementing projects in each institution implementing the project. The PMO is responsible for all administrative, financial, and legal matters related to the project implementation.

4 Results

Criticism of traditional, planar project management methodologies has led to the emergence and development of new trends in project management, which are agile methodologies as part of Agile Project Management (APM) [7]. The initial source of these methodologies was IT projects, characterized by uncontrollable changes in scope, which resulted in a low percentage of projects being successfully completed using traditional project management methodologies. Agile methodologies are intended to eliminate unnecessary administrative activities. They are most effective in areas characterized by high uncertainty and the inability to precisely plan out the entire project. They require a high level of interaction by the project team. The most famous schools of agile thinking include Scrum, XP (“eXtreme Programming”), Lean, and Kanban [7]. Agile methodologies do not treat design as a linear process with easily predicted steps. They are based on the specific competencies of the project team and the incremental creation of value for the client. The project’s effect is not delivered once at the end but gradually over time, as the functionality of the project results increases. In the Agile approach, the design is unpredictable and non-linear. Implementation of projects based on agile methodologies is not based on a precise plan. Usually, the initial stages of a project are scheduled. The agile approach focuses on interpersonal interactions and dynamic planning.

A comparison of selected elements of traditional and agile methodologies is presented in Table 1.

Table 1 – Comparison of traditional and agile project management methodologies

Project elements	Traditional methodologies	Agile methodologies
Project management cycle	<ul style="list-style-type: none"> – deterministic, linear, based on defined stages; – defined key processes; – the basis of the project management is a detailed schedule 	<ul style="list-style-type: none"> – iterative, empirical, based on providing elements of functionality, – adaptability, adapting to changing conditions, – short schedules for the implementation of the next stages
Focus	<ul style="list-style-type: none"> – process and division of tasks; – control procedures; – tools and techniques supporting the project implementation 	<ul style="list-style-type: none"> – stakeholders; – providing functionality
Project goals	<ul style="list-style-type: none"> – precisely defined and in detail under the SMART methodology; – cascade, short-term, and long-term goals based on a needs analysis; – execution of planned works on time, under the schedule and budget 	<ul style="list-style-type: none"> – precisely defined, constitute a hypothesis, speculation for the future; – general vision
Organizational aspect	<ul style="list-style-type: none"> – division of labor within the project; – high level of formalization; – extensive project documentation; – focus on maintaining a balance between limited resources, such as costs, quality, and time 	<ul style="list-style-type: none"> – simplified work organization, focused on quick and flexible adaptation to changes; – low degree of formalization
Project costs	<ul style="list-style-type: none"> – carefully estimated budget for the entire project 	<ul style="list-style-type: none"> – a specific estimated budget only for the first of several initial project stages; – overall cost forecast for the next stages of the project

Project elements	Traditional methodologies	Agile methodologies
Personnel / Project team aspect	<ul style="list-style-type: none"> – a team based on a narrow specialization; – high team competencies; – task-oriented, democratic and inclusive management style; – project manager focused mainly on the budget, schedule, and scope of the project 	<ul style="list-style-type: none"> – work based on small groups of self-organizing and self-disciplined project teams (9–12 people); – emphasis on cooperation, integration, and communication between team members; – a cooperative leadership style based on steering, not controlling
Deviations from the plan / Implementation of changes	<ul style="list-style-type: none"> – difficulties with introducing project changes; – treated as a consequence of incorrect project management; – requires remedial action, – implementation of changes hindered by a bureaucratic, formalized structure 	<ul style="list-style-type: none"> – openness to changes, flexible, adaptive approach to changes; – introducing changes while maintaining previously defined goals; – the causes of deviations form the basis of the analysis and conclusions for the future; – change is the engine of innovative processes
Control	<ul style="list-style-type: none"> – high level of formalization, control of all processes, degree of achievement of goals, time, scope, budget, resources, people 	<ul style="list-style-type: none"> – low level of formalization; – system approach; – control of the degree of achievement of goals and time

Depending on the project specifics, various project management methodologies can be used. The evolution of the project management field is moving away from the traditional approach to the agile methodologies, the greatest advantage of which is adaptability, creativity, and quick customer-oriented actions.

The elements of agile methodologies that can be most easily and quickly implemented in organizations implementing projects so far without the use of any methodology or based on traditional methodologies are:

- involvement of all or, in the case of numerous project teams, the main contractors working on the project together with the project manager at the stage of planning the project work;
- planning works in short periods, e.g., weekly or monthly, depending on the specifics of a given project;
- cyclical, short meetings of the project team, where the current status of the project is discussed (what a specific member of the project team has done since the last team meeting, what will he or she be doing in the near future, to the next meeting and what current problems/obstacles in project implementation are encountered). Regular, status project meetings should take place in the same place, at the same time, preferably standing, so that they do not turn into long meetings;
- regular retrospections, meetings where members of the project team think about how to improve the way they work;
- use of a project status visualization tool, e.g., a task board (physically hanging on the wall or a digital board prepared in a project management program) showing the status of the project and the work to be done in the project.

It allows to visualize the rate of work being done and monitor the progress of work in the project. This provides simultaneous access to project status information for all project team members and stakeholders.

The use of the above elements in the implementation of the project is an introduction to the development of a dedicated hybrid methodology for a given company, and then its implementation, where effective communication between members of the project team and project stakeholders is the foundation of the working methodology.

5 Conclusions

Elements of agile methodologies are beginning to be used in implementing projects previously based on traditional management increasingly more often, which in turn leads to the creation of hybrid methodologies containing elements of both traditional and agile approaches.

The implementation of a transport project regarding rolling stock with the use of elements of agile methodologies, based on a hybrid methodology, adapted to the specificity of a given company/organization, is a response to the growing economic requirements regarding innovation of products/project results, the pace of technology development, shortening the project life cycle, reducing project costs, as well as flexible and effective cooperation with project stakeholders.

Traditional methodologies are used at the level of project management, while elements of an agile approach are used for project management at the project team level. The synergy effect obtained in this way increases the efficiency of project implementation.

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