

PROJECT MANAGEMENT IN ENGEENERING

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Purpose: The aim of the paper is to analyze the methods of management in the case of project management of engineering teams.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The considerations presented in the publication made it possible to analyses the most important aspects of project management. The paper concentrate on the analysis of basic principles of project management especially in the condition of Industry 4.0. In the analysis we were concentrated on industrial organization and tried to characterize main benefits of using the project approach in those enterprises. We distinguished the main benefits of using project management in industrial enterprise in Industry 4.0 conditions. It is especially important to use this approach to handle complex, costly and risky projects which are not easy to manage in traditional way. In Industry 4.0 we can spot many those type indyscyplinary projects linking the technical and social knowledge. In those situation using of project management approach can lead to the success of organization activities.

Originality/value: Detailed analysis of all subjects related to the problems connected with project management in engineering organizations.

Keywords: project management, industrial management, management, project, Industry 4.0.

Category of the paper: literature review.

1. Introduction

We could to define project for example according to definition prepared by Project Management Institute. They said (Project Management Institute, 2013) that project is a temporary endeavor focused on producing a unique operational entity (product, service, result differing obtained in prior projects). Juran one of founders of quality management thought a project is ad problem scheduled for solution (Juran, 1992; Harris et al., 2020). We should mention that problem in this definition not should imply negatives. The outcomes of problem solution can create a positive effects.

The activities connected with project management are especially important in the conditions of Industry 4.0 (Drozd and Wolniak, 2021a; Gajdzik and Wolniak, 2021; 2022; Gębczyńska and Wolniak, 2018; Grabowska et al., 2021; Grabowska, 2019). A series of activities and actions precedes the initiation of the project. One of them is a project plan. It encompasses several components that collectively culminate in a realistic and well-planned sequence of actions and processes. The project plan should go beyond a general project scope and should include all the detail necessary to make a meaningful and value-based addition to work unit or an entire system (Harris et al., 2020). Tuthill thinks that project plan should include a budget, a work and activity breakdown and schedule, an overall project schedule and any other supporting documents (Tuthill, 2014). Billow point out that in every project should be scope definition, risk identification, team resource requirements and decomposing individual task (Billows, 2014). Kerzner thinks that a project is any series of activities and tasks that have a specific objective to be completed within certain specifications; have a defined start and end date; have funding limits; consume money, people and equipment; and are multifunctional (Kerzner, 2015). In 10006 standard project is defined as a unique process, consist of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time cost and resource (ISO 10006:2018; ISO 21500:2020; ISO 21504:2015).

The aim of the paper is to analyze the methods of management in the case of project management of engineering teams.

2. Benefits of project management

The project management itself can be defined as application of knowledge, skills, tools and techniques to project activities to meet project requirements (Hąbek and Wolniak, 2016a; Hąbek and Wolniak, 2016b; Hys and Wolniak, 2018; Jonek-Kowalska and Wolniak, 2021; Jonek-Kowalska and Wolniak, 2022; Jonek-Kowalska et al., 2022; Kordel and Wolniak, 2021; Kwiotkowska et al., 2021; Kwiotkowska et al., 2022). Project management is accomplished through the application and integration of the project management process of initiating, planning, executing, monitoring, controlling and closing (Project Management Institute, 2013; Bakator et al., 2017). Project management entails a combination of tools, people and systems, Tools may include computers, software packages and daily planners. People include organizations and projects teams who engage in processes geared toward goal accomplishment within system. Management of people may present as challenge in this endeavor, and leaders and communicators must use multiple skills to coach and mentor individuals towards achieving the common goal (Lewis, 2011). According to ISO 10006 project management means planning,

organizing, monitoring, controlling and reporting of all aspects of a project and the motivation of all those involved in it to achieve the project objectives (ISO 10006:2018).

Project management can be also seen as a professional discipline with its own body of knowledge and skills. Project management expertise can benefit any in-depth feasibility projects and analysis upfront in order to create an appropriate project strategy, governance and delivery structure (Gorod et al., 2020). Following the project management approach, detailed work breakdown structures, resource plans and delivery timeline schedules will be covered with the proposed methodology (Orzeł and Wolniak, 2022; Ponomarenko et al., 2016; Stawiarska et al., 2020; Stawiarska et al., 2021; Sułkowska and Wolniak, 2016; 2018; Wolniak and Sułkowski, 2015; Wolniak and Skotnicka-Zasadzień, 2014; Wolniak, 2011; 2013; 2014; 2016; 2017; 2018; 2019; 2020). Without a project management methods, all project actors will have different ideas about how things should be organized and when the different aspects of the project will be completed (Hyttinen, 2017).

There are following benefits of using project management concept within industrial organization (Introduction, 2021):

- Project management approach will help in handling complex, costly and risky assignments by providing interdisciplinary approach in handling the assignments. Example: R&D organizations.
- Project management approaches help in handling assignments in a specified time frame with definite start and completion points. Example handling customer orders by Industries involved in production of capital goods.
- Project management approaches provide task orientation to personnel in an Organization in handling assignments. Example: Organizations in IT sector handling software development assignments for clients.

3. Project management life cycle

We can identify four phases of project lifecycle (Tuthil, 2014; Kerzner, 2109):

1. Initiating the project (including identifying customer-driven factors and obtaining leadership approval and support).
2. Planning (including human and physical resources).
3. Executive (monitors, control, and cycle of efforts).
4. Project closure (training, operations, and support).

Other authors mentioned five step approach to project life cycle (Figure 1) (Hyttinen, 2017; Martinelli and Milosevic, 2016):

1. Initiating.
2. Planning.

3. Execution.
4. Monitoring and Controlling.
5. Closing.

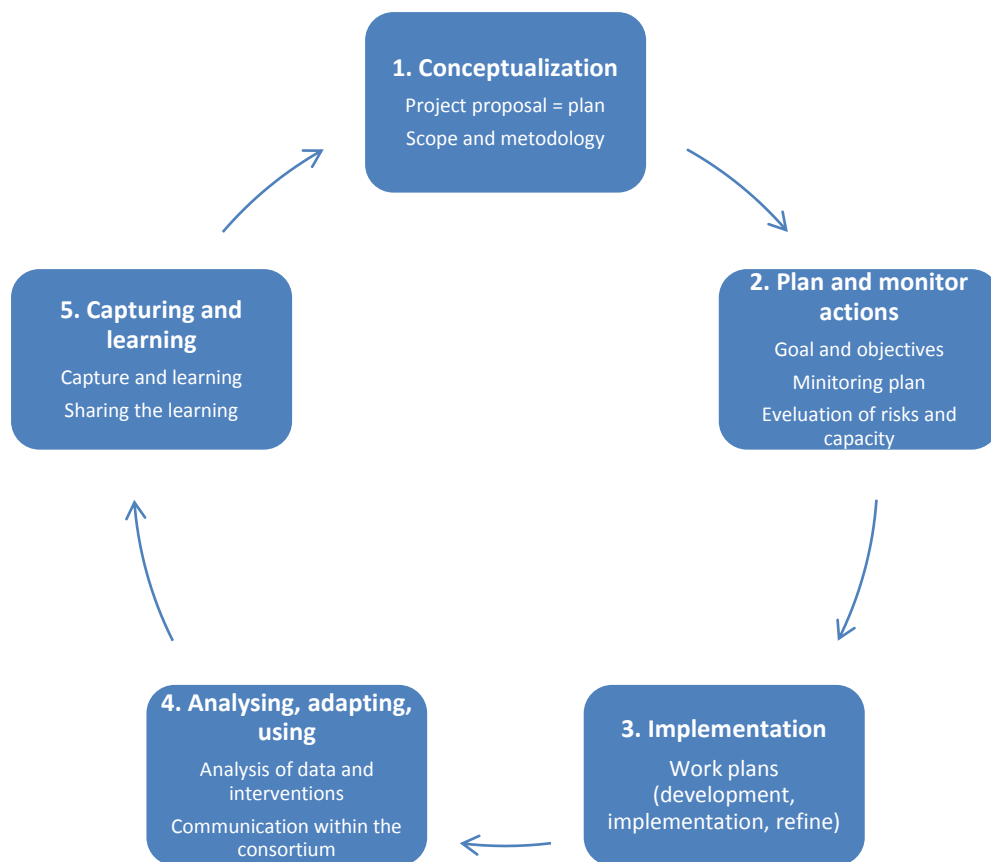


Figure 1. Project management life cycle. Source: (Hyttinen, 2017).

At the beginning of the project, the basic idea needs to be well explored and elaborated (Wolniak and Grebski, 2018; Wolniak et al., 2019; Wolniak and Hąbek, 2015; 2016; Wolniak and Jonek-Kowalska, 2021; 2022; Wolniak et al., 2020; Wolniak and Skotnicka, 2011; Wolniak and Skotnicka-Zasadzień, 2008; 2010; 2018). Initial phase includes also goals of the project, decision concerning the partners and parties to carry through the project implementation and the plan of the project (Smart, 2021; Campbell, 2020).

The project management plan should (ISO 10006:2018):

- refer to the customer's and other interested parties' documented requirements and the project objectives; the input source for each requirement should also be documented to allow traceability;
- identify and document the project processes and their purposes,
- identify organizational interfaces, giving particular attention to:
 - the project organization's connection and reporting lines with the various functions of the originating organization,
 - interfaces between functions within the project organization,

- integrate plans resulting from the planning carried out in other project processes, review these plans for consistency and resolve any discrepancies; these plans include:
 - quality plan,
 - work breakdown structure,
 - project schedule,
 - project budget,
 - communication plan,
 - risk management plan,
 - procurement plan,
- identify, include or reference the product/service characteristics and how they should be measured and assessed,
- provide a baseline for progress measurement and control, to provide for planning the remaining work; plans for reviews and progress evaluations should be prepared and scheduled,
- define performance indicators and how to measure them, and make provision for regular assessment in order to monitor progress; these assessments should:
 - facilitate preventive and corrective actions,
 - confirm that the project objectives remain valid in a changing project environment,
- provide for reviews of the project required by the contract to ensure the fulfilment of the requirements of the contract,
- be reviewed regularly and also when significant changes occur.

To evaluate project management it is necessary to define the key measure or key indicators (Denise, 2019; Wolniak and Skotnicka-Zasadzień, 2022; Wolniak, et al., 2019; Wolniak and Sułkowski, 2016). To achieve successful functioning of the project we should include five activities like: conceptualization, plan and monitor actions, implementation, analyzing, adapting and using, capturing and learning, which are described in table 1.

Table 1.

Main project activities

Activity	Characteristic
Conceptualization	The elaboration of project scope and methodology shall be defined during this first project phase. This phase includes expanding and encompassing the project concept to relevant elements such as current understanding and study fields. As a result, this phase provided a project plan at the beginning of the project.
Plan and monitor actions	In order for the project to meet the end users' needs, this phase shall redefine the goals and objectives for work package execution. The overall project plan is the stable foundation for the detailed plans. The risks and capacities must be updated and evaluated
Implementation	If the earlier phases have been effectively conducted, project execution and implementation are fluent processes. The activities in a CSA project vary and they can include desk-based studies, field studies, active data collection, organizing panel discussions, presentations, end user events, dissemination, gathering and analysing needs and feedback, providing publications, making research studies more available for public audiences, and utilising and exploiting relevant data for political decision-makers and/or other end users.

Cont. table 1

Analysing, adapting and using	Successful execution and implementation of the project or work package provides information and results to be analysed, adapted and used in relevant areas and fields. Depending on the objectives, the relevant bodies for this phase/process can be project consortium organisations, external end users (e.g. political decision-makers, industry, academics, technologies) or the general public. The use of change management processes, dissemination strategy, communications and exploitation is necessary during this phase.
Capturing and learning	At the end of the project or work package, one purpose is to gain more knowledge and skills at all levels: individual, group (consortium), organisational and public. Failures also provide platforms for the learning process. By sharing one's own experiences, the learning can happen in a wider framework (e.g. higher education). This phase aims to integrate the project findings to broader conceptualisation levels.

Source: own work based on: (Hytinen, 2017).

When we think about good project management in industrial enterprise we should stick to many principles and activities (Zwikael and Smyrk, 2019; Stecuła and Wolniak, 2022; Czerwińska-Lubszczyk, 2022; Gajdzik and Wolniak, 2022; Jonek-Kowalska et al., 2022). The challenge of project management is not only to deliver the project successfully, but also to deliver the result at an optimal balance cost, time, scope and quality, stakeholder satisfaction and achieving short and long term objectives at an acceptable risk. In the table 2 there is an characteristic of main project management principles.

Table 2.*Project management principles characteristic*

Principle	Characteristic
Focus on performances and results	Projects are specific endeavors with one or more explicit purpose and desired outcomes. Project managers are the main drivers toward achieving those goals and objectives. Where possible, leverage lessons learned from past projects to enhance the likelihood of achieving results.
Minimize surprises	Project professionals, especially project managers, should look ahead when possible and plan the execution of a project. Irrespective of the project management approach, project manager's primary responsibility is to navigate the situation, establish and manage the processes, and drive toward results. Even positive surprises, or opportunities, can be perceived as poor project management if they occur unexpectedly as the project cannot take more advantage of the opportunity.
Manage responsibility	The challenge of project management is to do more with less. By being as effectively and efficiently as possible, effective projects management should deliver results at lower costs and with greater satisfaction. Project managers should also find the optimized method for implementing projects, such as selecting between the spectrum of approaches from the predictive to the adaptive.
Optimize approach	Project management is an optimization exercise, performing the art of possibility by dealing with competing priorities and needs with factors such as availability of time and resources. Effective project management strives to find the optimal balance between good planning with overthinking and make difficult trade-off decisions, risk taking, speedy execution with thoroughness, focusing on exceptions while maintaining solid control over execution progress and managing change versus adopting change, and trust but verify. Combined with Manage Responsibly, project managers need to adopt the optimal method that works best for the project and the sponsoring organization.
Empower people	This is especially important on large projects involving many people. Organizations should provide an environment in which individuals can thrive and encourage their project managers to foster trust and independence in which people can contribute.

Cont. table 2

Communicate effectively	Communication has always been an important contributor of success. But in the era with a proliferation of technology tools such as social media, there may be a tendency toward too much information versus too little. Project professionals, especially the project managers, should concentrate on the most important messages and make sure they are delivered timely and appropriately.
Think and manage up	Most skilled project managers can manage both up and down one level effectively, but the truly experienced project managers can manage multiple levels up the organization chain. By developing the ability to think from the perspective of senior management, project managers can link their immediate project goals and deliverables with the broad goals and key performance indicators of executives multiple levels above their current standing. This is a sure way to ensure strategic alignment and continual support from the upper management.
Fact-based management	Complex projects, especially projects in a politically tense environment, can be intricate to manage. Project managers should always focus on the facts first and consider them first in their decision-making processes. Other sentiments, can be important, and even if some ultimate decisions are political, project managers should be aware that their decisions are based on extrinsic factors beyond mere facts.

Source: (We, 2020).

4. Conclusion

The considerations presented in the publication made it possible to analyse the most important aspects of project management. The paper concentrate on the analysis of basic principles of project management especially in the condition of Industry 4.0. In the analysis we were concentrated on industrial organization and tried to characterize main benefits of using the project approach in those enterprises. We distinguished the main benefits of using project management in industrial enterprise in Industry 4.0 conditions. It is especially important to use this approach to handle complex, costly and risky projects which are not easy to manage in traditional way. In Industry 4.0 we can spot many those type interdisciplinary projects linking the technical and social knowledge. In those situation using of project management approach can lead to the success of organization activities.

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