Project Management in a Sustainable Environment – a Comparison of Traditional and Agile Methods

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Abstract

The article presents two example projects, conducted according to different methodologies – traditional and agile. The projects take place in a company operating in the mining sector. One is organizational and the other is related to the introduction of a technological improvement. After the analysis of implementing project management techniques, the actions will be summarized and conclusions will be drawn as to which approach is better for the organization and whether the selection of the approach is an important factor in the success of the project.

Keywords: *sustainable development, project management, project, agile project management*

INTRODUCTION

The primary objective of this paper is to analyze both traditional and agile project management approaches in order to determine which method proves more effective for specific types of projects. The projects under analysis are conducted within a company operating in the mining sector. The first project, managed using a traditional methodology, is of an organizational nature. The evaluation will cover areas such as human resource and knowledge management, financial management, planning and scheduling, as well as communication and collaboration. The second project, managed using agile techniques, concerns the financial operations of the company—specifically, the optimization of the cost accounting process that takes place at the end of each month.

The paper will conclude with a summary of the undertaken analyses and a reflection on which project activities in mining industry enterprises benefit more from a traditional approach, and which are better suited to agile methods. It will also address whether the choice of project management methodology truly plays a crucial role in project success.

1. CONCEPT OF A PROJECT AND ITS SIGNIFICANCE IN PRACTICE

In the everyday practice of businesses, the term "project" is frequently encountered. However, its meaning often deviates from the official definition. This term is often misused, leading to the blurring of boundaries between projects and other types of undertakings, or even processes. According to the literature, a project is a temporary endeavor characterized by a defined scope and timeline, aimed at achieving a specific objective. The final outcome of a project should be unique and delivered within a set time frame. [Kosman, 2023]

Due to the ongoing changes in industry and the economy, particularly with the rise of Industry 4.0, it is necessary for businesses to respond dynamically to these shifts. Often, when such changes affect multiple areas, projects are formulated with the goal of organizing efforts to implement new solutions. The introduction of specific changes is a one-time event, further emphasizing the fundamental characteristic of a project. [Kosman, 2023]

The modern concept of a project dates back to the 1940s, when the construction of the atomic bomb under the codename "Manhattan" was undertaken. [Rhodes, 1995] In fact, it was a secretive initiative comprising a series of smaller projects carried out across the United States and Canada.

Key attributes that characterize any project include time, scope, and budget. These aspects are often referred to as the "project triangle".

Regardless of the chosen methodology, the essential task at the outset of any project is to define its objective. The main goal of the project should be set according to a goal-setting methodology, such as SMART, ensuring it is clear and indisputable. The SMART method is a concept that enables effective project management within the current requirements placed on projects. Its name is an acronym referring to five essential characteristics that any project goal should have. By incorporating these characteristics, the project goal remains indisputable, and the project's outcomes are easily verifiable.

The first attempt to formalize and define project management was presented by the Project Management Institute. According to this institution, project management is the application of knowledge, skills, tools, and techniques for forecasting actions to achieve the project's objectives. [Sołtysik, 2016] It is an interdisciplinary field focused on coordinating both material resources, such as people and machinery, and immaterial aspects, such as knowledge and risk. Over the centuries, project management has undergone numerous transformations and has been developed into various approaches. Two main approaches are typically distinguished: traditional and agile methodologies. Traditional methodologies include, among others, the waterfall model and PRINCE2, while agile techniques include frameworks such as Agile and SCRUM. [Trocki, 2003]

Project management is centered around the management of available resources to achieve a specific outcome (product or service), while being mindful of existing constraints and risks. A secondary objective is the management of the project team—motivation, skills, and communication among project participants. As mentioned earlier, over time, the field has evolved. Several project management methodologies can be distinguished, including:

- Waterfall model,
- Agile,
- Kanban,
- Scrum,
- Lean,
- Critical Path Method,
- Six Sigma,
- RAD (Rapid Application Development),
- Project Management Institute. [Trocki, 2003]

The choice of methodology is closely linked to the circumstances in which the project is conducted and the project's objectives.

2. TRADITIONAL PROJECT MANAGEMENT APPROACH

Project management in the sense of traditional methodologies is based on a static approach – going through the phases of the project one after another, without returns, except for changes and problems that arise during the implementation phase – then you have to go back to the planning phase. A lot of importance is attached to planning the goals, schedule, budget, and team composition as early as possible.

The project life cycle is the starting point for creating a schedule. To standardize and structure project work, 5 project phases are distinguished:

- initiation,
- planning,
- execution,
- locking.

It should also be noted that each phase is paralleled by a monitoring and control phase. [Wośko, 2016]

The choice of methodology is closely related to the circumstances in which the project is carried out and its purpose.

The traditional approach to project management is characterized by top-down planning of the team, task and scope allocation, and requirements. Emphasis is placed on detailed plans or documents. Most importantly, the project's product is delivered only at the end. Communication is mostly formal, and tasks are usually not subject to change.

Traditional project management, also known as the Waterfall model, is based on a linear progression through five main project phases: planning and analysis, design, implementation, testing, and deployment.

The Planning and Analysis stage involves determining the conditions under which the project will take place and its scope. An in-depth analysis of the input data is conducted. The requirements that must be met in order to consider the project a success are also determined. The next phase, as the name suggests, involves designing the actual form of the project.

In the next phase, the project is implemented, and the solution is then tested. Finally, after a successful testing phase, implementation follows. [Aina, 2020]

This approach requires a detailed, inflexible project plan. Waterfall assumes that the transition to the next stage occurs after the previous one is completed. Iterations are possible if the expected results are not delivered after a given phase, and then the process goes back to the beginning. This model is used in the manufacturing industry, for example, because it is difficult to implement changes in the later stages, so meticulous planning from the beginning is essential. The cascade model also requires clear documentation and immutability. [Wośko, 2016]

This method also has the advantage that individual design components do not have to work together all the time, but individually, which improves the speed of achieving results. Another advantage is the ability to determine the project cost and schedule at a very early stage. Each member of the project team is informed of what to do and by when, thanks to the extensive formal documentation. This allows you to plan your work time and increase productivity. [Soroka-Potrzebna, 2019]

As for the drawbacks of the cascade approach, the first noticeable one is the lack of flexibility – not every project will be effectively managed with this approach, due to the dynamically changing environment. Additionally, the project client is not always able to define all the requirements at the beginning, and defining them later causes serious problems and changes in the project organization. Furthermore, due to the assumption of a linear transition through the phases of the project, a delay in one phase means delays in every subsequent phase. [Aina, 2020]

3. AGILE PROJECT MANAGEMENT APPROACH

The agile approach is based on flexibility in planning and the ability to adapt to changing conditions throughout the project lifecycle. In this model, the schedule is not defined in detail at the outset. Team members are not assigned strictly defined roles but instead form an interdisciplinary unit. As the project progresses, members engage in iterative work cycles. In agile techniques, changes are not only acceptable but considered an essential component of the project. [Soroka-Potrzebna, 2019]

Project outputs are delivered continuously throughout implementation, unlike in the traditional approach, where delivery occurs at the end. Initial solutions are tested in the early stages of project development. The client and stakeholders are treated as partners and actively participate in the design, delivery, and product evaluation processes.

However, agile approaches come with certain drawbacks. One of the main challenges is the limited availability of final documentation, which is typically more comprehensive in traditional approaches. Furthermore, while flexibility is a benefit, it can result in unpredictability regarding changes. Agile methods require a high level of stakeholder involvement, which can be difficult to ensure. Additionally, due to the looser approach to planning and project flow, agile may not be suitable for very large or highly complex projects, where a high degree of discipline is essential. [Soroka-Potrzebna, 2019] Common agile techniques include Scrum and Lean Project Management.

SCRUM is a technique focused on values, principles, and practices. It relies on the project team's experience and self-organized task management. SCRUM emphasizes requirements and a predefined number of production cycles (sprints). Although initially developed for software development, SCRUM has been increasingly applied in other sectors.

Tab. 1. General project schedule. Source: own study

Tab. 1. Ogólny harmonogram projektu. Źródło: własne badania

No.	Phase	Estimated time	Scope
1.	Initiation	2 weeks	Establishment of the team Definition of the main and subsidiary objectives Determination of the initial scope of work
2.	Planning	6 weeks	Analysis of input data Knowledge transfer in the field of financial processes Development of an algorithm outline
3.	Implementation	6 weeks	Code development Code testing by analysts Introduction of improvements
4.	Closure	2 weeks	Final version of the code Summary of work and preparation of documentation Dissolution of the project team

During meetings held between sprints, high-priority tasks are selected, and the product owner presents the requirements. Each task is evaluated in terms of duration, workload, and risk. The team is not bound by rigid roles but is expected to self-organize. SCRUM involves the concept of a "backlog"—a prioritized list of tasks to be completed during a given sprint to achieve the desired level of product development. A good SCRUM practice includes daily meetings, known as Daily Scrum, where progress and current challenges are discussed. These meetings should be brief, typically no longer than 15 minutes. SCRUM is particularly effective for IT-related projects requiring iterative testing and improvement. [Hamza, 2023; Khiyal & Hussain, 2018]

Lean Project Management is a methodology and approach aligned with the philosophy of Lean Management. It is based on the PDCA (Plan-Do-Check-Act) cycle and originates from Toyota's methodology, where the goal is to maximize customer value while minimizing waste. A key aspect of this philosophy is identifying three types of waste:

- Muda – waste of time,
- Mura – process irregularity,
- Muri – overburden. [Georghakalou, 2023]

By addressing these types of waste, the project aims to reduce all forms of inefficiency, resulting in highly efficient, sustainable, and profitable outcomes. The client's needs are paramount and form the basis for identifying and visualizing the value stream. After each PDCA cycle, every team member is responsible for identifying ways to reduce waste. A central principle of Lean Management is continuous improvement, known as Kaizen, which the project team should follow even after project completion

Initially, project challenges are identified, stakeholder needs are analyzed, and goals are specified. Subsequently, actions, required resources, and budgets are determined. Responsibilities and task order are assigned, followed by schedule development. Risks and opportunities are analyzed, and rules for communication and reviews are established. The plan is then implemented with ongoing adjustments and monitoring. Upon achieving the desired outcomes, the solution is deployed, and the project is summarized. Iterations may be introduced as necessary. [Georgakalou, 2023]

Lean Project Management is especially useful in projects where lean resource management is essential, and the scope is relatively small, excluding the implementation of IT tools.

4. COMPARATIVE ANALYSIS OF PROJECT MANAGEMENT IN THE MINING INDUSTRY

The enterprise under analysis operates within the mining industry and undertakes a variety of project-based initiatives, including organizational, investment, and financial-settlement activities. Due to the high volume of concurrent projects, the company has not developed a single, unified methodology for project implementation. This situation allows for the observation of diverse approaches and provides an opportunity to evaluate which methodology proves more advantageous for the organization.

4.1. Evaluation of Traditional Project Management Implementation – Organizational Activities

1. Human Resource and Knowledge Management

- A key role was played by the analysis of project team competencies and the assignment of appropriate roles.
- In 2022, following the experiences of 2021, issues related to unclear responsibilities and knowledge gaps were eliminated.
- A competency matrix was introduced to identify the team's strengths.
- A RACI matrix was implemented to organise responsibilities and roles.

2. Financial Management

- In 2021, costs were overestimated due to a lack of previous experience.
- In 2022, a more realistic budget planning process was introduced, based on previous project iterations and accounting for external factors such as inflation.
- The cost estimation strategy was changed to one based on historical data and market trends.

3. Planning and Scheduling

- The project was carried out in accordance with a phased, traditional project management approach: Initiation → Planning → Execution → Closure.
- In 2022, a Work Breakdown Structure (WBS) was implemented, enabling precise assignment of dates and activities, although it reduced flexibility.
- The action plan was fixed and not modified during the course of the project.

4. Communication and Collaboration

- Team meetings were held regularly, with dates scheduled using the Doodle platform.
- Communication was formal in nature – the main channel being the MS Teams platform.
- The team received feedback from the coordinator and project leader, which supported the quality and effectiveness of task execution.

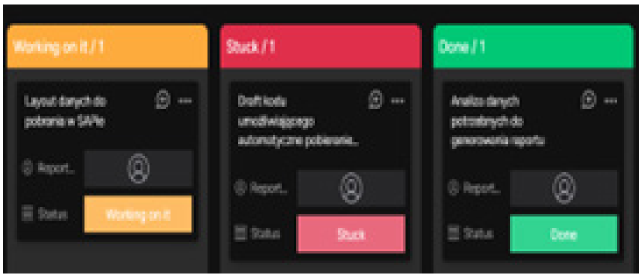

Fig. 1. Kanban board, which was used to track the project's progress. Source: own creation using Monday.com program
Rys. 1. Tablica Kanban, która służyła do śledzenia postępów projektu. Źródło: własne opracowanie przy użyciu programu Monday.com

An analysis of all the above aspects indicates that the implementation of the traditional project management approach was conducted correctly. In both the daily functioning of the team and the planning of activities, tools representative of this methodology were applied.

4.2. APPLICATION OF AGILE APPROACHES IN ENTERPRISE PROJECT EXECUTION

In modern enterprises, particularly within the IT sector, the use of agile approaches in project execution is gaining increasing popularity. This methodology offers greater flexibility, which proves especially beneficial in dynamic markets and under changing conditions. Today, it is difficult to imagine an efficiently functioning company without appropriate technology. Departments collaborate closely and the flow of information is becoming almost entirely digital. For the processes of information exchange and document analysis to function correctly, technology plays a crucial role in the daily operations of departments.

The implementation of modern solutions requires adequate preparation and resources. Merely purchasing software is not sufficient to improve core processes efficiently and effectively. Implementation demands not only the preparation of human resources but also the adaptation of all activities within a given area for the transition to an automated stage. In such endeavors, agile project management techniques prove more suitable than traditional approaches. They offer greater flexibility in responding to changing conditions and achieving desired outcomes.

To illustrate and analyze the implementation of agile methodologies in the day-to-day operations of enterprises, a project undertaken within the Finance and Controlling Department was examined. The project focused on improving the monthly cost settlement process.

In the process under discussion, the individual responsible for settlements must first extract data from the SAP system, then convert it and paste it into the appropriate cell range in Microsoft Excel. Using a designated key, they manually assign cost categories to the documents. The next step is to build a cost summary report, followed by time analysis. Additionally, given the workload of the person responsible for this task, errors are difficult to avoid. Below, the potential sources of discrepancies occurring during the process have been identified:

- No connection with internet
- Lack of knowledge of MS Excel
- Technical problems with SAP
- Extended responsiveness of MS Excel when analyzing large amounts of data
- Unclear work standards

The purpose of the report is to determine the extent to which the recognized costs deviate from the planned budget.

This process is labor-intensive and time-consuming.

Given that human error is the most straightforward source of inaccuracy to address, it was selected for deeper analysis. A number of typical mistakes that may be made by the individual responsible for the settlement process were identified, including:

1. selecting the wrong transaction in the SAP system,
2. incorrectly choosing the data layout,
3. selecting an inaccurate data range,
4. improper transfer of data from SAP to Microsoft Excel,
5. incorrectly applied formulas to the dataset,
6. insufficient proficiency in Microsoft Excel, particularly in relation to report generation and pivot tables,
7. incorrect data interpretation, e.g. analyzing figures in the wrong currency,
8. incorrect data conversion due to lack of awareness of work standards.

Given both the range and the likelihood of these errors occurring, a decision was made to initiate a project aimed at implementing a macro to support the cost coding and analysis process.

The primary objective of this project was to automate the process, thereby optimizing working time and eliminating errors. As a result of this time-saving initiative, the Finance and Controlling Department team would be able to focus on more strategically important tasks, thus significantly improving their overall productivity. Consequently, by reducing their involvement in demanding and time-consuming work, the team could engage in additional projects, ultimately leading to cost savings.

4.3. PROJECT PLANNING AND IMPLEMENTATION IN AN AGILE APPROACH

Following the initial identification of the project's subject matter, the main objective and subsidiary objectives were defined. The main objective is the aforementioned automation of the cost coding process and report generation. The subsidiary objective is to increase the awareness of the team operating within the accounting and controlling department regarding the creation of macros in Visual Basic for Applications, as well as the mechanisms functioning within the department.

The implementation of the project required individuals with extensive knowledge of the costs incurred by the enterprise, as well as those with skills in writing code in Visual Basic for Applications. Taking these requirements into account, it was possible to organize an interdisciplinary team.

Tab. 2. Comparison of traditional and agile project management approaches. Source: own study

Tab. 2. Porównanie tradycyjnego i zwinnego podejścia do zarządzania projektami. Źródło: opracowanie własne

	Traditional approach	**Agile approach**
Planning	Schedule determined at the outset of the project Work Breakdown Structure Division of work into sectors	Loosely defined schedule Definition of the main objective
Meeting frequency	Meetings held every 1–2 weeks for reporting and allocation of further tasks	Use of sprints and meetings every two weeks between sprints to define further actions Daily 15-minute Daily Scrums to summarize the previous day's activities and address current issues
Team structure	Functional structure defined at the beginning of the project Use of a competency matrix Use of a RACI matrix	Appointment of a Product Owner Interdisciplinary team without precisely assigned roles
Software/tools used	- MS Excel, - MS Project, - MS Teams.	- SAP, - MS Excel, - Kanban board in Monday.com
Communication	Formal communication, full documentation maintained on the MS Teams channel E-mail communication at key milestones	Informal discussions and live brainstorming without formal documentation Key aspects documented in group chats

The team manager was assigned the role of Product Owner. Their tasks included monitoring progress and conducting meetings between sprints to ensure the appropriate work dynamics. Additionally, the manager supported analysts in their work on data standardization. The analysts shared their knowledge of economics and data processing, and at later stages, their task was to test the solutions proposed by the technical expert. The technical expert was responsible for the correct interpretation of the knowledge and solutions previously applied by the analysts and, in cooperation with them, the creation of an algorithm that would subsequently be operated by the program.

Given the small scope and the internal nature of the project, the undertaking did not require additional funding and did not generate costs.

At the beginning of the project work, a general project schedule was defined. It is presented below in Table 1.

Since the core of the project was the creation of an efficiently functioning program, it was essential to consider iterations related to program testing and revisiting earlier phases. The agile approach allows for such actions, and flexibility is even recommended.

The planning and implementation method adopted followed agile methodologies, i.e., by conducting meetings between sprints and sprints lasting two weeks. During the meetings, tasks were divided, and the results were presented at each subsequent meeting. Work commenced with simple solutions aimed at the partial automation of the process. The analysts tested the code, which, after analysis and algorithm creation, was developed by the responsible technical expert. The analysts provided feedback on whether the code functioned correctly and what could be improved. After four iterations and the testing phase, the solution was satisfactory to all parties.

The final product was a program that, once launched, automatically retrieved data from SAP from the specified transaction in the given tabular layout and with the appropriate file extension. It then opened this file, copied the data, and pasted it into the relevant MS Excel file. Based on the characteristics of the input data, the program assigned a cost category and ultimately created pivot tables representing the dataset for a specified period.

In order to standardize project work, it was decided to use Kanban boards. This tool was considered to enable visualization of the workflow and allow for quick identification of which activities were stalled and needed to be moved to work-in-progress. Below, in the Figure 1, the scheme of the Kanban board used in the project is presented.

This graphical tool enabled the entire project team to track the current project status. As seen in the above figure, this was the initial phase of the project, in which the input data had been analyzed. This task was classified as completed. In the "work in progress" phase was the task of creating the data layout for extraction from SAP. Creating a template that automatically includes all conditions that generate valid data in the transaction was key to speeding up the process. The task entitled "draft code enabling automatic data extraction from SAP to MS Excel" was, at the time of analysis, not yet started, as creating the code required knowledge of the variant that would generate the correct data.

In addition to the Kanban board, it was decided to implement daily short meetings, i.e., Daily Stand-ups, aimed at monitoring progress and addressing emerging issues on an ongoing basis.

4.4. ASSESSMENT OF THE USE OF THE AGILE APPROACH

Projects involving the implementation of technology and automation elements in business processes, particularly in international enterprises, typically require a flexible approach and an interdisciplinary team. Given these conditions, it was decided to carry out the project focused on the automation of cost settlement processes within the financial controlling department using the Agile approach.

No strict division of roles was applied in the project—the only role assigned was that of Product Owner, fulfilled by the head of the controlling department due to their competencies and knowledge. At the outset, the project scope and the main objective were defined, namely the minimization of time and errors in preparing monthly cost settlements (including marketing costs) through a macro created in MS Excel. A project team was formed comprising the controlling department manager, financial analysts specializing in different cost categories, and a technical expert skilled in coding.

It was agreed that sprints would last two weeks and meetings would serve a reporting function. Additionally, subsequent steps were determined during these meetings. To track progress and monitor the project, a Kanban board was used. This allowed all project team members to see what was currently in progress, what tasks had been completed, and what had not yet been started. The use of short daily meetings eliminated lengthy problem-resolution times.

Communication was informal, with conversations taking place both on the MS Teams platform and in private messages. Extensive documentation and reporting, typical of projects run according to traditional methodologies, were not used.

The dynamic nature of project management employing agile techniques enabled the efficient completion of the project. The project's outcome was not only a functioning program but also an enhancement of the entire project team's knowledge, both in cost categorization and in the use of MS Excel, Visual Basic for Applications, and SAP. Additionally, participation in a project conducted using the Agile approach constitutes added value in the experience of each project team member.

CONCLUSIONS

The case study analysis comparing the traditional and agile approaches to project management confirms the highly contrasting differences between these methodologies. The traditional approach is characterized by significantly less flexibility and a considerably stronger emphasis on rigid planning—from team formation through scheduling to budget estimation. Such projects are easy to control; however, when delays occur, it is difficult to implement changes. The agile approach is far better suited to the current operations of large enterprises, which must dynamically respond to changing external conditions.

Table 2 below presents the key differences between the analyzed projects, further highlighting the contrast between traditional and agile project management approaches.

Key differences can be observed at the planning stage and in team formation.

In the traditional approach, the division of roles and areas of responsibility, as well as precise scheduling and planning of activities, are of paramount importance. The course of such a project was presented in the form of a Work Breakdown Structure, including dates and a division into phases. Meetings were held weekly or fortnightly depending on the project's progress phase. These meetings focused on what had been achieved, what problems had been encountered, and what needed to be done next. Regarding the team, a formal functional division was applied. This process was supported by the use of a RACI matrix and a competency matrix. Project planning was carried out using MS Excel and MS Project, while communication took place via a dedicated MS Teams channel, ensuring that all documentation was maintained in written form. Additionally, at key stages of the project, e-mail communication was sent to all project team members.

In contrast, in the agile project, the main objective and an initial outline of activities were defined at the start. Meetings were held every two weeks between sprints. Additionally, short daily morning meetings (Daily Scrums) took place, where the project team discussed current issues and had the opportunity to introduce immediate adjustments. These short meetings supported the dynamic nature of the work and served a motivational function. The team did not have a formal structure; only a Product Owner was appointed to oversee the project's progress. The team's competencies made it interdisciplinary.

The following conclusions were drawn:

- The traditional project management approach is particularly useful for projects of an organizational nature.
- Traditional methodologies are characterized by greater rigidity in planning, making it difficult to implement changes.
- The agile approach is ideally suited to projects conducted under conditions of higher risk and in dynamic environments.
- The agile approach requires a greater degree of team self-discipline than the traditional approach.
- In projects involving technology implementation, where iterations and solution testing are necessary, the agile approach is a far better choice.
- The choice of project management approach is crucial and has a significant impact on the ultimate success of the undertaking.
- To tailor the project management approach appropriately, it is essential first to analyze all the conditions in which the project will be conducted.

It should be noted that although agile techniques are increasingly applied in everyday business practice, they have not replaced the traditional approach. The approach represented by PRINCE2, the Project Management Institute, and even the waterfall model remains relevant and can be successfully applied in certain projects, especially those involving people and of an organizational nature.

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Zarządzanie projektami w zrównoważonym środowisku – porównanie metod tradycyjnych i zwinnycha

W artykule przedstawiono dwa przykładowe projekty, przeprowadzone według różnych metodologii – tradycyjnej i zwinnej. Projekty te mają miejsce w przedsiębiorstwie działającym w sektorze wydobywczym. Jeden ma charakter organizacyjny, a drugi dotyczy wprowadzenia usprawnienia technologicznego. Po analizie wdrażania technik zarządzania projektami zostaną podsumowane działania i wyciągnięte wnioski, które podejście jest lepsze dla organizacji i czy wybór podejścia jest ważnym czynnikiem sukcesu projektu.

Słowa kluczowe: *projekt, przemysł wydobywczy, zrównoważony rozwój, zwinne zarządzanie, optymalizacja*