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Adopting Agile Project Management Practices in Non-Software SMEs: A Case Study of a Slovenian Medium-Sized Manufacturing Company

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Abstract: In today's highly dynamic and unpredictable project environment, companies need to be able to manage changes quickly and effectively, otherwise, the final product will not be current and will only go to waste. Traditional project management approaches that focus on planning are no longer efficient and companies are forced to adopt new ways of working. As a result, more flexible agile project management (APM) approaches have emerged over the last decades. Originally developed for the software industry, APM is now increasingly recognized and adopted also by other industry sectors. However, due to some discipline-specific differences, the adoption of APM by non-software companies is challenging and requires many adjustments and high financial input. While the larger organizations have sufficient resources to make such a transition, small and medium-sized enterprises (SMEs) generally cannot afford to do so, and therefore need alternative strategies to increase their agility and stay competitive on the global market. In this paper, we present a case study of a Slovenian medium-sized manufacturing company that implemented only certain APM practices separately and not as part of a structured APM methodology, and still managed to achieve significant benefits: improved communication, faster detection of discrepancies, more effective problem-solving and greater flexibility. The results also suggest that APM practices, even when implemented separately, positively impact project success in terms of both efficiency and stakeholder satisfaction, and can thus help in establishing an economically, socially, and environmentally more sustainable workplace.

Keywords: project management; agile; manufacturing; SMEs: project success

1. Introduction

In today's highly dynamic, uncertain and rapidly changing project environment, traditional plan-driven project management approaches are no longer efficient [1]. Products have become increasingly complex, and customers are constantly demanding new functionalities. To cope with such an unpredictable environment, more flexible and value-driven approaches have been developed over the last decades. These approaches are also referred to as agile project management (APM) approaches [2].

APM first emerged in software development in the 1980s [3] and became widely popular with the release of the Manifesto for Agile Software Development in 2001. In the manifesto, Beck and co-authors presented core values and principles of the new development approach that is more people- and value-oriented. The main characteristics that distinguish APM from traditional management approaches include short iterative development cycles, flexible scope, incremental value creation,

iterative and adaptive planning, active customer involvement, self-organized cross-functional project teams, and embracing change [3–6].

Due to its great success in software development, APM has now increasingly spread to other domains [5,7] and has become an emergent topic for both scholars and practitioners [8]. However, due to some discipline-specific differences, a direct transfer of APM methodologies to physical product development is neither feasible nor beneficial [9,10]. Research on APM for physical product development therefore focuses on how to appropriately tailor APM approaches to suit a specific organization or specific project and how to effectively combine them with traditional approaches.

APM for physical product development is still a relatively young research field, however, the available studies show promising results. It has been shown that APM approaches can be successfully applied to a variety of industry sectors and that they have a positive impact on project success [5]. The most commonly reported benefits are related to teamwork, customer integration, productivity and flexibility [7]. Even though the results are promising, the literature on the topic is still scarce and the need for additional in-depth case studies and statistical analyses is still recognized [1,2,5,11].

There is an especially big lack of literature considering small and medium-sized enterprises (SMEs) adopting APM [12]. The adoption of APM methodologies requires high financial input because of big organizational changes, employment of agile experts, training of employees, etc., and while the large organizations usually have enough resources to undergo such a transformation, SMEs can only rarely afford it. Therefore, they require different principles and strategies to increase their agility and to stay competitive on the global market.

In this paper, we analyze the implementation of APM in a Slovenian medium-sized company specializing in wire harness manufacture for the automotive industry. The main goal of the paper is to show that, instead of adopting a whole structured APM methodology, SMEs can implement only a few APM practices without needing to undergo a complete transformation of their current organization and still reap significant benefits. The findings also indicate that even when implemented separately, APM practices can positively impact project success in terms of both efficiency and stakeholder satisfaction, and can thus help in establishing both an economically and socially more sustainable workplace. Additionally, identifying discrepancies early on and lowering the number of necessary corrections in the late project stages, APM practices reduce waste and rework rate and can also positively impact the environmental pillar of sustainability. The main contribution of the paper is in providing the companies that cannot afford to go fully agile an alternative that does not require an extensive reorganization or high financial input, but still allows them to increase their agility and thus improve their chances of success.

The rest of the paper is composed as follows. Section 2 presents a literature review on APM and APM for physical product development. The findings of existing studies are presented and some challenges of APM adoption are pointed out. In Section 3 the research methodology is described. Section 4 provides a brief description of the case company and the analyzed project, and presents the results of the study. Both the benefits of adopted APM practices and their impact on the overall project success are discussed. In Section 5 we elaborate on the findings of the study and discuss the main enablers that may facilitate the adoption of APM practices and the characteristics of the projects that may benefit most from introducing APM. The paper concludes with some final remarks and directions for future research.

2. Literature Review

2.1. Main Characteristics of Agile Project Management

Many scholars and practitioners have noted that traditional plan-driven project management is not efficient in today's turbulent business environment and cannot deal with challenges such as increasing complexity, unstable requirements, and high rates of change [3,13–15]. The solution to this

problem is, however, not in a more sophisticated and detailed initial project plan, but rather in a more flexible project management approach, which is also recognized by the term APM [2].

In 2001, 17 prominent software practitioners released the Manifesto for Agile Software Development, in which they collected the main values and principles of the new, better way of thinking and development [16]. They stated that they have come to value: (1) individuals and interactions over processes and tools; (2) working software over comprehensive documentation; (3) customer collaboration over contract negotiation; and (4) responding to change over following a plan. The twelve supporting principles are: (1) early and continuous delivery of valuable software; (2) embracing changing requirements, even late in development; (3) frequent delivery of working software; (4) daily interaction of business people and developers; (5) motivated individuals; (6) face-to-face interaction; (7) working software as the primary measure of progress; (8) sustainable development, ability to maintain a constant pace; (9) continuous attention to technical excellence and good design; (10) simplicity; (11) self-organizing teams; and (12) regular reflection and adaptation [16].

In APM, documentation and planning are kept to a minimum in order to facilitate flexibility and to enable a rapid response to the changing environment [5,17,18]. Flexibility helps to manage complexity, reduces both market and technical uncertainty, and increases the efficiency under unstable requirements [4,11]. APM is a learning-oriented approach [11]. The project team learns continuously through frequent testing and recurring customer feedback, which allow the new information and knowledge to be quickly incorporated into the next iteration, delivering the product the customer actually needs.

Interest in agility in project management is growing rapidly, but the definitions in this area are still inconsistent, incomplete and lack clarity [19,20]. Highsmith understood agility in terms of five key objectives: continuous innovation, product adaptability, reduced delivery times, people and process adaptability, and reliable results [21]. Augustine defined agility as "the ability to deliver customer value while dealing with inherent project unpredictability and dynamism by recognizing and adapting to change" [22]. Conforto et al. adopted the following definition of APM: "an approach based on a set of principles, whose goal is to render the process of project management simpler, more flexible and iterative in order to achieve better performance (cost, time, and quality) with less management effort and higher levels of innovation and added value for the customer" [2]. Cooper summarized the APM approach as "a microplanning or project management tool designed to engage a development team, including the customer, in getting to a working end product quickly" [23].

In 2016, Conforto et al. used the combination of a systematic literature review and a frame semantics methodology to build what they said is a complete definition of agility. Their proposed definition is as follows: "Agility is the project team's ability to quickly change the project plan as a response to customer or stakeholders' needs, market or technology demands in order to achieve better project and product performance in an innovative and dynamic project environment" [20]. They pointed out that agility should be considered as a project team's performance and not of a certain methodology or practice. This conclusion promoted an easier and better understood agility adoption by different organizations beyond the software industry. In addition, their research indicated that the two core elements of agility in project management are the ability to change the project plan rapidly and active customer involvement.

In their paper, Azanha et al. concluded that even though definitions of APM differ, there is still a general consensus among most authors that the essence of APM is " ... an approach that seeks flexibility, simplicity, iterations in short periods of time, and incrementally add value" [19].

2.2. Agile Project Management for Non-Software Development

Due to its many advantages, APM has quickly gained popularity across the software industry [17] and is now considered to be mainstream in software engineering [18]. The importance of APM has also been recognized by some of the most popular project management bodies of knowledge,

otherwise known for their traditional approaches. The sixth edition of the PMBOK® Guide was extended with the Agile Practice Guide [24], and the PRINCE2 with the PRINCE2 Agile [25].

In recent years, the success of APM in the software industry has encouraged the spread of APM to a variety of other industry sectors such as hardware development, construction and real estate, education, and services [1,5–7,26]. Trends observed in the recent literature are the so-called hybrid models, which combine agile and traditional project management approaches [27,28]. This allows organizations to reap the benefits of agility without sacrificing the stability provided by traditional approaches [1,27].

Conforto and Amaral proposed a hybrid model called IVPM2, which applies APM principles to the Stage-Gate model and analyzed its application in technology-based companies [29]. The results showed that using simple, iterative, visual, and agile techniques for planning and controlling innovative product projects combined with traditional project management best practices, such as standardization, positively impacts project and product development performance. The authors also suggested that combining these two approaches could be a potential solution for managing innovation projects in high-technology-based companies [8,29]. Gutiérrez et al. proposed a methodology for agile new product and process development that combines APM approaches and innovation management best practices [30]. The proposed methodology ensures that actual product requirements are met and project life cycles are shortened, while keeping the space for innovation and creativity. Hannola, Friman and Niemimuukko analyzed the applicability of APM methodologies for improving the efficiency of the innovation process [31]. The study showed that APM methodologies allow various improvements in terms of organizational practices, transfer of know-how, and understanding of customer needs.

Sommer et al. proposed a hybrid model that combines the Stage-Gate model at the strategic level and agile Scrum at the execution level [32]. The analysis of in-depth case studies within seven manufacturing companies showed that industrial companies can achieve significant performance advantages by implementing the proposed hybrid model for new product development. Cooper presented two large company best-practice examples to illustrate how to run such an Agile–Stage-Gate hybrid model [23]. The study indicated benefits such as significantly faster product releases, better response to changing customer requirements, and improved team communication and morale. In the following years, Cooper, Sommer and other colleagues further analyzed and improved the Agile–Stage-Gate hybrid, and conducted several additional studies in various major firms, such as LEGO Group, Danfoss, Tetrapak and others [33,34], all reporting improved development processes.

Edwards et al. analyzed the implementation of Agile–Stage-Gate hybrid in three manufacturing SMEs [12]. The study showed that the hybrid model can be successfully implemented in SMEs and that APM approaches positively impact time-to-market, overall new product process, and project success rate.

Although existing studies report several benefits and the potential gains are tempting, researchers also recognize that the process of implementing a hybrid model can be very daunting [33]. Conforto et al. acknowledged that non-software companies can face challenges such as difficulties in having co-located and full-time dedicated project teams, active customer collaboration, and supplier involvement [2]. Cooper and Sommer listed management skepticism and finding dedicated resources as the greatest challenges of adopting a hybrid model [33]. The study of Edwards et al. revealed that finding dedicated team members is also the biggest challenge for SMEs, where the problem is even more evident because of the individuals taking on multiple roles in the company [12]. There are also some new project roles that need to be introduced in hybrid models (e.g., Scrum master and product owner), which require an extensive reorganization and training of employees [33,35].

Furthermore, APM is based on iterative and incremental development and value delivery, which means that a working intermediate product (a working software code) is provided to the customer in each iteration. In physical product development, it is virtually impossible to deliver a functional and potentially marketable product every few weeks, therefore, the deliverable or "done" iteration needs to be redefined [23]. For that matter, Cooper introduced the idea of a *protocept*, a product

version somewhere between a concept and a prototype that can be shown to the customer to seek feedback [36]. It can represent anything from design drawings, computer models, virtual prototypes, working models, to ready-to-trial prototypes [23,33]. In his book, Ullman emphasized some additional challenges related to the constraints of physicality, such as modularization of hardware, developing hardware in short iterations, adding features to the finished product, a greater need for specialization, timely demonstrations and testing, the higher cost of changes, and others [37].

To effectively address all the challenges identified and to successfully implement a hybrid model for physical product development, some big changes in an entire organization are required, such as hierarchy reorganization, employment of agile experts, project role changes and extensive training and workshops for all employees. Also, some pilot projects must first be carried out to establish a clear implementation process. This kind of transformation requires a full management buy-in and a high financial and non-financial input, and many companies, especially SMEs, cannot or are not prepared to invest.

On the other hand, there are some studies that indicate that companies can also implement only some of the APM practices in their current development process instead of adopting a whole structured APM methodology or a new development model (such as proposed hybrids), and still achieve significant benefits. For greater clarity, the definitions of practice and methodology from the PMBOK® Guide (2017) are provided in the following. A practice is "a specific type of professional or management activity that contributes to the execution of a process and that may employ one or more techniques and tools" (e.g., daily stand-up meetings). A methodology is "a system of practices, techniques, procedures, and rules used by those who work in a discipline" (e.g., Scrum) [38].

Magistretti et al. analyzed the implementation of APM practices in a service-industry company and showed that they can be successfully implemented without the need to reconstruct the overall organization [27]. Hilt et al. analyzed the adoption of APM methodologies in predevelopment of new products and technologies in a large automotive company. They did not manage to implement a fully agile project, but they showed that many APM practices are easily adoptable and can help developers in the early stages [4]. They also found that these APM practices can be applied separately and combined with the traditional means without losing their benefit: they reported of APM practices encouraging close teamwork, supporting transparency, improving information flow and easing management of changing requirements.

There are also several studies that show that many non-software companies incorporate APM practices in their development process without having a systematic APM approach established and without formally recognizing these practices as agile [2,39]. Serrador and Pinto found that 65% of the surveyed projects have at least some agile component, and that implementing APM practices positively impacts project success [5]. Among the most frequently applied APM practices the researchers listed: small cross-functional teams, customer integration, frequent face-to-face meetings, empowering the team with autonomy to make decisions, test-driven development, and frequent updates to the project plan [2,4,39].

3. Research Methodology

In our research, we analyze the implementation of APM practices in one case project in a Slovenian medium-sized manufacturing company. Our research follows an action research approach [40] as it aims both to improve the current project management process in the company and to execute a very complex project successfully, as well as to enrich the rather scarce literature on APM adoption by non-software companies.

The research process was divided into five phases: (1) a literature review was carried out to analyze good practices and the biggest challenges of APM adoption by the manufacturing companies; (2) the current project management process in the case company was analyzed and a case project for introducing APM practices was selected; (3) in the project kick-off meeting, the head of the project and other team members were assigned, and a plan for managing the project using the chosen APM

practices was made; (4) the approach combining the company's standard management process and APM practices was implemented in the case project; and (5) after the completion, the project was analyzed and evaluated in order to address the two main research questions (RQs):

- RQ1: Was the implementation of APM practices successful and did the company benefit from implementing APM practices?
- RQ2: Was the project successfully executed and did APM practices impact project success in any way (positively or negatively)?

All the information was gained through active collaboration with the company, on-site observations, and several discussions and informal conversations with the stakeholders. During the project, the head of the project (the second author of the paper) also took on the role of an internal researcher. His primary goal remained to execute the project successfully, but he also constantly closely observed the processes, kept the list of observations and other notes, and reported to the other authors on the project progress.

All the information and documentation was thoroughly analyzed and is presented as a case study. The success of the implementation and the benefits of the APM practices (RQ1) are discussed based on the project team's response to how the APM practices impacted the project's course and their ability to respond to changes and adapt the project plan accordingly in order to achieve better project success. The questionnaire for measuring agility was used to evaluate the agility level in the case project and compare it to the company's standard way of managing projects. The five variables, used to evaluate the agility level are: customer and team integration, delivery frequency, customer validation, decision time, and project plan updating time. The questionnaire was taken from Conforto et al., who proposed a 6-point Likert scale adoption for the evaluation [20].

Questionnaire for measuring agility:

1. *Customer and team integration*: The frequency of the communication (interaction) between the project team and the customer to discuss project related topics was: (1) above 6 months; (2) every 6 months; (3) bimonthly; (4) monthly; (5) biweekly; (6) weekly or daily.
2. *Delivery frequency*: The frequency in which the team delivered partial results to the customer was: (1) above 6 months; (2) every 6 months; (3) bimonthly; (4) monthly; (5) biweekly; (6) weekly or daily.
3. *Customer validation*: The partial results of the project were frequently presented, discussed and validated by the customer: (1) strongly disagree to (6) strongly agree.
4. *Decision time*: In case of changes in the project scope, what was the average time needed for the team analyze an information and make a decision? (1) above 30 days; (2) 15 to 30 days; (3) 8 to 14 days; (4) 4 to 7 days; (5) 1 to 3 days; (6) less than 24 h.
5. *Project plan updating time*: In case of changes in the project scope, what was the average time for the team to update the project plan and to communicate to all stakeholders? (1) above 30 days; (2) 15 to 30 days; (3) 8 to 14 days; (4) 4 to 7 days; (5) 1 to 3 days; (6) less than 24 h.

For the project success evaluation (RQ2), we adopted the definition of Serrador and Pinto, who defined project success through the adoption of project efficiency (the traditional meeting of the cost, time and scope goals) and stakeholder success (the satisfaction of all the main project stakeholders: sponsors/organization, project team, customer, and end user) [5]. For project efficiency evaluation, the project costs were compared to the planned project budget, the time to execute the project was compared to the project deadline (the major milestones were also taken into consideration), and the scope was evaluated through the meeting of the customer's requirements and product features, and fulfilling the automotive industry standards. The information about the satisfaction of the organization and project team was gained through different discussions and semi-structured interviews within the case company, while for the customer satisfaction, their supplier evaluation was used. Since the final product was not yet on the market at the time of the research, the satisfaction of the end user was left out of the evaluation.

After the project completion, the head of the project was asked to answer the questions regarding project success (see below) using a 5-point Likert scale (1—unsatisfactory, 2—goals not fully met, 3—fully meets goals, 4—exceeds goals, 5—exceptional), as suggested by Serrador and Pinto [5]. The responses were used to calculate the two success factors [5]:

Efficiency factor = mean of the following three responses:

1. How did the project do in meeting project budget goals?
2. How did the project do in meeting project time goals?
3. How did the project do in meeting project scope and requirements goals?

Stakeholder success factor = mean of the following three responses:

1. How did the organization (top management) rate the success of the project?
2. How do you rate the project team's satisfaction with the project?
3. How do you rate the customer's satisfaction with the project?

The evaluation of success factors was based on real data; however, information about actual cost and time savings cannot be disclosed due to the sensitivity and confidentiality of the information.

The impact of APM practices on project success were qualitatively evaluated and are discussed based on the observed benefits and stakeholder feedback. Additionally, the head of the project was asked to evaluate the impact of the APM practices by comparing the case project to some similar projects the company has worked on in the past (similar in scope and complexity) and where their standard management approach was applied. The head of the project represented a reliable source of information, as he had years of experience in managing and participating in various projects in the case company.

4. Case Study

4.1. Company Environment

The case company is a Slovenian medium-sized enterprise specializing in wire harness manufacture. The company is a tier 2 supplier for the automotive industry. In 2019, they had 200 employees and EUR 20 million turnover. Their development process follows the APQP (Advanced Product Quality Planning) framework and automotive standards such as IATF 16949:2016.

In terms of project management, standards, and required project documentation (APQP milestones, PPAP–Production Part Approval Process, etc.), the automotive industry is one of the most rigid and strict industry sectors. The company therefore developed a Microsoft Excel template that automatically generates the project plan based on standard project milestones (customer nomination, prototype, first samples, first serial/batch samples, start of serial/batch production), and containing all standard project activities and their dependencies. Based on the project characteristics, the plan can then be adjusted manually, if needed.

The company does not employ specialized project managers, therefore one of the team members is also assigned the role of the head of the project (usually someone from the technology or research and development department). The project team is multidisciplinary. The team members work on several projects concurrently, therefore the team's composition can change, depending on the project stage underway. The communication and intensity of interactions within the team depends on the complexity of the project. In many cases, team meetings are set only as needed, usually when problems arise. The same applies to the collaboration with the customer. If the project is relatively simple or similar to some previous projects, the customer collaboration can be very infrequent (samples review, problem-solving, audits, etc.). Many customers are also not used to or not willing to actively participate in the project—they provide the requirements and the necessary information and expect the product to be delivered on time.

4.2. Case Project

In March 2019, the company received a nomination from a large, respected and internationally recognized car manufacturer for a project including process development and a small batch manufacture of a very complex wiring harness for a car battery (205 pieces). The initial risk evaluation showed that the project was very risky because the company had not yet collaborated with either the customer, the toolmaker or the equipment supplier, and there were also several new materials and technologies that the company had not yet worked with.

After a discussion with top management, it was decided that the project should be taken on as it represented a great strategic opportunity, but that some changes should be introduced to the company's standard project management process and teamwork, in order to address the potential risks more effectively. It was decided that certain APM practices from agile software development should be adopted to enable the project team to respond more rapidly to potential changes or discrepancies.

4.3. Adopted APM Practices

The company decided to adopt the following APM practices: dedicated and co-located project team, daily stand-up meetings, active customer collaboration and weekly teleconferences, supplier involvement, and iterative and adaptive planning. The main differences between the company's standard project management process and the project management process implementing APM practices are shown in Table 1. The adopted APM practices are described in more detail in the following.

Table 1. The main differences between the company's standard project management process and the project management process implementing agile project management (APM) practices.

Project Management Dimension	Company's Standard Project Management Process	Project Management Process Implementing APM Practices
Project team	Varying composition	As dedicated and co-located as possible (still working on multiple projects)
Team meetings	Irregular, as needed	Daily stand-up meetings
Customer collaboration	Irregular, as needed	Active collaboration, weekly teleconferences, evaluating partial results
Supplier involvement	Not directly involved	Flexible collaboration
Project planning	Upfront planning using a template	Adaptive and iterative, upfront macro-planning using a template, weekly micro-planning

The project team was small and consisted of highly motivated individuals from various fields: research and development, technology, quality, production, strategic sales, and purchase. The role of the head of the project was assigned to the head of research and development. Working in a multi-project environment, the team members could not be fully dedicated to this project only, but the main team members did commit to dedicate the majority of their work time to the analyzed project, and other employees agreed to jump in and help in other projects if necessary. In addition, the entire team worked most of the time in the same room, or at least in the same building, making the communication easier and more effective.

The short daily stand-up meetings were set every day at the same time in the same specifically dedicated place. At these daily stand-up meetings, all team members were present and discussed the progress of the project, the work planned for the day, and potential problems that could occur. This was very similar to the daily stand-ups that are typical of the APM methodology Scrum. For a greater transparency, all important information such as to-do tasks, open points, important dates, etc., were put on a white board.

The next change that was introduced to the project management process was the weekly teleconferences in which the head of the project, the critical project team members (variable, depending on the project stage) and the customer representatives discussed the project progress. The time of the conference call was set at the same time each week (Wednesday at 8 a.m.), but could be slightly moved, if necessary. The customer agreed to participate in these weekly

meetings and actively collaborate with the project team throughout the project. The customer also ensured constant availability for any additional information via mobile phone or e-mail. At the weekly teleconferences, the project team presented the project progress and delivered some kind of a protocept [36] for the customer to review: new sketches, digital drawings, pictures of samples, measurement results, etc. All new information was then discussed and all open points and potential problems were elaborated. Also, the plan for the following week was coordinated.

The company also contacted the suppliers about the possibility of a more flexible cooperation during the project so that the identified discrepancies could be addressed instantly. All suppliers were prepared to fully collaborate.

Lastly, there were some changes introduced to the project planning process. The project team still used the prepared template as the macro-planning prompt, but they micro-planned the work for each week separately. After each weekly conference call with the customer, the project macro-plan was updated accordingly, and a more detailed work plan for the following week was prepared.

4.4. Benefits of Adopted APM Practices

During the project, the project team faced many challenges, and the change rate was even higher than expected. Product specifications provided in the customer's documentation and drawings were sometimes incompatible, and the project team had to correct the discrepancies. Even after the design freeze, the bill of materials changed daily (up to three times a day), so that material prices and delivery dates also fluctuated constantly. There were also delays in the equipment delivery. In addition, when assembling the samples, the project team discovered that the cable terminal was false and had to be replaced. Later, it was also found that the connector type needed to be re-selected. The change of connector type happened twice: once before the batch samples, and once again before batch production. With all the changing materials, the team also encountered serious problems in securing the required IMDS (International Material Data System) documentation.

Despite all the challenges and the constantly changing project environment, the project was successfully completed in September 2019 with the production of all 205 pieces. The team managed to implement all chosen practices relatively easily. There was a need for a slight reorganization, mainly regarding the organization of day-to-day work (daily stand-up meetings), collaboration with the customer, planning, and coordination of work on other projects, but the team quickly adapted to this new way of working without any serious problems.

The comparison of agility level before and after the implementation of APM practices is shown in Table 2. The five variables were evaluated by the head of the project according to the questionnaire presented in Section 3, Research methodology. For the evaluation, a 6-point Likert scale was applied. One can see that with the implementation of APM practices, the agility level increased noticeably.

Table 2. Agility level evaluation of the company's standard project management process and the project management process implementing APM practices.

Variable	Company's Standard Project Management Process	Project Management Process Implementing APM Practices
Customer and team integration	4	6
Delivery frequency	3	5
Customer validation	6	6
Decision time	3	6
Project plan updating time	3	5
Σ	19	28

The benefits of increased agility level were very evident, and the team noted that the adopted APM practices represented an important factor in executing the project successfully. The most important benefits of each implemented APM practice are presented in Table 3, and described in more detail in the following.

Table 3. The main benefits of APM practices.

APM Practice	Main Benefits
Dedicated and co-located project team	Increased focus, facilitated communication, easier problem-solving
Daily stand-up meetings	Up-to-date information, facilitated work in a multi-project environment, improved communication
Active customer collaboration and weekly teleconferences	Faster identification of discrepancies, additional know-how, faster and more effective problem-solving
Supplier involvement	Faster response to discovered problems, timely implementation of needed changes
Iterative and adaptive planning	Increased flexibility, faster and more effective response to changing environment

- Dedicated and co-located project team The project team could not be fully dedicated to the case project only, but the effect of a greater dedication was still evident, compared to the other projects the team members had worked on. Knowing that they had full management support and that other employees would help in other projects if needed, the level of multi-tasking lowered, allowing the team members to focus more on the case project. Greater dedication, combined with the team members' co-location, also facilitated communication and eased problem-solving.
- Daily stand-up meetings Daily stand-up meetings enabled the project team to keep up with the latest project status, regardless of a high change rate and work on multiple projects concurrently. The meetings ensured that all the team members were kept up to date with all the latest information about the project and the work plan for the following days. The communication within the team improved and an encouraging environment for solving the problems was established.
- Active customer collaboration and weekly teleconferences The biggest advantage of constant customer collaboration and weekly conference calls was that all the technical and quality issues could be immediately discussed and collectively solved. The customer provided additional know-how, which led to more effective and faster problem-solving. The needed changes in design, materials and other product specifications could be identified and addressed in time. A great example of effective collaboration and collective problem-solving is represent by the case of IMDS, where the customer got fully involved in the process and, in the end, even took on a full responsibility for ensuring all necessary documentation.
- Supplier involvement The collaboration and flexibility of the suppliers proved to be of crucial importance, as they in many cases enabled a faster response to the discovered problems and timely implementation of the needed changes. For example, when the equipment delivery was delayed, one of the suppliers was prepared to reopen the plant for the holiday period, just so that the samples for the project could be manufactured and the team could reach one of the project milestones on time.
- Iterative and adaptive planning The changes introduced into the project planning process were not only beneficial, but necessary. With such a high change rate, creating a detailed plan at the very beginning of the project would have been a huge waste of time, and strict adherence to the plan regardless of changing circumstances would have ended up a major failure. The macro-plan generated with the company's template containing the basic timeline and all major milestones was still very helpful as it kept the project team focused on the final goal, but the frequent updates of the plan and weekly micro-planning were what provided the much needed flexibility and allowed the team to respond effectively to changes.

4.5. Evaluation of Project Success

The case project was one of the most challenging projects the company has ever faced. However, with the changes introduced to the company's standard management process, the project

team managed to successfully complete the project in terms of both project efficiency and stakeholder satisfaction.

After the project completion, the head of the project was asked to answer the questions regarding the project's success (see Section 3, Research methodology) using a 5-point Likert scale. The responses were used for efficiency factor and stakeholder success factor evaluation. Results are shown in Tables 4 and 5,and are discussed in the following.

Table 4. Efficiency factor evaluation.

Meeting Project Budget Goals	Meeting Project Time Goals	Meeting Project Scope and Requirements Goals	Efficiency Factor
4	4	4	4

Legend: 1—unsatisfactory, 2—goals not fully met, 3—fully meets goals, 4—exceeds goals, 5—exceptional.

Table 5. Stakeholder success factor evaluation.

Organization Satisfaction	Project Team Satisfaction	Customer Satisfaction	Stakeholder Success Factor
5	4	5	4.667

Legend: 1—unsatisfactory, 2—goals not fully met, 3—fully meets goals, 4—exceeds goals, 5—exceptional.

Project efficiency was evaluated in terms of the traditional meeting of the project budget, time and scope goals. All of the project efficiency aspects exceeded the company's expectations, and the calculated efficiency factor for the case project equaled 4 (exceeds goals).

The actual project costs did slightly exceed the planned costs, which was mostly a consequence of new materials and equipment, upgrades of the testing equipment, and additional labor costs. However, for this project, costs were of secondary importance. The emphasis was on finishing the project on time while meeting all of the customer's requirements and embracing any change, even in the late project stages. Some cost overruns could thus be expected, and the company prepared for it by setting an appropriate budget for the project. The final project costs were still well below the set budget; therefore, the project budget goals were evaluated as exceeded (4).

In addition, both the project time goals and project scope and requirement goals exceeded the company's expectations (4). Before taking on the project, the company knew that it would be challenging and was prepared for some potential delays and requirements issues. However, all milestones were reached on time, and the product was manufactured by the project deadline. Also, all scope and requirements goals were fully met, and all automotive industry standards fulfilled.

When discussing stakeholder satisfaction, the responses from all parties involved were very positive. The calculated stakeholder success factor equaled 4.667, which means that stakeholder satisfaction greatly exceeded the expectations.

The organization (top management) praised both the head of the project and the project team for the successful execution of such a complex project and for managing to satisfy the customer. The outcome of the project exceeded their expectations, and as the team succeeded in satisfying and possibly winning a new, regular, and, for them, very important customer, the organization's satisfaction was rated as exceptional (5). As additional recognition of the work done, the management offered the team members several trainings and courses in state and abroad.

The project team was also very satisfied with the overall project course and its outcome. The head of the project was very impressed by the work done by all team members, their motivation, collaboration and work ethic. The team members admitted that the pace of the project could sometimes be a little overwhelming, but having a competent leadership, working as a team, and focusing on the final goal created a highly stimulating and encouraging work environment that kept them motivated throughout the project. Although it took the project team some time to adjust to the changes introduced in their standard way of working, they acknowledged the positive effects of the new practices and their satisfaction with the project exceeded their expectations (4).

Finally, the customer expressed great satisfaction with the project team's responsiveness, their collaboration and communication, the quality of the product, and the overall service. Very revealing

was also that the customer gave the company the award for the best supplier on the project. The customer's satisfaction was therefore rated as exceptional (5).

When asked to evaluate the impact of APM practices by comparing the case project to some similar projects the company has worked on in the past (similar in scope and complexity), the head of the project stated that if their standard project management approach had been used (1) the project would have taken longer to finish; (2) the costs would have been the same or a little bit lower, because of not including all the changes in the later project stages; (3) functionality requirements would have been met, but the quality of product might have been lower; and (4) while the project team might have been more comfortable working the old way, the overall stakeholder satisfaction would have been much lower. He also noted that even though the costs could be somewhat lower if sticking to the standard approach, there was a great chance that the project would not meet the deadline, which would lead to high monetary penalties and consequently also to higher overall costs. The final conclusion was that by using the company's standard management approach the team would not be able to execute the project as successfully, both efficiency- and satisfaction-wise.

Based on the stakeholders' feedback and all identified benefits of APM implementation, we can confidently conclude that APM practices represented an important factor in assuring a successful execution of the case project and had a positive impact on the overall project success. For proving and determining an exact quantitative impact of a single practice on each dimension of project success, further research should be done in the future.

5. Discussion

Based on the findings of the case study, we can now address the main research questions of the paper. First, we showed that even though the company only implemented some APM practices, and not a whole structured APM methodology, the agility level increased noticeably and the benefits for the management process were very evident. Among the main benefits were: improved communication both within the team and with the customer, faster detection of discrepancies, more effective problem-solving, additional know-how provided by external stakeholders (customer and suppliers), faster response to change, and greater flexibility. These benefits are comparable to those of larger enterprises implementing a fully agile or hybrid development approach (e.g., Agile–Stage-Gate Hybrid using Scrum), but additional research is needed to be able to compare the improvements quantitatively.

One of the disadvantages, on the other hand, was the very intense pace of work the team needed to get used to, especially with having to work on other projects concurrently. Another thing worth mentioning is the slightly exceeded planned costs of the project. The actual costs were still within the set budget, but could have possibly been a little bit lower if the company's standard project management approach had been applied. For this project, however, the costs were of secondary importance, and the main goal was to satisfy a new important customer in order to have a chance at becoming its regular supplier. Nevertheless, it is very important to note that embracing all changes and new customer requirements, even in the late project stages, regardless of additional costs and potential budget overruns, is in the long run not financially sustainable. This is only advisable and pays off if the company has a clear strategic goal in mind (e.g., winning a new important regular customer) and the long-term gains outweigh the possible short-term financial loss.

The case study further showed that, despite not having any prior experience with APM, the team managed to successfully adopt the new practices and implement them in their standard way of working without major problems. Some challenges similar to those of companies implementing hybrid models still needed to be addressed, though, e.g., properly defining the deliverable of each iteration (the protocept) and finding dedicated team members. In the case company, it proved impossible to ensure fully dedicated team members because of limited resources, but this did not end up representing a major drawback. Other employees agreed to help on other projects when necessary, so the team members could focus primarily on the case project. On the other hand, by implementing only some APM practices, the company did not need to face the problems related to hierarchy reorganization and

introduction of new roles that are characteristic of hybrid models. Consequently, there were also no additional costs related to employing agile experts or special training of employees.

The findings of the case study indicated that the implementation of APM practices improved the project team's ability to quickly and effectively respond to changes, and that both of the two core elements of APM as identified by Conforto et al. could be recognized: the ability to rapidly change the project plan according to the changing environment, and active customer involvement. Also, the evaluation of the five main agility variables showed that the agility level increased noticeably. We can therefore conclude that the implementation of APM practices can indeed be considered successful, and that the implemented practices substantially benefited the project management process (RQ1).

We found, though, that there were several important preconditions that enabled a successful adoption of APM practices in the case company. These preconditions are consistent with the finding of Conforto et al., who thoroughly analyzed the enablers related to APM adoption by medium- and large-sized companies from different industry sectors [2].

First, the project team needs the full support and trust of the top management. In the case company, the management empowered the project team to make autonomous decisions, which enabled them to address all the challenges instantly. This autonomy also led to a greater responsibility of the team and an additional motivation to complete the project successfully. The management further ensured that the other employees helped in other projects, so that the team members could focus on the case project and be as dedicated as possible.

Second, APM practices are people-oriented and their implementation would not be successful without a capable project team. The project team was multidisciplinary and consisted of experts from different domains, with various experiences and knowledge. Even more important than the knowledge and the skills of the team members was their dedication and motivation. The given autonomy to make decisions and the greater responsibility created a feeling of ownership and kept the team motivated to face all challenges and finish the project on time. They were willing to participate in daily meetings and weekly teleconferences with customer, they worked late hours if needed, and some of them even worked during holiday periods. The team morale was high throughout the project, and to cite the head of the project: "Without such a great team, we would not be able to sprint through the marathon, which this project was."

Another important precondition for a successful implementation of APM practices is the willingness of the customer to engage in this new and intensive way of collaboration. This is not to be taken for granted. In the case project, the customer participated in weekly conference calls and actively collaborated with the project team, but in many cases the customer is not prepared to be as involved. Similarly, it is also very important that the suppliers are flexible and willing to collaborate. As it turns out, in the case project, it was in many cases the suppliers who enabled such a quick response to discovered problems and timely implementation of changes (supplying new materials, working during holidays, etc.).

To answer the second research question regarding project success, both the efficiency and stakeholder satisfaction were evaluated. Project efficiency exceeded company expectations in terms of all three dimensions: project budget, time, and scope and requirements. Also, all the stakeholders were very satisfied with the project course and its outcome, and the company even received the award for the best supplier on the project. The project team acknowledged that the project could not have been executed as successfully using only the company's standard management practices. Based on the feedback from the stakeholders and the project success evaluation, we can conclude that with the implementation of APM practices, the team managed to execute a very complex project successfully, in terms of both efficiency and stakeholder success, and that APM practices positively impacted the overall project success (RQ2).

Not all projects, however, are suitable for APM adoption and will not yield such positive results. The case company implemented APM practices for managing a very complex and unpredictable project. The team admitted that with the implementation of APM practices the intensity of work and

collaboration increased, which was of a great advantage for this specific project; however, this way of working would be very unsuitable for other projects they have worked on.

The majority of the company's projects represent the projects for their regular customers. The company is familiar with the way its customers work, the products are relatively simple, and most projects are either recurring or similar to those from the past. For these predictable projects, where requirements are known in advance and are not expected to change, the project team would not benefit from adopting APM practices. In a stable and certain environment, the daily stand-up meetings and constant customer involvement would unnecessarily burden both the team and the customer and hinder the work. Iterative and adaptive planning would also be a great disadvantage and would only cause an unnecessary chaos. For simple, routine projects, the company should therefore stick to its standard, more traditional project management approach, which focuses on upfront planning and control.

We can conclude that the implementation of APM practices is generally best suited for complex projects where the unpredictability is high or where not all requirements are known in advance [15,39,41]. It has also proved to be very suitable for projects where uncertainty is high because of lack of experience with the other parties involved, or when dealing with new materials and technologies, as this can lead to many unexpected difficulties and a high change rate, requiring many adjustments and intensive testing. In such an environment, iterative and incremental development, intensive collaboration, and flexibility are of great benefit and can significantly improve project success.

6. Conclusions

In recent years, the interest in APM has grown enormously and companies from various industry sectors have started to see a great potential in adopting different APM aspects. The process of implementing APM methodologies in non-software companies is, however, very daunting and requires high financial and non-financial input, and many companies, especially SMEs, cannot afford it.

In this paper, we present a case study of a Slovenian manufacturing SME that decided to adopt only certain APM practices, instead of a whole structured APM methodology: The adopted practices were: a dedicated and co-located project team, daily stand-up meetings, active customer collaboration and weekly teleconferences, supplier involvement, and iterative and adaptive planning. The findings show that the company managed to successfully implement the chosen APM practices and combine them with their traditional project management means (e.g., standardized templates and milestones) with no prior employee training, structured implementation process or pilot projects. The main benefits of adopting APM practices were: improved communication both within the team and with the customer, faster detection of discrepancies, more effective problem-solving, faster response to change, and greater flexibility.

The main challenges of the implementation were similar to those identified in the companies implementing hybrid models: ensuring fully dedicated team members, coordinating the work on other projects, and properly defining the deliverable of each iteration. Also, the team members needed some time to get used to the higher intensity of work and collaboration (daily stand-ups and weekly teleconferences). The team still managed to complete the project successfully, both in terms of efficiency and, even more importantly, stakeholder satisfaction. The findings also indicate that APM practices had a positive impact on project success.

In our study, we also found that there are several key preconditions that enable a successful APM adoption in the company. These enablers were: a full management buy-in, competent and dedicated team members, and willingness of both the customer and the suppliers to actively collaborate throughout the project. It is also important to mention that for some projects, even if all these preconditions are met, APM adoption will not be beneficial. These are routine and predictable projects where all requirements are known in advance and are not expected to change. The most suitable for APM adoption are highly uncertain and complex projects where a high change rate is expected and a high level of innovativeness is required.

The main contribution of the paper is in showing that manufacturing SMEs can also successfully adopt some APM practices and combine them with their standard project management approach, without a high financial input and without an extensive reorganization. APM practices, even when implemented separately and not as part of a structured APM methodology, can be very beneficial and contribute to all three pillars of sustainable project management: economic, social, and environmental. Since the case company and many other SMEs can never go fully agile because of limited resources, adopting only some APM practices represents a good alternative for them.

Future research on APM adoption by the non-software SMEs should include more in-depth case studies and statistical analyses of larger samples of projects to enable a quantitative evaluation of the impact of a single practice on each dimension of project success. Another crucial topic to address is also the scaling problem. While the implementation of APM practices in one project was relatively simple, executing multiple projects at such an intense pace would be very challenging. The scaling problem is even more evident in SMEs, as employees have to work on several projects concurrently, and it is virtually impossible to find enough dedicated team members to carry out a large number of projects with such intensity.

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