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EXPLORING THE CHALLENGES OF AGILE PROJECT MANAGEMENT IN SOFTWARE AND NON-SOFTWARE DEVELOPMENT CONTEXT

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Abstract
Agile project management (APM) has become increasingly popular among organizations due to the benefits it offers through the application of agile practices, principles, and values. These approaches are no longer limited to software project development. They are being applied in various fields such as education, human resources, research, healthcare, public relations, and production. By using an empirical approach, APM provides a significant level of adaptability that makes it suitable for a wide range of projects. Although agile values and practices are beneficial, their successful implementation depends on adapting them to the specific needs of the company, team, and project. In many cases, a hybrid project management framework that combines different approaches is preferred to create adaptive methods that cater to the specific needs of the project and project team. Nevertheless, the complexity and scale of projects can create more challenges to implementing agile practices. When selecting an agile framework, whether hybrid or not, it is essential to conduct a rigorous analysis that identifies the necessary adaptations and estimates the potential impact of those changes. This analysis is critical to ensure successful implementation and effective project management, aiming to complete projects within the established timeline and cost constraints while ensuring successful implementation and usage. The benefits of agile methodologies have been significant, particularly in software project development and other fields that require flexibility and adaptation. This study aims to enhance understanding of the challenges involved in APM, both in software development and non-software contexts.
Keywords: *agile project management; challenge; software development; non-software context.*
JEL Classification: O22, M15, O3.

1. INTRODUCTION

The popularity of agile methodologies has increased in recent decades due to the growing number of successful projects completed by companies that apply them, especially in the software development field. These methodologies were created as alternatives to traditional ones, promising to provide better quality results, faster, and with greater customer satisfaction.

Applying agile methodologies sometimes requires changes to the organization's strategy. While methods that apply agile principles offer a distinct perspective on project management, they are not suitable for every project or field of activity. In cases where they are considered the best option, choosing one of the agile methods can become a challenge. Adopting them can bring added value as they focus on project components considered most important by the client. In this context, many organizations have decided to embrace specific practices of agile methodologies favoured by the dynamic economic environment, easy communication, and early delivery of results in the project implementation.

The Agile Manifesto, published in 2001, serves as a reference point for the increasing popularity of agile methodologies (Beck *et al.*, 2001). Through this document, its initiators promote communication, collaboration, rapid delivery, and adaptability while discouraging bureaucratic processes and extensive documentation, thus stimulating the early release of the product. As a result, they provide visible results faster than traditional project management models because they are based on values and principles rather than processes that have longer execution times. Additionally, they offer support in adopting changes in a less costly manner than traditional project management models and methods.

However, the benefits of adopting agile methodologies are not limited to the outcomes. They include increasing the satisfaction level across the entire team, a sense of improved efficiency, increased autonomy, and a stronger sense of belonging (Laanti, Salo and Abrahamsson, 2011). The priority in agile project management (APM) is to ensure timely project delivery while incorporating all initial client requirements and any other requests that arise during the process. Numerous intermediate deliveries are made, and efforts are focused on shortening the development duration, contributing to the widespread acceptance of deliverables by clients.

The paper aims to identify the most significant challenges faced by teams that have adopted APM, both in software development and in other fields. The rest of the article is structured as follows. Section 2 presents a literature review on APM. In Section 3 the research methodology is described. Section 4 provides the main challenges of APM adoption and the results of the study. The last section presents some conclusions of the research.

2. LITERATURE REVIEW

The concept of agility in project management has multiple meanings. Highsmith (2004) describes it through the following five key objectives: continuous innovation, product adaptability, reduced delivery times, adaptability of people and processes, and reliable results. In 2016, Conforto *et al.* (2016) defined agility as "the project team's ability to quickly change the project plan as a response to customer or stakeholders needs, market or technology demands to achieve better project and product performance in an innovative and dynamic project environment". In a study that combines systematic literature review and frame semantics methodology, aimed at clarifying the concept of agility in the context of project management, the same authors draw another interesting and relevant conclusion. They find that the active involvement of clients in the product development process, coupled with the team's ability to adapt and change the project plan, can significantly influence the performance of agility.

Agile methodologies include a series of frameworks explicitly developed for the software industry, such as Scrum (Schwaber and Beedle, 2001), eXtreme Programming (Beck, 1999), Lean Software Development (Poppendieck and Poppendieck, 2003), Dynamic Systems Development Method: The Method in Practice (Stapleton, 1997), Feature Driven Development (Palmer and Felsing, 2001). Initially, all models were designed for software development, but later they were extended to other fields of activity. Since 2011, the Project Management Institute (PMI) has launched a certification for practitioners using agile in software product development, named PMI Agile Certified Practitioner (PMI-ACP). This represented a significant milestone in recognizing the role of agile methodologies in the project management field.

Conforto *et al.* (2014) define APM as "an approach based on a set of principles, whose goal is to render the process of project management simpler, more flexible and iterative to achieve better performance (cost, time and quality), with less management effort and higher levels of innovation and added value for the customer". The same authors consider agility as a team's ability rather than a characteristic of a methodology or practice. It enables team members to quickly adapt to changing customer requirements, market demands, or technological evolution. Cooper (2016) defines APM as "a microplanning or project management tool designed to engage a development team, including the customer, in getting to a working end product quickly".

Several universally accepted characteristics differentiate the agile approach from traditional project management, regardless of the domain in which it is applied. These include flexible scope, incremental and iterative development of value-adding functionalities, adaptive planning, the presence of cross-functional self-organizing teams, and short iterations or continuous delivery (Serrador and Pinto, 2015; López-Alcarria, Olivares-Vicente and Poza-Vilches, 2019; Žužek *et al.*, 2020).

Over time, the agile approach has evolved from being specific to software development to becoming an innovative and versatile way of managing projects in various domains such as the food industry, marketing, construction, hardware development, research, education, and more. Organizations are now adopting it to enhance project and business performance (Goldstein and Euchner, 2017; Pellizzoni, Trabucchi and Buganza, 2019; Zasa, Patrucco and Pellizzoni, 2020). However, the use of agile methodologies is not a one-size-fits-all solution for all projects and domains of activity. Similar to other approaches, they pose numerous challenges and can lead to failure if the change is not preceded by an objective and detailed analysis of the context, or if the change occurs abruptly without preliminary testing.

3. RESEARCH METHODOLOGY

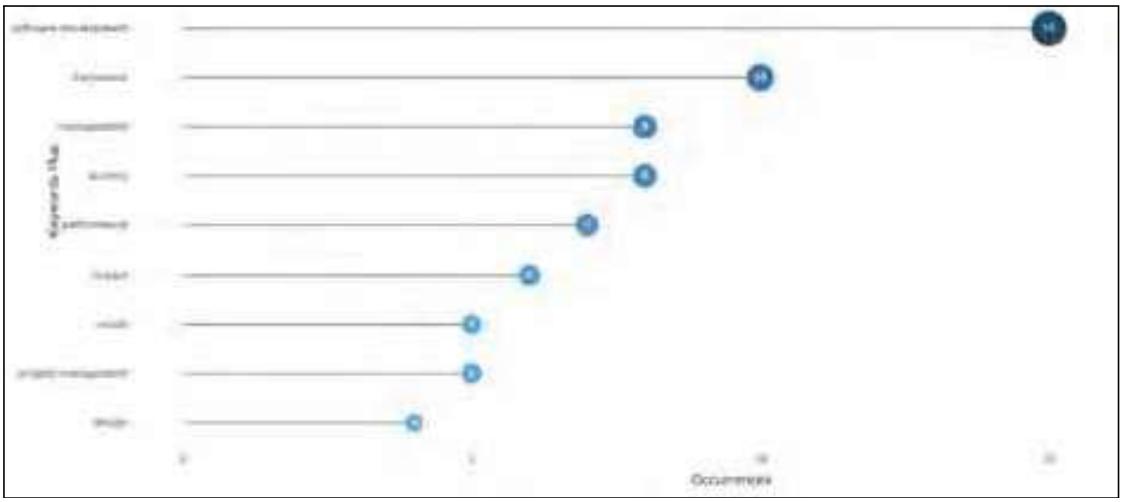
We conducted a literature review based on a well-defined plan and clear inclusion and exclusion criteria. We searched the ISI Web of Science database without limiting the time horizon to capture all the stages through which APM has evolved. The search term used was: *'agile project management' AND (challenge OR challenges)*. The main research question is:

What challenges are experienced when using APM in software and non-software contexts?

We included only articles published in English and excluded editorial materials. Applying these criteria, we excluded 7 articles. Additionally, we removed one duplicate and a call for papers for a workshop. We obtained 98 results, including 47 articles (including two early access papers), 47 proceeding papers, 4 review articles, and 1 book chapter, published between 2005 and 2023. These results were then analysed using the Bibliometrix R package and the Biblioshiny web application.

4. RESULTS

This section analyses the main findings regarding the challenges of APM. The results obtained from data analysis with Bibliometrix reflect the fact that the challenges faced by teams and organizations choosing to adopt agile methodologies in project implementation are a significant concern among researchers (Figure 1).



Source: authors' representation

Figure 1. Most frequent word

As expected, the agile approach is predominantly associated with the software development domain. The main publishers of the extracted articles are IEEE (26 papers), Springer Nature (10 papers), Elsevier (9 papers), and Taylor & Francis (8 papers).

Within the extracted articles, the challenges of APM have been analysed from various perspectives, and they appear in the same cluster with critical success factors, scaling, leadership, decision-making, and the methods used by different teams and organizations (Figure 2). It is interesting to notice that the word 'success' appears in three out of four clusters.

Source: authors' representation

Figure 2. Co-occurrence Network

The challenges of APM are diverse, encompassing aspects related to the client relationship, team organization, requirements management, and more. Hoda and Murugesan (2016**)** analysed the challenges determined by team self-organization at four levels: project-level, team-level, individual, and task-level.

At the *project* level, these challenges are associated with changing requirements, which lead to difficulties in estimation, understanding the client's actual needs, and persuading managers to adopt agile methods and embrace a self-organizing context (Hoda and Murugesan, 2016; Maassen, 2018; Sithambaram, Nasir and Ahmad, 2021). Another significant challenge at the project level is the absence of an overall vision. In the context where each team member or the entire team, in the case of scaling, focuses on implementing small-scale requirements, there is a possibility for the overall project not to progress at the client's expected pace or to deviate from the client's perceived direction. At the same level, Ciric *et al.* (2019) mention two important challenges: the lack of predictability of delivered business value and visibility of client value at all levels (business, project, team, and customer), as well as the absence of a project management strategy, formal guidelines, and standard processes. Additionally, the lack of well-defined project requirements requires the team's ability to identify critical aspects and resolve them based on often undocumented client expectations. The rules, procedures, and standards are minimal, so system requirements specify precisely what needs to be done, but they do not provide details on how it should be done (Dybå and Dingsøyr, 2015).

At the *team* level, challenges arise from finding a balance between cross-functionality, which enables self-organizing, and specialization, which allows for achieving better results in the shortest possible term **(**Hoda and Murugesan, 2016). The lack of clear role definitions can create difficulties at the team level (Ciric *et al.*, 2019). Estimation is another significant challenge due to the varying levels of competence among team members (Zahraoui and Idrissi, 2015). Finding an optimal balance between the time dedicated to estimation and its accuracy is necessary. Spending too much time on less important details reduces the time allocated to activities that truly bring value to the client. The adoption of APM must be preceded by preparing team members, familiarizing them with the specific practices of agile approaches, and assisting them in the initial stages of the change, as the lack of training and education can lead to significant failures (Kovaleva, 2020; Aghajani, Ahsan and Whiteside, 2023). The Covid-19 pandemic has led to changes in the implementation of agile practices, mainly manifested in the increased utilization of virtual environments for conducting meetings with clients and among team members **(**Sharma *et al.*, 2022; Kadenic and Tambo, 2023). In this context, at least in the initial stage, maintaining the duration of daily 15-minute meetings, as recommended by agile methods, has been a real challenge. Additionally, pair programming needed to adapt to the new conditions of remote work.

Regarding the *individual* level, Hoda and Murugesan (2016) consider it a challenge for each team member to take on tasks proportional to their abilities. In APM, task distribution is achieved through task ownership by each team member, not through delegation. As a result, there is a possibility that some individuals may take on tasks that are either too complex or too simple compared to their abilities and knowledge. An equilibrium between each team member's competencies, task complexity, and the level of workload is necessary to ensure progress both for the project and team members. To avoid waste and bottlenecks, many agile teams use work-in-progress (WIP), a Kanban practice that limits the maximum number of work items in the different stages of the workflow.

At the *task* level, the main challenges identified are determined by acceptance criteria and dependencies between tasks, which can lead to chained delays, estimation difficulties, and the need to revisit tasks considered already completed (Hoda and Murugesan, 2016; Lei *et al.*, 2017; Castañón-Puga *et al.*, 2023). Additionally, difficulties may arise in addressing urgent requests, especially in agile frameworks where work is organized into sprints or iterations with predefined tasks for the upcoming period, which ideally should not be changed (Dybå and Dingsøyr, 2015).

Identifying projects that are suitable for agile practices can be a challenge. As we already mentioned, APM does not fit every domain or team, and if it is deemed appropriate, transitioning from traditional methods to agile ones is a gradual process that should be done in stages to prevent potential failures. (Kalenda, Hyna and Rossi, 2018; Dumitriu, Meșniță and Radu, 2019). Furthermore, even in the context of the current highly dynamic environment, resistance to change is considered a challenge for adopting APM, especially when scaling it at the organizational level (Kalenda, Hyna and Rossi, 2018).

5. CONCLUSIONS

The purpose of this paper is to highlight the main challenges of adopting APM in both software and non-software contexts. The success of these methodologies has led companies from various fields of activity to adopt them in project implementation or at the level of the entire organisation. The level of maturity they have achieved in software development has facilitated their easier adaptation to new specific environments. The identified challenges are related to projects, collaboration with clients, team member collaboration, or other specific activities.

Implementing agile at scale extends the impact of these challenges and introduces new ones that may be even more challenging to manage. This is because of the cultural and educational differences between fields and people from various countries and regions. However, aligning towards the same common objective, namely the successful completion of the project or the successful

execution of business activities, can serve as a motivating factor in finding solutions for these challenges.

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