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Presentation to obtain an Academic Master's degree in
« **ENTREPRENEURSHIP AND PROJECT MANAGEMENT**»

The impact of agile practices and project risk management performance on project success Case Study: Ooredoo Algeria Projects

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ABSTRACT

The purpose of this study is to present the impact of agile practices and project risk management performance on Ooredoo Algeria's projects' success A questionnaire survey was used to conduct a quantitative study with a post-positivist epistemological posture and hypothetical-deductive reasoning. Agile practices proved to enhance project risk management performance, but neither of them showed a significant impact on project success. As a conclusion, this study's projects' success is clearly impacted by other factors.

Keywords: project risk management performance, agile practices, project success, Ooredoo.

Résumé

L'objectif de cette étude est de mettre en évidence l'impact des pratiques agiles et de la performance de la gestion des risques du projet sur la réussite des projets réalisés par Ooredoo Algérie. Une étude quantitative a été menée sur la base d'une enquête par questionnaire, selon une posture épistémologique post positiviste avec un raisonnement hypothético-déductif. Les pratiques agiles se sont avérées améliorer la performance de la gestion des risques du projet, mais aucune de ces variables n'a indiqué un impact significatif sur la réussite du projet. En conclusion, la réussite des projets de cette étude est clairement influencée par d'autres facteurs.

Mots clés : gestion des risques du projet, pratiques agiles, la réussite du projet, Ooredoo.

الملخص

تهدف هذه الدراسة إلى تسليط الضوء على تأثير الممارسات المرنة وأداء إدارة مخاطر المشروع على مدى نجاح المشاريع التي اقامتها شركة أريد بالجزائر. حيث تم إجراء دراسة كمية عن طريق الاستبيان، وفقًا لموقف ما بعد الوضعية المعرفية مع تفكير استنتاجي افتراضي.

كنتيجة لهذه الدراسة، وُجد أن للممارسات المرنة أثر كبير على تحسين أداء إدارة مخاطر المشروع، ولكن لم يُظهر أي من هذين المتغيرين تأثير كبير على نجاح المشروع. ومنه فمن الواضح أن نجاح المشاريع في هذه الدراسة متعلق بعوامل أخرى.

الكلمات المفتاحية: أداء إدارة مخاطر المشروع، الممارسات المرنة، نجاح المشروع، أريد.

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LISTE OF ABBREVIATIONS AND ACRONYMS

AFITEP : Association Francophone de Management des Projets

APM: Agile Project Management

IRM: the leading body for professional risk management.

ISO: The International Organization for Standardization

OGC: The Office of Government Commerce

PMBOK: Project Management Body of Knowledge

PMI: Project Management Institute

PRM: Project Risk Management

INTRODUCTION

1. Context & theme interest

Project participants seek to finish projects on schedule and budget while retaining strong operations in an ecologically conscientious way (Younis & Younus, 2021).

Every project is inherently risky, and therefore, project risk management is an essential component of any project. It is an iterative process that lasts for the duration of the project. These risks, if not managed properly, have the possibility to trigger the project to stray from the original plan and fail to meet the project's goals (Styen, 2018c). As a result, project success is directly proportional to project risk management performance (PMI, 2021; Sikweya & Njeru Njue, 2021).

To make matters even worse, there is a widespread expectation that, no matter how fast the previous project was, the next one should be even faster. The frequency and magnitude of risks associated with these projects continue to rise. To avoid a project that is bound to fail, you must employ the best practices available regularly (Kendrick, 2015).

Small increments, task visibility, and expectation management are all common agile practices that operate as risk reduction strategies. Where agile approaches tend to maximize predictability and risk control through an iterative and incremental approach, which has an inherent risk-driven strategy that implicitly supports risk management (Vieira, Hauck, & Matalonga, 2020).

The outcomes of combining explicit risk management with Agile methods are positive (Vieira, Hauck, & Matalonga, 2020).

Agile has an important positive mediation in the relationship between the product owner, team leader, team members, cost/time, and stakeholder factors with project performance in terms of timeline, cost, and quality (Younis & Younus, 2021).

Which is confirmed by Chelangat & Karanja (2018), reworked agile project management through rapid planning, iterative methods, close collaboration, and continuous improvement are statistically significant and positively correlated with project success.

2. The objective

The main objective of our study is to measure and analyze the impact of implementing agile practices and the performance of project risk management on project success.
The specific objectives are:

- To describe the extent to which agile practices affect project success (Sandstø & Reme-Ness, 2021).
- To define the extent to which a performant risk management system affects project success (Kishk & Ukaga, 2008).
- To determine the extent to which agile practices enhance project risk management performance (Vieira, Hauck, & Matalonga, 2020).

3. Research question

In order to achieve the objectives of the research, the research question is formulated as follows:

"What is the impact of agile practices and project risk management performance on project success?"

4. Hypotheses

Based on the literature review, the following hypotheses were established to better understand and test the validity of the research question:

- **The impact of Agile practices on project success**

Younis & Younus (2021) investigated the impact of externl factors (agile) on project outcomes. Because these are the most commonly utilized factors by researchers across the board, the impact of these elements on the outcomes was explored in terms of cost, time, and quality. For a further study, Sandstø & Reme-Ness (2021) discovered that only a few of the most widely reported agile practices have been proved to have an entirely beneficial impact on project success (Chelangat & Karanja, 2018; Sandstø & Reme-Ness, 2021; Younis & Younus, 2021; Muhammad, et al., 2021).
H1: Agile practices have a positive significant impact on project success

- **The impact of the performance of project risk management on project success**

Kishk & Ukaga (2008) conducted a detailed examination of the risk management techniques employed during two previously completed projects to establish the relationship between

risk management and project outcome (2008). Based on the case studies, it was found that a performant risk management and project success are closely intertwined. Furthermore, it is possible to argue that the more effective and ongoing risk management is implemented in a project, the higher the project's chances of success (Kishk & Ukaga, 2008; Monteiro de Carvalho & Rabechini Junior, 2013; Muchelule & Silas, 2018; Wasswa & Namulindwa, 2020).

H2: A performant project risk management have a significant positive impact on project success

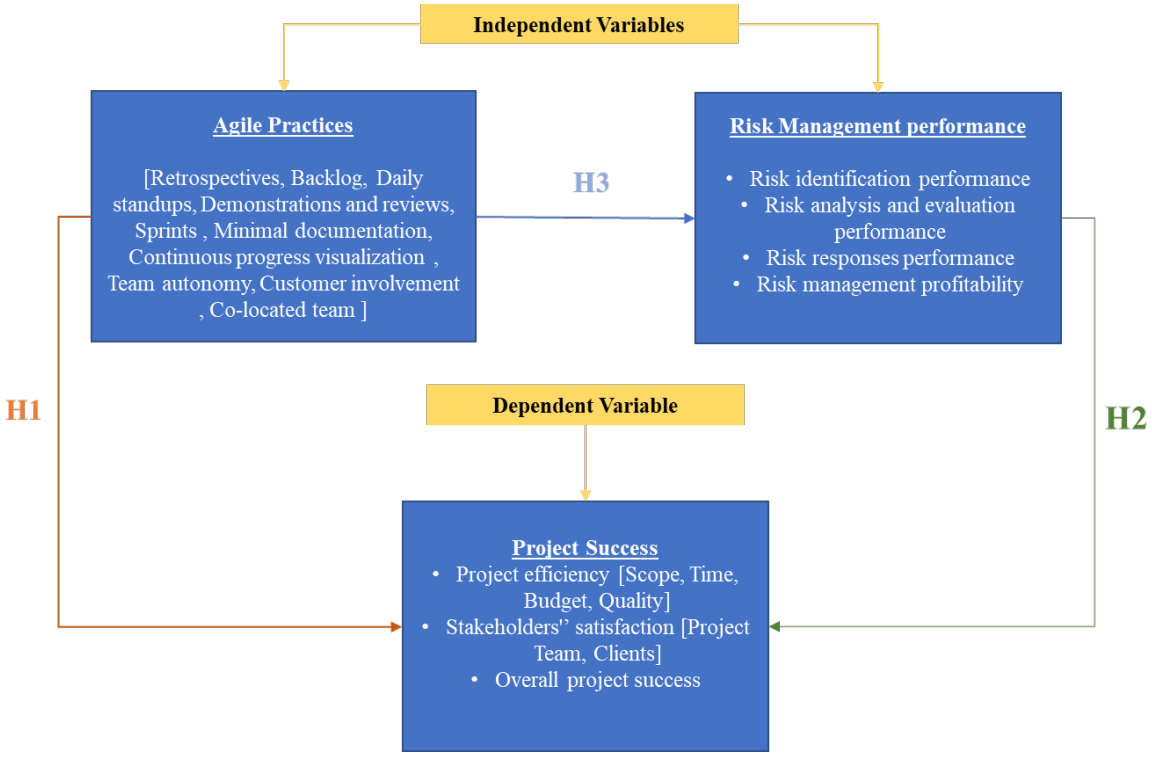
- **The impact of implementing agile practices on project risk management**

In general, the practical results of adopting risk management in the context of Agile methods are quite positive. Most of the primary studies applied in practice (Vieira, Hauck, & Matalonga, 2020), naturally report an improvement in the efficiency of risk management (Vieira, Hauck, & Matalonga, 2020; Younus & Abumandil, 2021; Sikweya & Njeru Njue, 2021; Šimíčková, Buganová, & Mošková, 2021).

H3: Agile practices have a significant positive impact on risk management performance.

The research model is summarized in **Figure 1.**

Figure 1: Research Model



Source: Self-developed based on (Sandstø & Reme-Ness, 2021; Serpell, Ferrada, & Rubio, 2018; Serrador & Turner, 2015)

5. Research field

To carry out this study, we were interested in doing an internship within Ooredoo Algeria, a multinational subsidiary of a multimedia cell phone operator, with international standards. Through the internship, it was sought to better understand the impact of agile practices and project risk management performance on the success of different projects carried out in different departments in the company.

6. Method

This research paper is part of a post-positivist epistemological posture with a hypothetical-deductive reasoning. And to answer the research question and to test the hypotheses, a quantitative study was developed, based on documentary research and a questionnaire survey. The survey was established with a sample of 43 employees who have already worked on one of the projects and a basic knowledge or experience of how to deal with project risks.

7. Research interest

This research contributes to the scientific literature by highlighting the importance of performant risk management for the successfulness of projects, which can be enhanced by implementing agile practices, therefore, the agile methodology for project management.

Also, most of the previous studies on the agile methodology, project risk management, and different factors impacting project success, are foreign and therefore, outside the Algerian context.

Given the differences in results between studies from different countries, it seems interesting to compare whether the results of this research are similar to the results reported in previous research.

8. Plan announcement

This document is organized as follows:

The Introduction provides an overview of the context and interest of the topic. It presents the objectives and identifies the research problem. It also presents the research model developed from the literature and discusses its main concepts and components and then formulates the research hypotheses that are tested by the applied research method.

Followed by 3 chapters:

Chapter I presents the theoretical framework in two sections:

A Literature Review, which constitutes a recension of previous research and studies or documentation. And a Conceptual Framework, where each concept studied will be defined with the key elements surrounding it, namely: "project success," "agile methodology," and “risk management.”

Chapter II presents the Organizational Framework where the host company, Ooredoo Algeria, will be presented. And the Methodological Framework is composed of an explanation of the research methodology chosen for this study, such as the methodological approach and the data collection tools chosen.

Chapter III presents the results of the empirical study, followed by a discussion of these results with those of the literature review.

Finally, the conclusion summarizes the elements discussed in the thesis, the main results and the theoretical and managerial contributions of this research. It ends with a description of the limits of the research and possible future research.

CHAPTER 1: THEORETICAL FRAMEWORK

This first chapter presents in its first section the literature review and identification and definitions of all the concepts, used in this research, in the second section.

Section 1: Literature review

In this first section, articles and publications of several researchers that address agile project management, risk management and project suuccess, will be presented.

1. Agile project management

Despite the fact that agile methodologies are various, they all have the same basic goals, as mentioned by Jalali Sohi, Hertogh, Bosch-Rekveldt & Blom (2016): increasing client involvement, substituting forthright planning with incremental planning that adapts to the most latest data available, building in quality upfront, tackling technical risks as early in the process as possible, minimizing the impact of changing requirements, entrusting and empowering and coaching staff, and delivering frequent and continuous business value to the organization.

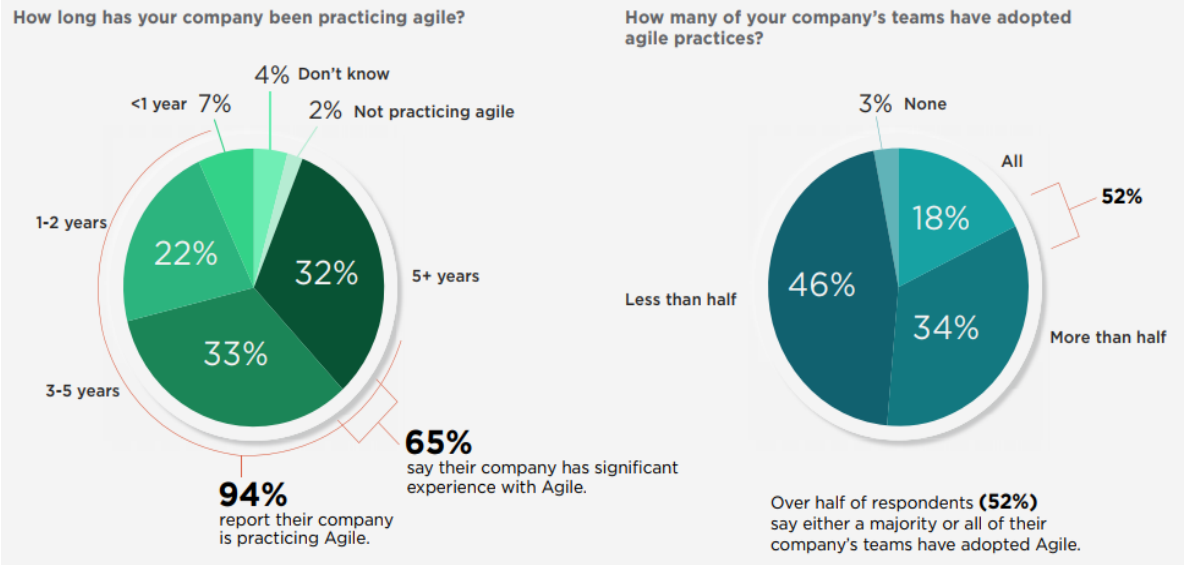
According to Thesing, Feldmann & Burchardt (2021), the most significant advantage of agile project management is the ability to recognize changed requirements in a very short period as a result of regular customer feedback. Furthermore, the benefit of quickly identifying errors due to short feedback-and-development cycles is also regarded as a significant advantage. This goes hand in hand with the third major advantage: the ability to respond flexibly and quickly to dynamically changing customer demands. The main limitation of the agile approach is that the iterative approach may not fit into the corporate culture, for example in terms of planning, reporting, hierarchy, and leadership. In addition, the success of a project depends heavily on the skills of the team and the organizational skills of the members (Thesing, Feldmann, & Burchardt, 2021).

According to Ciric, et al (2019), the reasons why to use agile project management beyond software development are enhancing the ability to manage changing priorities as most important, accelerating project/product delivery, and focusing on client and reducing project risk are top reasons also. On the other side reducing project cost, improving team, morale and enhancing delivery predictability are considered as less important.

Based on the results of the 15th edition of the State of Agile survey (Digital.ai, 2021), agile adoption in non-IT business lines has doubled, and software development adoption continues to be strong. Out of 1,380 global respondents, over 90% of them said their company has

implemented agile, with the majority saying that either most or even all company teams have agile practices. As illustrated in **Figure 2.**

Figure 2: Company Experience with Agile



Source: (Digital.ai, 2021, p. 6)

Sandstø & Reme-Ness (2021) summarized the most common agile practices with their different names that are directly analogous, based on a narrative literature review, shown in **Table 1**.

Table 1: Commonly reported Agile practices

Agile Practice	Additional names and Similar Agile Practices
Co-located team	Open office landscape/space, co-located office space, open working environment, face-to-face conversations at the workspace, open workspaces
Customer involvement	Customer team member, client-driven iterations, end-user involvement, on-site customer, customer collaboration
Self-organized team	Team autonomy
Continuous progress visualization	Tracking iteration progress, continuous visualization, task board, storyboard, status board, informative workspace
Incremental releases	Frequent releases, review of deliveries, early releases, agile feedback, sprint review, demonstration, customer feedback, iteration reviews, collective / review meetings
Minimal documentation	Agile documentation
Retrospectives	Retrospective meetings, iteration retrospective, reflection workshop, post iteration workshops, sprint retrospective, collective retrospective meetings

Value-prioritized requirements	Planning game, simplicity in design, specification of requirements, prioritization of requirements, user stories, client-driven iterations, iteration backlog, product backlog, sprint backlog, metaphor, agile specification, gathering and clarifying requirements
Continuous code integration	Frequent integration, continuous builds, automated builds, continuous integration
Pair programming	No additional names or similar Agile practices were identified.
Sprints	Short iterative cycles, iteration planning (meetings), constant planning, adaptive planning, agile sprints
Stand-up meetings	Daily progress tracking, daily (team) meetings, daily stand-up (meeting), scrum meeting

Source: (Sandstø & Reme-Ness, 2021, p. 257)

2. Risk management

Project risk management is an essential component of any project. It is an iterative process that lasts the duration of the project. Unmanaged risks can lead to issues such as schedule and/or cost overruns, performance shortfalls, and reputational damage (Styen, 2018c). Therefore, managers should always aim to consider potential risks and take concrete steps to reduce their levels and cover possible losses. Indeed, this is the essence of risk management (Khurramov & Ganiev, 2021).

The assessment of project risk management is divided based on Baharuddin & Yusof (2018) into three dimensions, namely Culture, Process, and Experience. Several key aspects make up these dimensions, which vary from top management commitment, risk awareness culture, and different processes activities to sufficient resources and training programs.

Olechowski, Oehmen, Seeting, & Ben-Daya (2016) found that, in addition to achieving more stable project execution, adherence to risk management principles at a high level is an important factor in better achieving cost, schedule, technical, and client goals.

Serpell, Ferrada, & Rubio (2018) resulted that PRM performance can be measured using the key performance indexes linked with a combination of these variables, as shown in **Figure 3**, and considering these four factors:

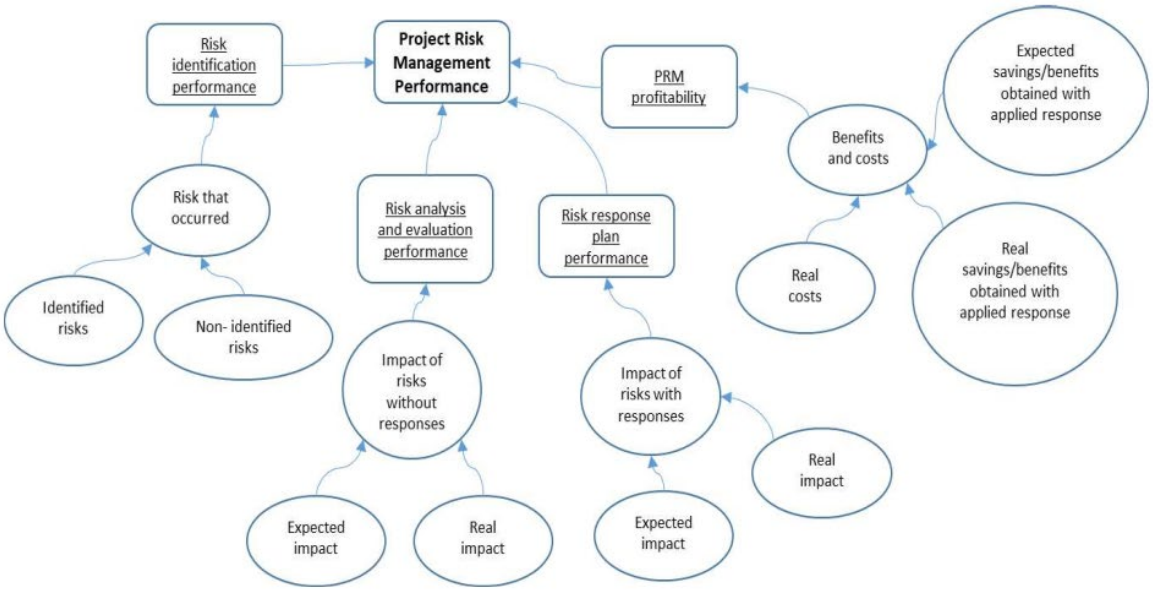
1) Risk Identification Performance;

2) Risk Analysis and Evaluation Performance;

3) Risk Responses Performance; and

4) Risk Management Profitability

Figure 3: Proposed model for measuring PRM performance



Source: (Serpell, Ferrada, & Rubio, 2018)

3. Agile Risk Management

Sikweya & Njeru Njue (2021) argues that most users of traditional methods limit the risk management process to the planning stage and therefore may not be able to deal with unforeseen risks that arise at a later stage. Due to the sequential nature of the waterfall approach, there is little room for continuous development or effective change management.

Risk management is a key aspect of project management, whether agile or not. Project risk management is essential for every project, but it is more important for agile projects because of the risk factors associated with the agile project prioritization process. Because the basis of the agile approach is adaptability, it is important to use risk analysis in risk management to flexibly respond to all changes in the project and gradually build an early warning system that acts as part of risk monitoring (Šimíčková, Buganová, & Mošková, 2021).

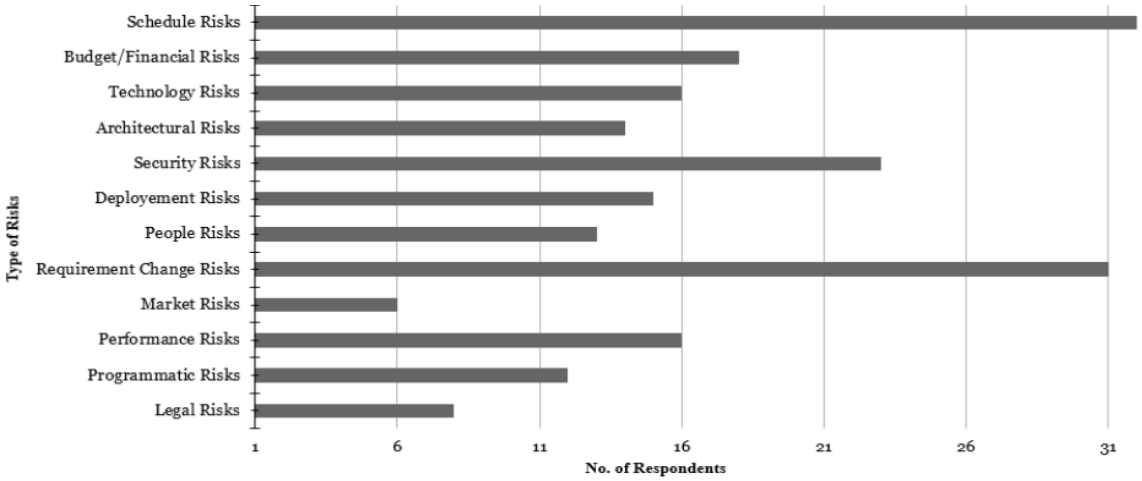
Based on the documentary research done by Buganová & Šimíčková (2019), the agile approach is integrated into individual project stages to mitigate the threat of false consequences. It emphasizes regular communication with customers, short iterations, and testing. Explicit risk management can also be implemented with an agile approach that allows for thoroughly assess and then manage all risks.

The outcomes of combining explicit risk management with Agile methods are positive, including improved communication, improved product quality, increased risk visibility, cost

reduction, improved team efficiency, and reduced time-to-market (Vieira, Hauck, & Matalonga, 2020).

The results of the survey done by Hammad, Inayat, & Zahir (2019) show that during the development of software projects using agile methods, failure to meet schedules and requirements are the two most faced risks, followed by security risks. The least exposed risk is related to the marketing of the product. Delays in development due to planned changes may result in market risk or a reduction in product marketing time. As shown in **Figure 4**.

Figure 4: Risks Reported by Respondents

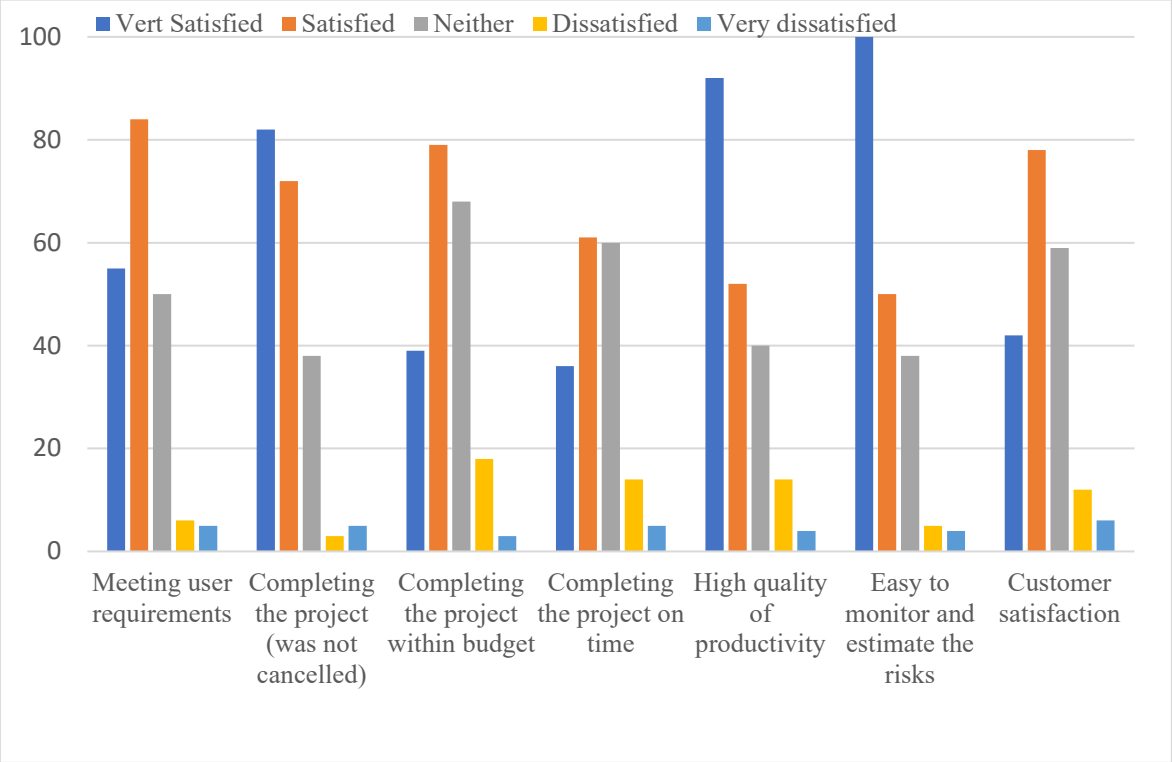


Source: (Hammad, Inayat, & Zahir, 2019)

Also, based on the 15th edition of the State of Agile survey (Digital.ai, 2021), the two most compelling reasons to adopt Agile are the speed and flexibility that still unpredictable and volatile work environments demand. Followed by the need for constant focus on alignment between teams and reducing project risk. 49% of the respondents answered that the implementation of agile positively impacted the risk reduction area.

Most respondents with 103 out of 250 votes collected from a survey done by Younus & Abumandil (2021), indicate that the most significant gains of using agile techniques will be under management and anticipation of danger that could exist in the future in SMEs, the outcome of which we see in the combined responses in **Figure 5**.

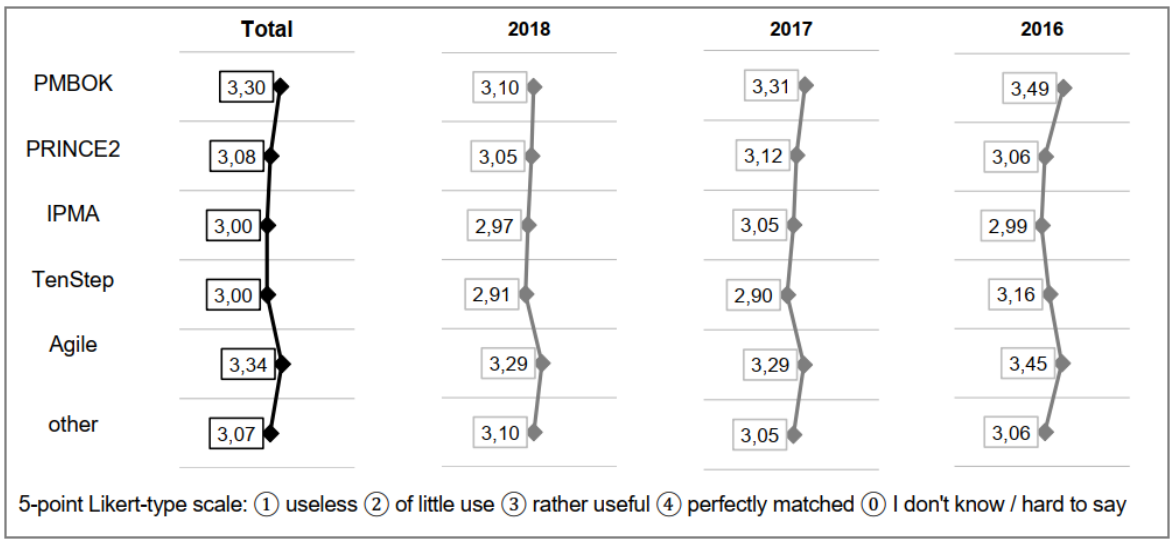
Figure 5: Agile and benefits earned



Source: (Younus & Abumandil, 2021, p. 499)

An assessment of the usefulness of project management methodologies in the project risk management process done by Brzozowski (2020) based on empirical studies of 384 observations, showed that the highest average values were recorded for agile methodologies (M = 3.34) and PMBOK (M = 3.08) as shown in **Figure 6**.

Figure 6: Evaluation of project management approaches' utility in the project risk management process



Source: (Brzozowski, 2020)

4. Project Success

Serrador & Turner (2015) support the assertion that several factors can contribute significantly to overall project success, and they postulate that these factors might include risks that were not considered or changes to the environment that were not anticipated. They mention that "*overall project success is a much wider concept than the traditional so-called iron triangle of project efficiency*". And to measure the overall success of projects, they asked the respondents to judge success regarding timeline, budget, scope, project team assessment and client assessment.

The 6 journal articles reviewed by Chilumo, et al. (2020), show that risk management practices in project management are important for improving project success. The authors conclude that risk management practices are a key factor in determining project success. Therefore, it is important for project managers to use risk management techniques to plan and manage their projects to ensure that their projects comply with three constraints: cost, time, and quality.

The findings of Wasswa & Namulindwa (2020) revealed that risk management practices including risk identification, risk analysis, risk management planning, risk responses and control had a significant effect on the level of time, cost and quality performance of HSC projects in Uganda. By employing cross-sectional study design and adopting both quantitative and qualitative approaches, the study concluded that the performance of health supply chain projects in Uganda has been below average due to a lack of standard risk management practices.

This is confirmed by Muchelule & Silas (2018), according to the results of their study to determine the effect of project risk management on the performance, there is a need to improve knowledge of project major risk processes, project risk expertise, identification of risks posed by entrants, new products and services, along with competitors, project main processes, and ensuring the board exhibits diversity in terms of project risk to enhance project performance.

Also as resulted by Monteiro de Carvalho & Rabechini Junior (2013), the presence of a risk manager has a positive impact on project success, implying that implementing risk management practices also have the same impact.

Agile has an important positive mediation in the relationship between the product owner, team leader, team members, cost/time, and stakeholder factors with project performance in terms of timeline, cost, and quality (Younis & Younus, 2021).

Some agile practices have been identified as having a more positive impact than others and affecting broader project success conditions - for example, sprints and retrospectives. It also shows that some agile practices may require more attention to conclude whether it is worthwhile to implement - for example, self-organizing teams. Based on the findings of Sandstø & Reme-Ness (2021), the decision on which agile practices to implement should be tailored to the requirements of each project. Each Agile practice must be carefully evaluated to ensure that the effects of the chosen agile practice align with those that are desirable and necessary in each project. Practitioners are encouraged to be aware of the reported effects of each agile practice implemented.

Keeping that in view, the study of Muhammad, et al. (2021), showed a significantly positive influence of the implementation of agile management practices on the overall performance of the projects carried out. This suggests that breaking down a project into smaller functional parts and responding in a timely manner is a commendable approach to improving the performance of the projects undertaken.

This is confirmed by Chelangat & Karanja (2018), reworked agile project management through rapid planning, iterative methods, close collaboration, and continuous improvement were statistically significant and positively correlated with project success.

Section 2: Conceptual Framework

In this section, the central concepts mobilized in this research will be presented.

1. Project Management Notion

According to the Project Management Dictionary (AFITEP, 2010)[1], project management is planning, organizing, monitoring, controlling, and reporting on all aspects of a project and motivating the people involved to achieve the project objectives.

1.1. Project Definition

Many authors have tried to define the notion of the project according to their points of view.

Based on the PMBOK, 6thedition: *"A project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. Temporary does not necessarily mean a project has a short duration. A project's end is reached when the objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists"* (PMI, 2017, p. 542)[2].

And according to the Project Management Dictionary (AFITEP, 2010), a project is a singular event that comprises a set of linked and regulated operations with a start and an end date, undertaken to achieve an objective by specific requirements.

The previous definitions lead to the following main characteristics of a project:

- Satisfaction of a demand or an expressed or potential need;
- Setting specific objectives (constraints) precise and coherent;
- Limited period (a clearly identified beginning and end), marked by the achievement of the targeted objectives;
- Uniqueness (even if many of its components are identical) and non-repeatability;
- More or less partial innovation, requiring a specific analysis and providing new answers;
- Mobilization of multiple and heterogeneous resources means, and skills over a more or less long period;

[1] Association Francophone de Management de Projet
[2] The Project Management Institute is a U.S.-based not-for-profit professional organization for project management.

- Setting up of specific and temporary organizational structures, most often evolving.

1.1.1. Project success

As mentioned by Serrador & Turner (2015) that "overall project success is a much wider concept than the traditional so-called iron triangle of project efficiency". To measure the overall success of projects, the stakeholders' satisfaction can also be taken in consideration.

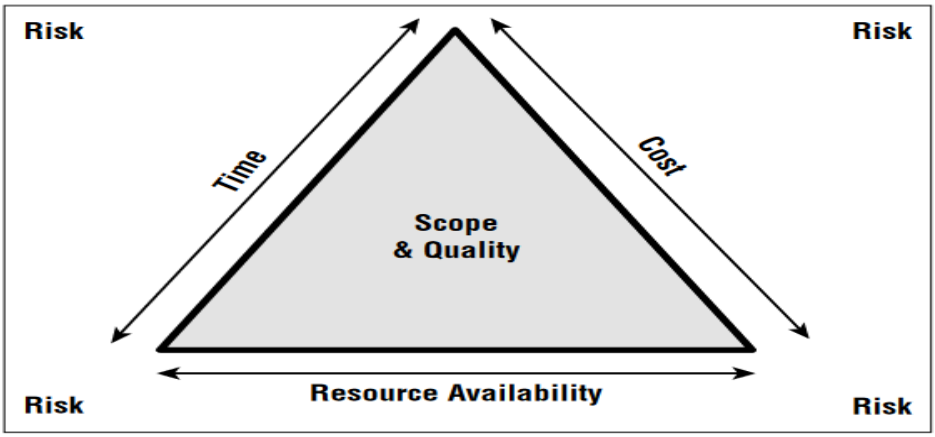
- **The Iron Triangle**

Managing a project means ensuring that the desired results are obtained and that they are on the right path towards the final result or deliverable by constantly checking that this deliverable remains relevant in terms of the three fundamental project criteria: quality, cost, and time (Corbel, 2012). That's all well and good, but there's more to it than that as shown in **Figure 7**, Wysocki and the PMBOK 6thedition (2019; PMI, 2017) consider the following constraints that apply to all projects:

- Scope: Scope is a declaration or document that outlines the project's bounds. It provides a framework for all subsequent project activity, states what should and should not be done, and is crucial to get the scope right. The scope can change during the project lifecycle and can result in considerable modifications to the project's plan.
- Quality: A solid quality management program with oversight of project workflow is a good investment. The payoff is a higher likelihood of completing the project and keeping the client happy. It also helps organizations use their resources more efficiently.
- Cost: The project consists of constantly seeking the best services at the lowest cost.
- Time: a time limit or deadline by which the project must be finished Cost and time are inversely connected to some extent. The time it takes to finish a project can be lowered, but the expense will rise as a result. The goal is to spend the project's future time in the most efficient and productive manner feasible.
- Resources: Assets with restricted availability, such as people, equipment, physical facilities, or inventories, might be scheduled or leased from a third party. Some are fixed, while others are simply changeable in the long run. In any event, they are critical to project activity scheduling and project completion in a timely manner.
- Risk: Risk is not a component of the Scope Triangle, but it is always there and spans all aspects of the project, both external and internal, and so it has an impact on the management of the other five constraints.

Except for risk, these constraints constitute an interconnected set—a change in one constraint may need a change in one or more of the others in order to restore the project's equilibrium. These five constraints make up a system that must be balanced in order for the project to remain balanced. Because they are critical to the success or failure of the project.

Figure 7: The Scope Triangle



Source: (Wysocki, 2019, p. 14)

According to Corbel (2012), one of the adapted methods to meet these objectives is to constantly anticipate risks. It is also necessary to imagine everything that could happen:
- anticipate the reactions of the competition, regulatory and environmental institutions, and the position of the players.

- anticipate the points where the project is vulnerable, subject to hazards;
- anticipate the consequences of the project on the company's other projects;
- anticipate industrial difficulties.

- **The project stakeholders**

Muller (2016) described them as individuals, legal entities or even vague entities such as society or the public, affected by the realization or purpose (outcome) of a project. Some stakeholders are in favor of the project, but others are opposed to it.

Without the list being limitative, they include according to Moine (2013):

- The project owner (*le maître d'ouvrage* MOA, or client): the decision-making body that carries the need and will become the owner of the resulting project, work or product; is responsible for the adequacy of the result of the project in relation to the organization that ordered the work and the needs of users.

- The engineer (*le maître d'œuvre* MOE): the company in charge of carrying out the work for the project owner. His responsibilities are oriented towards the timely production of the planned results.
- Project manager: appointed by the company and is responsible for achieving the project's objectives in all areas of project management.
- The project team: includes all the actors and contributors of the project: the project manager, the project management team, and the technical staff in charge of the project. This team may include people from outside the company.
- Management Office (PMO) is an organizational unit, a group of experts who intervene in a matrix manner in relation to projects and provide them with support.

The stakeholders of a project also include:

- The internal members of the organization carrying out the project (functional managers); the client, the beneficiary of the project object;
- the consumer, e.g., the user of the products resulting from the work;
- the funders, e.g., the financial institutions; the financial backers and shareholders
- the subcontractors, who provide products included in the project; equipment and material suppliers; manufacturers; Transporters;
- vendors and business partners;
- inspection and insurance agencies and administrations

1.1.2. Project types

Depending on the requirements, the projects can be classified (AFITEP, 2010) according to:

- The economic activity: agricultural projects, industrial projects, construction projects, development projects, cultural or event-based projects, etc.;
- The life cycle of a product: design projects, new product development or launch projects, implementation projects, etc.;
- The field of application: R&D projects, IT projects, energy projects, organizational projects, product development or new product implementation projects, etc.;
- The destination: internal projects, external projects;
- Size: large projects, small projects (depending on the sector of activity);
- The project owner: private projects, public projects;
- The nature: technical or technological projects, administrative projects, commercial projects, financial projects, etc.;

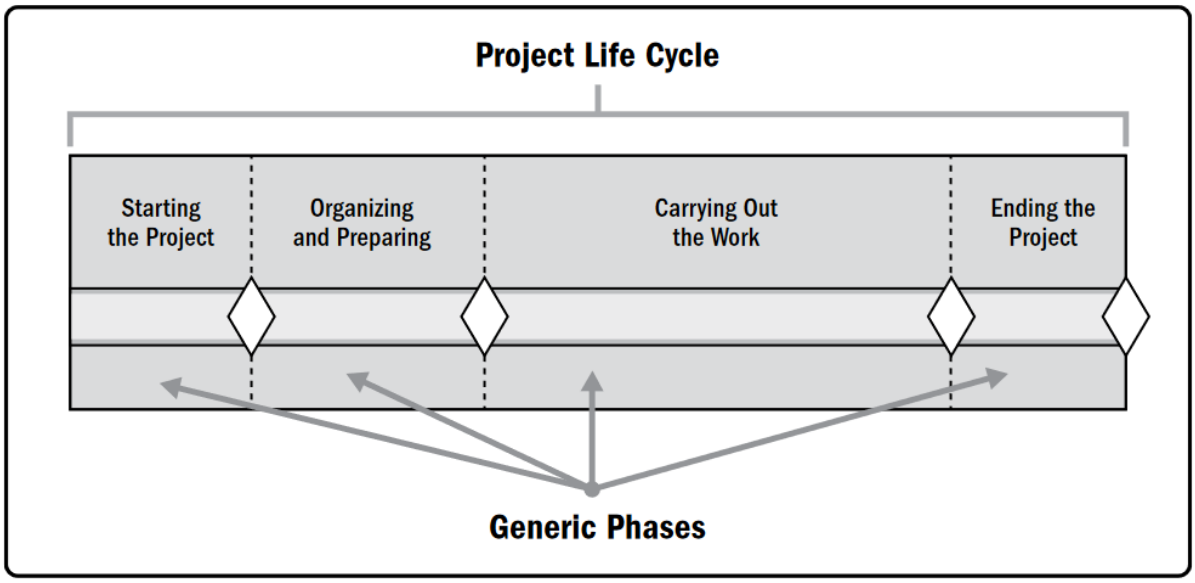
- Complexity: simple projects, complex projects, etc.
- The location: national projects, multinational projects.

1.1.3. Project lifecycle

The project lifecycle is a sequence of phases, limited in time, have an initial and end point or a control point. That are a set of coherent project actions, culminating in one or more outcomes, through which the project goes from start to finish. The phases may be sequential, iterative or overlapping. The names, number and duration of the project phase are determined by the management (PMI, 2017).

These stages can be sequential, iterative or overlapping. The name, number and duration of project phases are determined by management. Unique aspects of the organization, industry, development method, or technology used can affect the project life cycle. Regardless of the specific work, the life cycle forms the basic framework for project management. However, projects vary in size and complexity, a typical project can be mapped to the project life cycle structure shown in **Figure 8**.

Figure 8: Typical overview of a Project Life Cycle



Source: (PMI, 2017, p. 548)

A basic life cycle structure usually exhibits the following features:

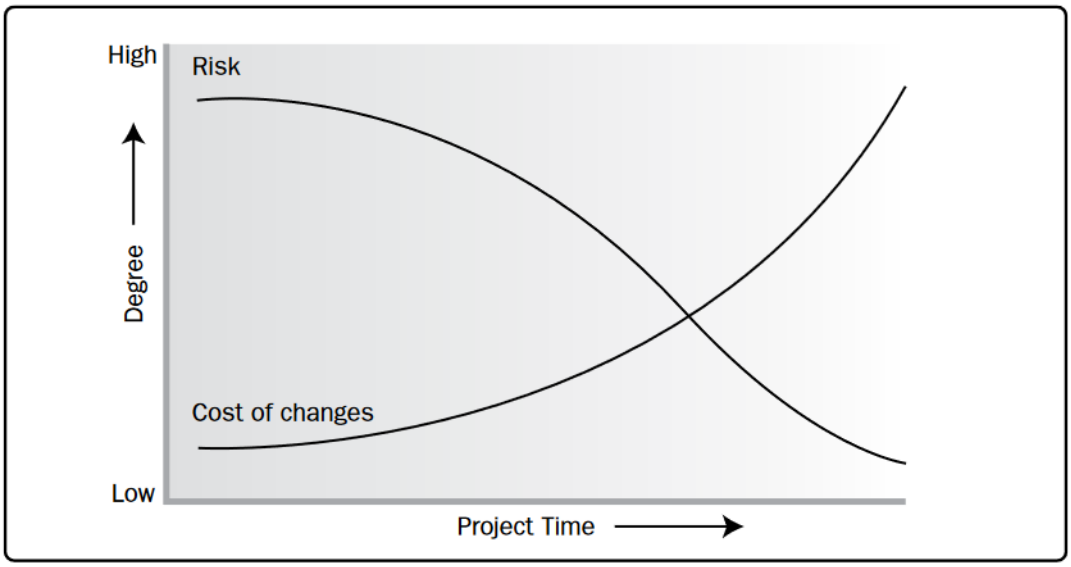
- Cost and staffing levels are low at the start, raise as work is completed, and rapidly decrease as the project concludes.

- As shown in **Figure 9**, the risk increases at the start of the project. As decisions are made and deliverables are accepted, these factors decrease over the project lifecycle.

- Stakeholders' ability to influence the final characteristics of the project's product without significantly impacting cost and schedule is strongest at the start of the project and declines as the project moves toward completion.

Figure 9 shows how the cost of making changes and correcting errors typically rises significantly as the project draws to a close.

Figure 9: Variables' effects throughout time



Source: (PMI, 2017, p. 549)

1.2. Project management

This part will be taking in consideration different concepts related to project management.

1.2.1. Definition

Based on PMBOK, 6thedition (PMI, 2017, p. 542) : *"Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management is accomplished through the appropriate application and integration of the project management processes identified for the project."*

1.2.2. Project management methodologies

For decades, projects have been managed using classical methods, most commonly the "Waterfall" or its adaptation "V", based on a continuum of activities characterized by a passionate commitment to planning everything, "everything must be predictable", at the beginning of the project. The project management plan describes how and when the work will be done, how the project will be planned, executed, monitored and completed. This plan-driven development leads project stakeholders to fear or even systematically reject any

changes: changes to the project content or scope within the team, the development process, in other words, any changes to the original plan that must remain consistent (Messager, 2013).

Based on the observation that initial plans are always modified and that needs are constantly evolving in response to market changes, these predictive approaches sometimes proved to be too "solid". In the 1990s, less predictive methods appeared, more flexible in the face of adaptation needs, thus facilitating the agility of organizations in the face of market constraints. These are known as "agile" methods.

1.2.3. Limitation of traditional approaches

- **Characteristics of the waterfall approach**

The "waterfall" cycle is distinguished by consecutive stages, which follow each other after the validation of the deliverables produced in the previous phase:

- All requirements are expressed and collected in the first phase, since the detailed analysis of these requirements, and then the design of the system that will meet these requirements, will depend on them.
- The design of the system, although textual or represented in the form of diagrams, must be validated before starting the developments.
- Development must be completed to allow the testing team to launch its functional and technical testing campaigns.
- Finally, once, and only once, the anomalies have been corrected, we can proceed with the final global integration and the release of the system.

In this context, and on the basis of the defined scope, we ask the project manager to commit to a detailed schedule of the project, including the milestones at the beginning and end of the phases, and the tasks that must be completed.

The flaws of this approach can be seen very quickly, if they have not already been experienced.

- **The flaws of the waterfall approach**

According to (Messager, 2013), the biggest waterfall flaws are:

- Rigidity of the approach:

The "waterfall" approach is too restrictive to allow for backtracking; it assumes that we get it right the first time. A decision or an anomaly detected in a downstream phase of the cascade can partially or totally call into question work previously validated and considered definitive.

- The tunnel effect:
  Where, for an example, a project lasts one year, the requirements gathering phase lasts two months and the client only sees the result nine months later.
- Poor communication:
  The lack of intermediate milestones prohibits the validation of what the final version of the product will be. The succession of participants, through the various trades, also hinders the flow of information, and even creates a loss of information and energy, as well as numerous load breaks.
- Late removal of risk factors:
  In a "cascading" life cycle, risk factors are removed late, since performance or integration tests, i.e., are postponed until after development, which are often subject to endless, highly subjective debates. The impact of the risks increases with the progress of the project, since the later an anomaly is detected, the more complex the rollback, the more expensive its correction and the more threatening the side effects.
- A large amount of documentation:
  To guard against these risks, the "waterfall" approach focuses on producing extensive documentation. It reassures and, if necessary, provides proof that the project is progressing; it materializes the progress and commits the stakeholders. Indeed, it is easier to oppose change by brandishing a previously validated contractual document! Unfortunately, this heavy documentation, does not reflect the reality, no matter how much we validate an architecture document, it remains theoretical and conceptual as long as it is not implemented and tested in real conditions.

Finally, one wonders about the usefulness of this documentation, which is not always updated during the project and thus becomes unusable very quickly. With this approach too rigid, how can we improve customer satisfaction while facilitating project management and improving development quality? Especially through the so-called "agile" method, we will be able to deal with the dangers of the project more flexibly and "adaptively" (Messager, 2013).

2. The alternative: agile methodology

2.1. Origins

The Agile Alliance, an organization formed by the 17 signers of the Agile Manifesto, defines Agile simply as "*the ability to create and respond to change in order to succeed in an uncertain and turbulent environment*." (LeMay, 2019, p. 19)

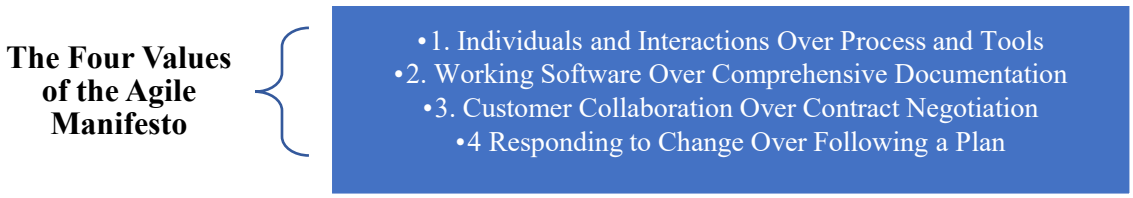
2.1.1. The Agile Manifesto

The Manifesto for Agile Software Development is a text written by seventeen experts in the development of computer applications in the form of several so-called agile methods. These experts felt that the traditional waterfall development cycle no longer met the constraints and requirements of fast-moving organizations. Agile methods did not appear with the Agile manifesto in 2001, but it determines their common denominators and consecrates the term "agile" to refer to them (LeMay, 2019).

The Agile Manifesto consists of four values and twelve founding principles defended by the Agile Alliance and presented in **Figure 10** and **Table 2**.

2.1.2. The Four Values of The Agile Manifesto

Figure 10: The four Values of The Agile Manifesto



Source: (Agile Manifesto, 2001)

2.1.3. The Twelve Agile Manifesto Principles

In addition to these four pairs of values, the authors of the Agile Manifesto list 12 other principles that apply to an agile management framework. The Twelve Principles are the guiding principles of the approach summarized under the heading "Agile Movement". They describe a culture that welcomes change and is customer-focused. They also demonstrated the movement's intent to align development with business needs, as described by Alistair Cockburn, one of the signatories of the Agile Manifesto.

Table 2: The Twelve Agile Manifesto Principles

The Twelve Agile Manifesto Principles	1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
	2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
	3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
	4. Business people and developers must work together daily throughout the project.
	5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
	6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
	7. Working software is the primary measure of progress.
	8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
	9. Continuous attention to technical excellence and good design enhances agility.
	10. Simplicity--the art of maximizing the amount of work not done--is essential.
	11. The best architectures, requirements, and designs emerge from self-organizing teams.
	12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Source: (Agile Manifesto, 2001)

2.1.4. The Declaration if Interdependence

Agile manifests have attracted attention in the field of knowledge labor, but many believed that additional input was needed to provide principles that could be used in other non-software development situations. Some of the original authors of the Agile Manifest, as well as other experts in the field, wrote the 2005 Declaration of Interdependence. The concept behind the Declaration of Interdependence was the development of the latest management principles essential to project management and general management. The six principles are based on what may be needed to realize the agile-type project mindset, regardless of industry.

The Declaration of interdependence begins with a statement that sets out the philosophy of the creators, followed by six principles.

Table 3: The Declaration of Interdependence

Agile and adaptive approaches for linking people, projects, and value. We are a community of project leaders that are highly successful at delivering results.

To achieve these results:

1. We increase return on investment by making continuous flow of value our focus.
2. We deliver reliable results by engaging customers in frequent interactions and shared ownership.
3. We expect uncertainty and manage for it through iterations, anticipation, and adaptation.
4. We unleash creativity and innovation by recognizing that individuals are the ultimate source of value and creating an environment where they can make a difference.
5. We boost performance through group accountability for results and shared responsibility for team performance.
6. We improve performance and reliability through situationally specific strategies, processes, and practices.

Source: (Cockburn, et al., 2005)

2.2. Major agile methodologies

There are countless methodologies that all draw on the values and principles of the Manifesto; however, if they have a common core of practices, they differ to some degree. In this research, only the four main agile methods (Tavares, da Silva, & de Souza, 2019) and their advantages and disadvantages will be briefly highlighted. The most popular and common methods are Scrum, Kanban, eXtreme Programming (XP), Dynamic Systems Development Method (DSDM). Teams generally pick one or two methods (Tavares, da Silva, & de Souza, 2019).

Table 4 highlights the features of these 4 agile methodologies.

Table 4: Features of most popular agile methods

	Scrum	Kanban	XP	DSDM
Created in	1993	1953	1996	1994
Team size	3 – 9	Any size	Below 20	Any size
Iterations	2 weeks – 4 weeks	Continuous flow	1 week – 6 weeks	80% of solution in 20% of schedule
Events	6	On demand	4	On demand
Roles	3	None specific	7	10
Artifacts	3	2	7	None specific

Risk management	Implicit	Implicit	Implicit	Implicit
Impediment management	Yes	Implicit	Yes	Implicit

Source : *(Tavares, da Silva, & de Souza, 2019)*

And **Table 5** demonstrates briefly the advantaged and disadvantaged of these Agile methodologies.

Table 5: Advantages and disadvantages of selected agile methodologies

Agile method	Advantages	Disadvantages
Scrum	• Greater transparency and visibility of the project • Increased team responsibility • Easily adaptable to change • Increased cost savings • Risk management is implemented at the project level and at the iteration or sprint level.	• The team requires experience and commitment • Incorrectly defined Scrum Master • Poorly defined tasks can lead to inaccuracies
Kanban	• Increases flexibility • Reduces unnecessary activities • Easy to understand • Risk Burndown chart – allows teams to visualize how much risk there is and monitor the risk.	• Opacity of the time frame • Out of date information
Extreme Programming	• Saves costs and time required to implement the project • The whole process in Extreme Programming is visible and responsible - developers are committed to what they will achieve and show progress • Continuous feedback • Complete risk elimination is achieved by an interconnected set of project development procedures	• Lack of time is devoted to the design phase • Insufficient documentation of errors
DSDM	Avoid overruns cost and time. Highly reliable Comprehensive approach. Improve communication and management	Costly to carry out action for all risks. In the evaluation phase.

Source: (Šimíčková, Buganová, & Mošková, 2021, p. 1440; Albadarneh, Albadarneh, & Qusef, 2015, p. 5)

2.3. Common agile practices

This part describes some of the most common agile project practices according to the Agile Practice Guide (Agile Alliance & PMI, 2017) and the most commonly reported agile practices mentioned in **Table 1**.

2.3.1. Retrospectives

The most important practice is the retrospective, because it allows the team to address, improve, and adapt its process by learning from previous work and make small improvements.

Many teams use iterations, especially 2-week iterations, because they result in a demonstration and a retrospective. However, the team does not need an iteration to decide on a retrospective. Team members can decide to do a retrospective when it seems appropriate or needed, i.e., reaching a milestone or making a delivery.

It is about observing qualitative data (people's feelings) and quantitative data (measurements) and then using it data to find root causes, design countermeasures and develop action plans. This allows the team to decide on many actions to address the barriers. Consider limiting the number of actions based on the team's ability to address the improvement in the next iteration or work period. It is better to plan to complete fewer items and get it done than to try to improve too many items at once and not finish any. Then, if time permits, the team can work on the next improvement opportunity on the list. When the team selects the improvements, agree on how to measure the results. Then, at the next time period, measure the results to validate the success or failure of each improvement.

2.3.2. Backlog preparation

The backlog is the prioritized list of all the work of a team, presented in story form. There is no need to create the stories for the entire project before the work starts, but just enough to understand the first release in outline and then enough for the next iteration.

The product owners could develop a product roadmap to show the anticipated sequence of deliverables over time, and reschedule it based on what the team produces.

2.3.3. Backlog Refinement

In an iteration-based agile environment, the product owner often joins the team in preparing stories for the next iteration during at least one session during the iteration. The goal of these meetings is to refine enough stories so that the team understands their nature and size in relation to the others.

- Just-in-time refinement is where a team takes the next card in the "to do" column and discusses it.
- In iteration-based Agile, many teams use a one-hour discussion in a block of time during a 2-week iteration.
- There is no consensus on the duration of the refinement. Refinement discussions for iteration-based agile teams. Teams can use these when they are new to the product, product area, or problem area.

The product owner has many ways to prepare the backlog and hold refinement meetings, including: Encouraging the team to work in triads of developer, tester, and business analyst/product owner. Making sure that all the stories are small enough that the team produces a steady stream of accomplished work.

2.3.4. Daily Standups

Teams hold Daily Standups, which can be facilitated by any member and should not exceed 15 minutes, to engage with each other, identify issues, and ensure the smooth flow of work within the team. Team goes through the Kanban board or activity board.

Daily standups are about identifying problems, not solving them.
In an iteration-based agile environment, everyone takes turns answering the following questions that allow the team to self-organize and take responsibility for completing the work they committed to the day before and throughout the iteration:
- What have I completed since the last Daily standup?
- What do I plan to complete by the next Daily standup?
- What are my obstacles (risks or problems)?

The flow-based agile environment approaches Daily standups differently, focusing on the team's performance. The team evaluates the content of the board from the right to the left. The questions are:
- How should we proceed to move this work forward?
- Is there someone working on an item that is not on the chart?
- What do we need to complete as a team?
- Are there any bottlenecks or sticking points in the workflow?

2.3.5. Demonstrations and Reviews

As the team completes the functionalities, generally in the form of user stories, it carries out regular demonstrations of the operational product. The product owner attends the demonstration and accepts or rejects the stories.

In an iteration-based agile environment, the team presents all completed work items at the end of the iteration. In a flow-based agile environment, the team presents the completed work at the appropriate time, usually when enough features have accumulated into a coherent package. Teams, including the product owner, need feedback to know when to ask for product feedback.

An Agile team should deliver a working product at least once every two weeks. This way, members get the feedback they need to avoid going in the wrong direction. A team that does not demo or release frequently cannot learn quickly or adopt agile techniques. It may need additional coaching to deliver frequently.

2.3.6. Planning in an iteration-based agile environment

Each team has a different capacity. Each product owner has a different typical story size. The teams consider the size of their story so that they do not commit to multiple stories if they do not have the capacity to complete them in one iteration.

In case of unavailability of some members (vacation, vacations or any event preventing them from participating in the next work), the product owner understands that the team has limited capacities. The team will not be able to finish the same amount of work as it did in the previous period. When the team's capacity is limited, it plans only the work that corresponds to that capacity.

When product owners make smaller stories and teams see progress in the form of a finished product, they reassess what they are capable of doing in the future. Agile teams don't plan everything at once; instead, they plan a small part, deliver, learn, and then plan again.

2.3.7. Iterations and increments

Iterations help the team create a delivery cadence and various types of feedback. The team produces value increments for delivery and feedback. The first part of this delivery is the demonstration. The team receives feedback on how the product looks and works through this demonstration. Team members conduct a retrospective to see how to inspect and adapt their processes.

Demos or reviews are an integral part of the agile project flow.

2.4. Benefits of agile methods

According to Messager (2013) :

- Added value

  The requirements are the property of the customer or his representative, who values them and prioritizes them according to the added value that their implementation brings to the organization. Project planning and management are based on this prioritization, which can be modified during the course of the project; this ultimately leads the team to continuously deliver added value to the customer. This is the primary objective of an agile team

- Adaptability

  Thanks to the iterative development and the permanent collection of the customer's feedback, the agile team is able to continuously align the developed product with the needs expressed and specified by the customer during the project. This ability to adapt to changing requirements is the demonstration of its agility.

- Visibility

  By measuring and evaluating the progress of the project in terms of the number of functionalities actually implemented and validated by the client, and by constantly analyzing the adequacy of the process, visibility is increased, both on the work done and, on the work, remaining to be done. This facilitates planning and the necessary arbitrations, in a consensual context.

- Risk reduction:

  Motivated by the delivery of added value for the client, concerned about demonstrating its adaptability and guided by a better visibility, an agile team reduces the risks of project failure. Thanks to the permanent feedback, drifts or dysfunctions are detected early and can be reduced by accepting the change.

2.5. The major contrasts comparing traditional and agile approaches

The following summary presents, in **Table 6**, the major differences by theme between a traditional approach and an agile approach.

Table 6: Contrasts between traditional and agile approaches

Theme	Traditional approach	Agile approach
Life cycle	In cascade or in V, without feedback, sequential phases.	Iterative and incremental
Planning	Predictive, characterized by more or less detailed plans based on a defined and stable scope and requirements at the start of the project.	Adaptive with several levels of planning (macro and micro planning) with adjustments, if necessary, over time according to the changes that have occurred.
Documentation	Produced in large quantities as a support for communication, validation and congratulation	Reduced to what is strictly necessary in favor if operational functional increments to obtain customer feedback
Team	A team with specialized resources, led by a project manager	An empowered team where initiative and communication are privileged, supported by the project manager
Quality	Quality control at the end of the development cycle, the customer discovers the product when finished	Early and permanent quality control, at product and process level. The client sees the results early and frequently.
Change	Resistance or even opposition to change	Welcoming to inevitable change, integrated into the process
Progress tracking	Measurement of compliance with initial plans. Gap analysis	A single progress indicator: the number of features implemented and the work remaining to be done
Risk management	Separate and rigorous risk management process	Risk management integrated into the overall process, with everyone taking responsibility for identifying and resolving risks
Measure of success	Compliance with initial commitments in terms of costs, budget and level of quality	Customer satisfaction through the delivery of added value

Source: (Messager, 2013)

3. Project Risk Management Notion

Concern over risk relates to the ability to achieve project objectives. All projects are exposed to risks. While particular risks will be different for varying projects and project environments, therefor; managing risks is an important part of managing projects (Edwards, Vaz Serra, & Edwards, 2020).

3.1. Risk definition

Risk is defined within the broad based International Standard ISO 31000 entitled "Risk Management – Principles and Guidelines" as "*effect of uncertainty on objectives*" (ISO, 2018, p. 1)[3]. A further definition, again focusing on the realization of objectives, is provided by the Management of Risk: Guidance for Practitioners (OGC, 2010, p. 4)[4] states that risk is "*an uncertain event or set of events that, should it occur, will have an effect on the achievement of objectives. A risk is measured by the combination of the probability of a perceived threat or opportunity occurring and the magnitude of its impact on objectives.*".

Additional definitions go on to state that a risk might be either positive (opportunity) or negative (threat). It's rarely a good idea to focus on minimizing threats without taking into account the opportunities that come with them, and it's also not a good idea to chase opportunities without carefully weighing the threats that come with them. Exposure to threats is an unintended consequence of firms chasing opportunities through project execution. An early definition of risk is beneficial due to the necessity to recognize both categories of risk and their dimensions (IRM, 2018)[5].

The Standard for Risk Management (PMI, p. 7) describes risks as *"An individual risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more objectives. Overall risk is the effect of uncertainty that affects organizational objectives at different levels or aspects. Risk arises from all sources of uncertainty, including individual risks in the portfolio, program, and project domains."*

Risk Exposure is considered as a measure of the potential impact of all risks at any given point in time in a project.

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[3] The International Organization for Standardization is an international standard development organization composed of representatives from the national standards organizations of member countries.

[4] The Office of Government Commerce was a UK Government Office established as part of HM Treasury in 2000. It was moved into the Efficiency and Reform Group of the Cabinet Office in 2010, before being closed in 2011.

[5] IRM is the leading body for professional risk management.

3.1.1. Opportunities and Threats

The terms 'threat' and 'opportunity' are used in the previous definitions to characterize an uncertain event which would have a negative impact on objectives if it happened, while 'opportunity' is used to describe an uncertain event that would have a positive influence on objectives if it happened.

Organizations have only recently realized that risk management, in the broadest sense, encompasses both negative threats and positive opportunities. In each situation, a proactive strategy is necessary, with the goal of determining the extent of potential threats and opportunities so that a decision can be taken on whether to accept or act on the threat or opportunity. While it may be tempting to think of these as distinct activities, opportunities and threats are rarely independent in practice (OGC, 2010).

Opportunity management aids in the identification and comprehension of possible avenues for achieving goals more effectively.

Threat management entails using risk management resources to describe risks, analyze risk features, and evaluate the probability of risk occurrence and impact, as well as other characteristics, and, when appropriate, implement a planned response. Threat management, like opportunity management, is a phased process. To ensure that the process is strong and complete, both use a standardized life cycle framework (PMI, 2019).

3.1.2. Types of risks

The primary objective of a project is to manage the risks caused by the changes and there are all kinds of risks. The following list, although not exhaustive, gives a general idea: (Corbel, 2012)

- risks of a bad identification of customer needs ;
- technical risks, mainly at the interfaces of different parts and organizations
- human risks, such as absences or lack of technical and managerial skills
- industrial risks, due to a poor capacity to manufacture the required quality and quantity;
- financial risks, through poor evaluation of resources
- commercial risks, through difficulties in selling the products and/or services designed and produced;
- legal risks;
- taking into account existing and future regulations, etc.

3.2. Project Risk management

The PMBOK Guide 6thedition (PMI, 2017) describes project risk management as "*the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project. The objectives of Project Risk Management are to increase the probability and/or impact of opportunities and to decrease the probability and/or impact of threats in order to optimize the chances of project success."* The PMBOK states that when unmanaged, these risks have the potential to cause the project to deviate from the plan and fail to achieve the defined project objectives. Consequently, project success is directly related to the performance of project risk management.

Project risk management supports project objectives by adapting or implementing procedures and project activities to take advantage of emerging changes in the project environment. Therefore, the project baseline (i.e., scope, schedule, and cost) is risk-informed. When risks affect the baseline and/or the combined impact of multiple risks needs to be analyzed, all risks should be analyzed qualitatively, while some risks should be analyzed quantitatively.

3.2.1. Project risk management accountability

Project managers are responsible for assessing, reporting, and managing individual and overall project risks within project constraints. Depending on project complexity and organizational input, they may escalate certain risks to or seek advice from sources such as other project managers, portfolio managers, program management offices, governance committees, and other senior leadership bodies. All members of the project team are responsible for risk management, such as: identifying risks during the initiation, clarifying triggering events, or understanding potential new risks that may affect the project (PMI, 2019).

Furthermore, project stakeholders may have strong individual views on project risk. Although some stakeholders may want risks, others may be risk averse, and still others may prefer to avoid risks by taking activities that reduce the likelihood of severe consequences (Kendrick, 2015).

3.2.2. The Project Risk Management Performance

Serpell, Ferrada, & Rubio (2018) resulted that PRM performance can be measured using the key performance indexes linked to the PRM processes.

The Project Management Institute (2017; 2019) offers a seven-point plan for project risk management as follows:

- **Plan risk management**

It is the process of outlining how to execute risk management activities for a project. The major benefit of this method is that it guarantees that risk management is appropriate to both risks and the project's importance to the business and other stakeholders in terms of degree, type, and visibility. This technique is performed only once or at specified intervals during the project's lifecycle, but it may be altered subsequently (i.e., at a major phase change) (PMI, 2017).

- **Identify risks**

Identifying and documenting individual project risks as well as sources of overall project risk is the process of identifying risks. It also brings all data so that the project team may respond properly to risks that have been recognized. Throughout the project, this method is repeated (PMI, 2017).

The aim of this process is to identify the risks to the activity goals in order to minimize threats while optimizing opportunities. This will entail: (OGC, 2010)

- Identifying the activity's threats and opportunities
- Compiling a risk register
- Developing key performance indicators and early warning indications.
- Understanding the risks from the perspective of the stakeholders

Once all of the possible risks have been identified, a risk owner can be selected at the same time. The risk owner is the person in charge of keeping track of the risk and deciding on and implementing an effective risk response strategy. It is the risk owner's responsibility to manage the corresponding risk throughout the risk management process (PMI, 2019).

- **Perform qualitative risk analysis**

By measuring their probability of occurrence and impact, as well as other features, qualitative risk analysis assesses the magnitude of each risk in order to categorize and

prioritize individual risks for further analysis or action. The main advantage of this method is that it concentrates efforts on high-priority risks. This process is followed throughout the project. These risks may be further analyzed using quantitative risk analysis (PMI, 2017; PMI, 2019).

- **Perform quantitative risk analysis**

This process clarifies the cumulative impact of recognized risks on the desired result.

The main advantage of this method is that it quantifies overall project risk exposure and can also provide extra quantitative risk information to enhance risk response planning by including probabilistic or component-wide impacts such risk correlation, interdependency, and feedback loops. This process is not required for every project, but it is followed throughout the project when it is used (PMI, 2017; PMI, 2019).

Risks that are considered and assessed after both qualitative and quantitative risk analyses, as high priority and that potentially threaten or enhance the achievement of objectives are highlighted in The Plan Risk Responses process.

- **Plan risk response**

Risks that are significant and/or urgent enough to necessitate action must be addressed in the most effective manner possible. Risk response planning allows for a variety of response methods to be examined, with the approach that offers the maximum change in risk exposure (combined probability and impact) for the least amount of expenditure being chosen. The risk register is used to keep track of response plans as well as residual risk (probability, impact, and proximity). Identifying and describing any secondary risks that may occur as a result of the response activity, such as threats or opportunities, is an important aspect of risk response planning (OGC, 2010).

Once individual risks are prioritized, appropriate risk responses for threats and opportunities are established. This process is repeated until an optimal set of replies is found.

Both threats and opportunities have a variety of possible solutions or strategies as illustrated in **Table 7.**

Table 7: Strategies for dealing with Threats and Opportunities

Threats	Opportunities
Avoid. **Threat avoidance is when the project team acts to eliminate the threat or protect the project from its impact**	**Exploit**. A response strategy whereby the project team acts to ensure that an opportunity occurs
Escalate. **Escalation is appropriate when the project team or the project sponsor agrees that a threat is outside the scope of the project or that the proposed response would exceed the project manager's authority.**	**Escalate.** As with threats, this opportunity response strategy is used when the project team or the project sponsor agrees that an opportunity is outside the scope of the project or that the proposed response would exceed the project manager's authority.
Transfer. **Transfer involves shifting ownership of a threat to a third party to manage the risk and to bear the impact if the threat occurs.**	**Share.** Opportunity sharing involves allocating ownership of an opportunity to a third party who is best able to capture the benefit of that opportunity.
Mitigate. **In threat mitigation, action is taken to reduce the probability of occurrence and/ or impact of a threat. Early mitigation action is often more effective than trying to repair the damage after the threat has occurred.**	**Enhance.** In opportunity enhancement, the project team acts to increase the probability of occurrence or impact of an opportunity. Early enhancement action is often more effective than trying to improve the opportunity after it has occurred.
Accept. **Threat acceptance acknowledges the existence of a threat, but no proactive action is planned. Actively accepting a risk can include developing a contingency plan that would be triggered if the event occurred; or it can include passive acceptance, which means doing nothing.**	**Accept.** As with threats, accepting an opportunity acknowledges its existence but no proactive action is planned.

Source: (PMI, 2021)

Implement risk responses

The process of putting agreed-upon risk response strategies into action is known as Implement Risk Responses (PMI, 2017). The goal of the implementation is to make sure that the risk management actions that have been planned are carried out and monitored for performance, with corrective action taken if the results do not meet expectations (OGC, 2010). This process is followed throughout the project.

The risk owner supervises actions to accurately predict their efficiencies and to diagnose any secondary risks that may arise as a result of their widespread adoption. Any changes that may influence the risk owners' and risk action owners' obligations are briefed. Risk owners and project managers maintain effective communication so that the designated stakeholders (PMI, 2019):

- Accept responsibility for controlling the potential outcomes of specific risks
- Use their best efforts to track the associated trigger conditions
- Implement the agreed-upon responses in a timely manner.

Monitor Risks

The Monitor Risks process allows the project management team to examine the status of previously recognized hazards, identify emergent, secondary, and residual risks, and assess the risk management processes' performance.

As some risks arise, whether expected or unforeseen, and other risks become or cease to be important, the project environment may alter. As new information becomes available, the management team ensures that the planning materials are kept up to date. Periodic risk reassessment utilizing the risk management life cycle is undertaken at appropriate intervals or in response to relevant occurrences (PMI, 2019).

3.3. Project Risk Management in an Agile Context

By definition, high-variability environments are more uncertain and riskier. To tackle this, adaptive project management employs frequent reviews of incremental work products and cross-functional project teams to improve knowledge sharing and ensure risk is acknowledged and controlled. Each iteration's content is chosen with risk in mind, and risks are discovered, analyzed, and managed throughout the process. Furthermore, the requirements are maintained as a living document that is updated on a regular basis, and work may be reprioritized as the project develops as a result of a better understanding of current risk exposure (Agile Alliance & PMI, 2017).

CHAPTER 2: ORGANIZATIONAL CONTEXT AND METHODOLOGICAL FRAMEWORK

This present chapter includes, in the first section, the organizational context of the study field, and in the second section, methods and tools used in the realization of the study.

Section 1: Organizational context

The purpose of this section is to give an overview of the internship host organization, with a presentation of its objectives, vision, missions and organizational chart, as well as the missions of our host structure and its importance within the organization.

Company Presentation

Algeria's leading multimedia mobile operator, Nedjma which became Ooredoo on November 21, 2013, is the Algerian subsidiary of the Ooredoo Group.

Present in Algeria since December 23, 2003, the date of obtaining the license to provide cell phone services in Algeria, the Nedjma brand was commercially launched on August 24, 2004, offering Algerians, whether they are individual or corporate customers, a range of innovative offers and services, which adhere to international standards.

1.1. History and objectives

- WTA was set up by Kuwait's Wataniya Telecom and joined by United Gulf Bank (UGB). With a 15-year license, WTA has adopted an accelerated investment program with projects worth US$1 billion over three years.
- Wataniya Telecom was founded in 1999 in Kuwait. It is one of the companies of Kuwait Projects Company (KIPCO), the largest private company in Kuwait with assets of more than 10 billion USD.
- In March 2007, Qtel became the majority shareholder (51%) of Wataniya Telecom Kuwait and consequently owns 80% of Nedjma.
- It was during a press conference held, on November 12, 2013 at the Sheraton Hotel in *Club des Pins* that the CEO of Nedjma, Joseph Ged announced the official change of its commercial and visual identity by adopting the new name Ooredoo (The brand name translated from Arabic means "I want-أريدُ ").
- On December 15, 2013 in conjunction with the commercial launch of the 3G++ network, Nedjma becomes Ooredoo Algeria.

The company's visual identity and core values are illustrated in **Figure 11** and **Figure 12.**

Figure 11: Ooredoo Algeria's visual identity evolution

Logo 2004-2009 **Logo 2010- 2013** **Logo since 2014** **Alternative logo**

Source: Internal document

Figure 12: Ooredoo Values

Connecting	For the support, trust, respect of others and responsibility that Ooredoo embodies
Caring	For Ooredoo's commitment to work in a collaborative spirit and by fully integrating the Algerian community
Challenging	For the progress to which Ooredoo aspires and the continuous search for improvement and difference

Source: Self-developed based on an internal document

Also, besides the three core values of the company, Ooredoo Algeria has the following objectives:

- *To provide telecommunication services allowing the transport and exchange of voice, text messages, digital data and audiovisual information.*
- *Provide a unique customer experience by relying on highly competent human resources and a strong brand by offering the most efficient and innovative mobile telecommunication services throughout Algeria.*
- *Develop, explain and manage interconnections with network operators.*

1.2. SWOT Analysis of Ooredoo Group

Table 8 bellow illustrates a situational assessment of the company, presented by a SWOT analysis.

Table 8: SWOT Analysis of Ooredoo Group

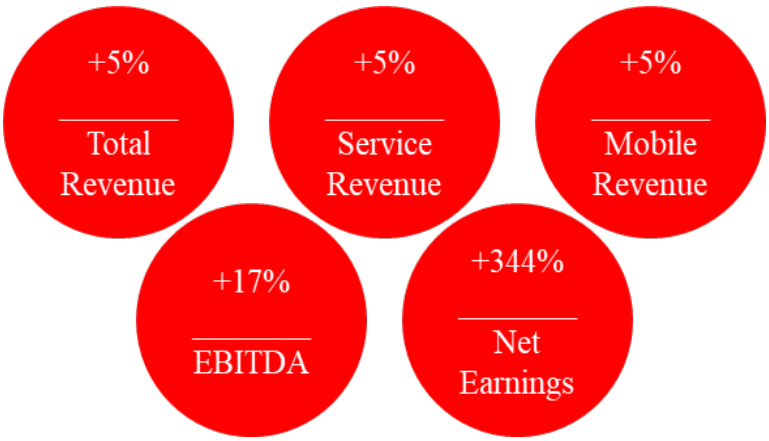
Strengths	Weaknesses
Strong Brand	Speed
Unique mix of mature and emerging markets	Digitize faster
across three regions (MENA, SE, Asia)	Business Continuity Management
Massive customer base	Organizational Transformation
Established distribution	Varies across the Group
Leading networks 4G and 5G	Need to drive further efficiencies
Date growth	Legacy Technology/ IT

Strong Group Efficiencies in cost optimization Market leading position in key markets "Lead strategy" Digital transformation started In all markets "Get Digital"	Acquiring new talent & digital skill set
Opportunities	**Threats**
Further Digital Transformation (customer, enablement, digital company) 5G Media MVNO or Digital MNVO B2B: ICT Home Broadband (Fixed) Mobile BB Partnership for future revenue growth Internet of Things (IoT) Data monetization	Competitive dynamics Price war New MNVO New Fixed FX & interest rate Regulatory environment changes Country macroeconomics and economical risk (hike in oil prices) Natural, man-made & technological disasters Geo political situation in some markets
Source : (https://www.ooredoo.com/)	

1.3. The Financial Results of Quarter1 2022 for Ooredoo Algeria

Figure 13 below is a visual representation of the company's financial results of the first semester of 2022.

Figure 13: Ooredoo Algeria Q1 2022 Results



Self-developed from an internal document.

1.4. The general organizational chart of Ooredoo Algeria

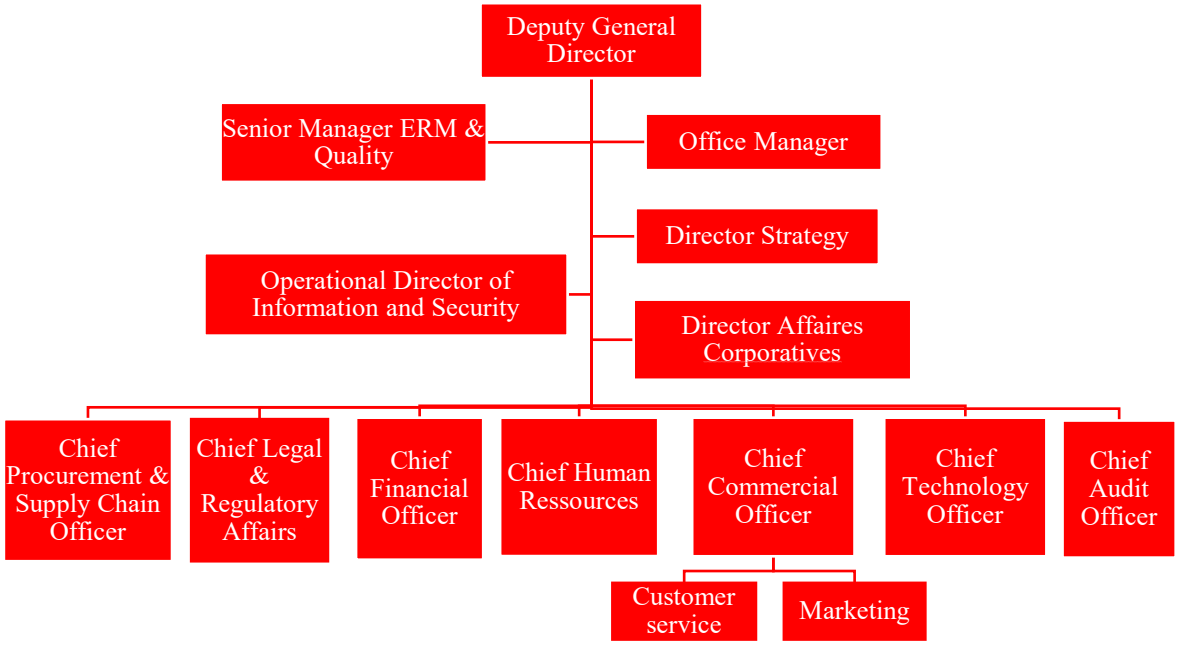
At the central level there are 13 departments in the company:

1. Deputy Department
2. ERM & Quality Department
3. Project Management Office Department

4. Strategy Department
5. Corporate Affairs Department
6. Operational of Information and Security Department
7. Procurement & Supply Chain Department
8. Legal & Regulatory Affairs Department
9. Financial Department
10. Human Resources Department
11. Commercial Department
    Customer Service Department
    Marketing Department
12. Technology Department
13. Audit Department

These different departments are illustrated in **Figure 14** bellow.

Figure 14: The general organizational chart of the Ooredoo Company



Source: internal document

Section 2: Data and Method

The objective of this second section is to present the research method adopted to carry out our research and achieve the objectives of this study, indicating the tools and methods of data collection and the instruments of analysis used.

2.1. Epistemological posture

Epistemology can be defined as the philosophical discipline that aims at establishing the foundations of science (Thietart, 2014), and as defined by ((Piaget, 1967, p6 as cited in (Thietart, 2014)) as the study of the constitution of valid knowledge.
An epistemological paradigm is a system of assumptions about the questions that epistemology studies. These hypotheses concern what is considered knowledge, what knowledge is, and how knowledge is constituted (Gavard-Perret, Gotteland, Haon, & Jolibert, 2008).

According to Gavard-Perret & al (2008), there are two families of epistemological paradigms: positivist/post-positivist epistemological paradigms and constructivist epistemological paradigms.

This research work is part of a post-positivist epistemological paradigm. This choice is motivated by the researcher's position with the object of this research.

For positivism, the reality is independent of the mind and of the descriptions that are made of it. Science would make it possible to observe "the" reality: a reality independent of the observer's view of it and reduced to observable and measurable facts (Thietart, 2014).

And because project success, is not completely measurable and is influenced by subjective evaluation. Although positivism cannot disclose the complete truth in business research, post-positivism recognizes that its discoveries are still valuable (Serrador & Turner, 2015).

For post-positivists, it is not always possible to fully and perfectly grasp reality in its entirety. The researcher must therefore be satisfied with approaching it "as closely as possible", in particular by multiplying the methods. Similarly, post-positivists believe that the researcher must do everything possible to strive for maximum objectivity and, in particular, to control as precisely as possible the conditions in which he carries out his research, and especially his data collection, to ensure the objectivity of his work as much as possible (Gavard-Perret, Gotteland, Haon, & Jolibert, 2008).

2.2. Research reasoning

Post-positivists follow the hypothetical-deductive reasoning, as they accept the existence of error and consider research results and conclusions to be probable as long as they are not disproved ((Riccucci, 2010) as cited by (Bouyzem & Al Meriouh, 2017)).

A deductive approach, more often qualified as hypothetical-deductive, is a question of testing, by means of hypotheses, a theory, or of putting to the test in particular situations a certain amount of knowledge developed beforehand (Gavard-Perret, Gotteland, Haon, & Jolibert, 2008).

The hypothetical-deductive approach is where the researcher asks himself a question, formulates a provisional answer, elaborates theoretical conjectures, and submits them to empirical tests whose aim is to verify the truth of the provisional answer. Where researchers in the humanities and social sciences use different instruments of data collection such as content analysis and statistical analysis to engage in the deductive approach (N'DA, 2015).

2.3. Methodological approach

In the framework of this study, quantitative research is the most appropriate and adequate approach that will allow testing the hypotheses.

Quantitative research is based on the collection and reporting of information and facts that can be quantified and measured or social facts that can be converted into numbers, statistics, and graphical data. This type of research is based on the measurement of opinions through a survey, a questionnaire, or the measurement of behavior through observation and the collection of recorded information (FES, 2021)[6].

Quantitative research is a technique for testing objective assumptions by looking at the relationship between variables. These variables can then be determined, usually with tools, and the resulting numerical data can be statistically analyzed. The final written report provides a structured format that comprises an introduction, literature and theory, methods, results, and discussion. Those that do this type of research make assumptions about deductively testing ideas, adding bias safeguards, adjusting for alternative or unfalsifiable explanations, and being able to aggregate the research findings (Creswell & Creswell, 2018).

[6] The Friedrich Ebert Foundation is a German political party foundation associated, but independent from, the Social Democratic Party of Germany.

The inclusion in this research method is imposed by the nature of its question which tries to study the impact of agile practices and risk management performance and on project success.

Which is confirmed by Creswell & Creswell *"the post positivist assumptions have represented the traditional form of research, and these assumptions hold true more for quantitative research than qualitative research"* (2018, p. 44).

2.4. Data collection instruments

The data collection process consists of collecting the desired information in a systematic way, using the instruments chosen for this purpose (N'DA, 2015).

2.4.1. Documentary and study

The documentary study or the study of existing data, allows the researcher to have what he needs to explain or understand a phenomenon (N'DA, 2015).

This tool helped us to collect as much information as possible on agile practices, the performance of risk management, and the project success based on several sources of information such as: articles, books, official reports and international standards.

For the writing of our literature review we started by consulting several scientific articles in several online libraries such as: Google Scholar, SNDL, Connected Papers, ResearchGate. Then, to expand our research paper, and more specifically our conceptual framework, we resorted to several books on different digital platforms, including Z Library and PDF Drive, in addition to the books available in our school's library.

2.4.2. Questionnaire survey

The questionnaire is the most suitable primary data collection tool for conducting surveys and using quantitative and/or qualitative information. It allows the collection of a large amount of information from large samples of respondents. It makes it possible to record responses whose modalities have been defined beforehand (Thietart, 2014).

For the collection of data for this study, this survey took place from 25/04/2022 to 05/05/2022 and was conducted through a self-administrated electronic questionnaire, where respondents answer directly to a document that they read themselves, developed on Google Forms, and distributed to company professional emails and LinkedIn direct messages to the study sample.

The questionnaire (check Appendix A) is structured in four sections, namely admissibility to the survey, agile methodology, project risk management, and project success. They are detailed as follows:

Eligibility and identification: This section contains respondents' characteristics and eligibility questions to filter the respondents and keep only those who own are employees at Ooredoo and currently working or already worked on a project [Q1 – Q5].

The descriptive questions of this questionnaire are gender, years of experience, current department, and the role that better describes their position.

Agile methodology: the second part [Q6 – Q10] holds five questions that aim to have information on the agile methodology with a check-all-that-applies question for the independent variable (Q9) to identify how many agile practices were implemented by the employees (Sandstø & Reme-Ness, 2021).

Project risk management: this part is composed of 6 questions [Q11 – Q16] to gather details about the company's PRM structure, with a question (Q15) aiming to measure its performance according to 5 items with a 5 points Likert scale (Serpell, Ferrada, & Rubio, 2018) that represents the second independent variable.

Project success: a set of 7 questions for the dependent variable [Q17 – Q23], that serve to measure the successfulness of project success based on 3 components: project efficiency measured with a scale of 7points, project stakeholders' satisfaction, and overall project success measured with a scale of 5points (Serrador & Turner, 2015).

2.5. Population and Sample

The population is a collection of individuals, that is, a set of elementary units (a person, a group, a city, a country) that share common characteristics specified by a set of criteria.

It is not always possible or necessary to study the entire population to know it well. We can collect useful information on a fraction (sample) of the whole (population) to make generalizations (N'DA, 2015).

The study population of this research is the employees of Ooredoo Algeria's Headquarters in Ouled Fayet, especially those who were/are part of a project.

The sampling method used for this study is a non-probabilistic judgment-based method, where individuals who were judged to be eligible for the survey were contacted.

This choice is justified by the non-accessibility of a database that contains all the information on the population.

This type of sample is intended to be representative in that the researcher will interview the individuals most likely to shed light on and provide relevant information about the problem to be solved.

First, 36 employees' emails were collected and contacted. Another platform was also used as a database, namely LinkedIn, which contains contacts of professional people including Ooredoo Algeria's employees, where 100 employees were collected and contacted via direct messages.

In total, 136 employees were contacted, to obtain 45 responses only 43 of them were complete and usable, with a 33.08% response rate.

3. Data treatment and analysis

When processing the results of the survey, two computer programs SPSS[7] version 26.0 as a tool for processing the collected data because of its efficiency in statistical processing, and Excel to convert the data before importing them to SPSS.

First descriptive and frequency analysis was proceeded. Followed by preliminary analysis for missing or extreme values and normality tests.

Then a factorial analysis was performed to reduce the number of items from the scales of the independent variable (PRM performance) and the dependent variable (project success) of the study, followed by a reliability test.

Finally, the hypotheses were tested with a regression analysis.

[7] Statistical Package for the social sciences

CHAPTER 3: RESULTS AND DISCUSSION

In this chapter, results of the data collection are presented, followed by a discussion of the finding of this research.

Section 1: Results

1. Description of the sample

43 complete and usable answers were collected and analyzed for this study, of which 58.13% of them are men and the rest are women. 100% of respondents already worked or currently working on a project, which was the main criteria for accepting answers.

The respondents' profiles are detailed in **Table 9** using descriptive and frequency statistics.

Table 9: Respondents' profiles

Variable	Specification	Frequency	Percentage%
Q1: You are:	Female	18	41,86%
	Male	25	58,13%
Q2: Experience in Ooredoo	Less than 1 year	5	11,6%
	Between 1 and 5 years	20	46,5%
	More than 5 years	18	41,4%
Q3: Department	Marketing	15	34,9%
	Commercial	7	16,3%
	Technology	8	18,6%
	Office	1	2,3%
	ERM & Quality	1	2,3%
	Human Resources	5	11,6%
	Affaires Corporative	2	4,7%
	Strategy	2	4,7%
	Financial	1	2,3%
	Procurement & Supply Chain	1	2,3%
Q4: Working or have an experience with projects	Yes	43	100%
	No	0	0%
Q5: Role	Project manager	21	48,8%
	Product manager	6	14,0%
	Project team-member	16	37,2%

Source: self-developed based on SPSS results

The table above demonstrates that most of the respondents have between 1 and 5 years of experience in Ooredoo Algeria with a 46.5%, most of them are currently working in the departments of Marketing, Commercial, Technology, and Human resources, representing

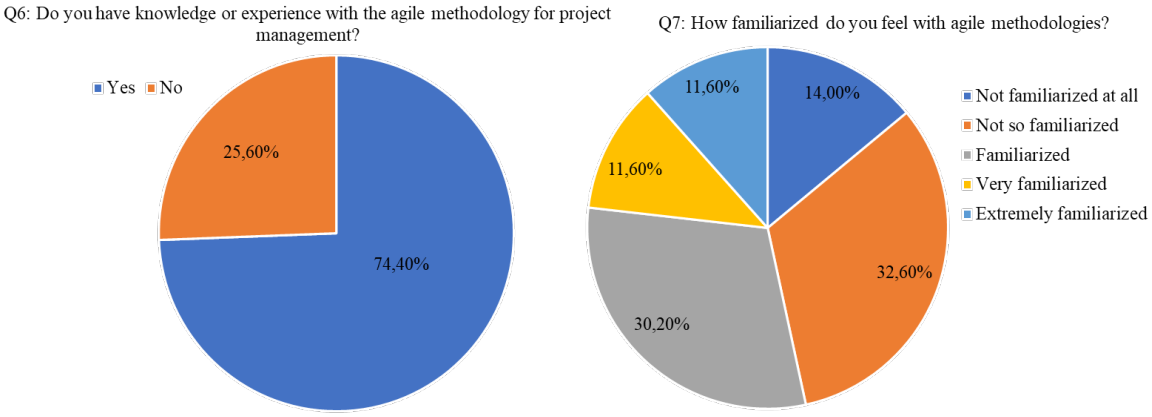
81.4% of the total respondents. As for the role, most of the respondents are project managers representing 48.8%, while product managers and project team members represent 14% and 37.2% of the respondents, respectively.

2. Univariate descriptive analysis

This step includes a univariate descriptive analysis of the survey questions, with descriptive statistics such as table of frequencies and percentages of responses for each question.

2.1. Agile methodology

Figure 15: Agile culture



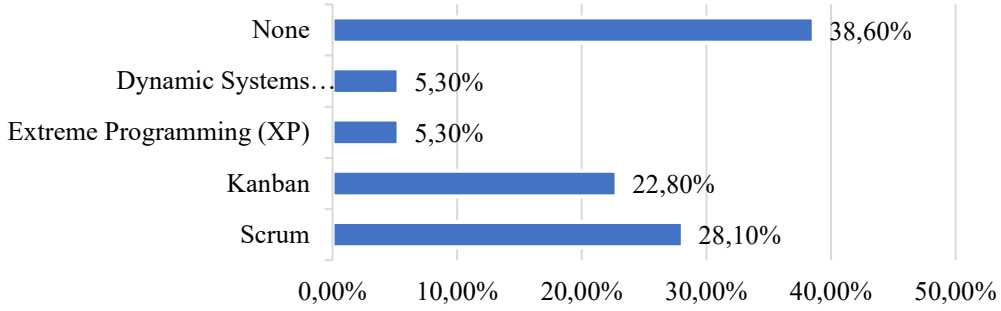
Source: self-developed based on SPSS results

Figure 15 above, and based on Q6 of the questionnaire results, 74.40% of the employees surveyed have knowledge or experience with the agile methodology, while only 25.60% of them do not.

And based on Q7 results, the employees are fairly familiarized with the agile methodologies with a cumulative result of 53.40% of the respondents who are familiarized, very familiarized, and extremely familiarized with agile methodologies, while 46.6% are not so

Figure 16: Agile methodologies

Q8: Which agile methodologies do you have experience or knowledge with?

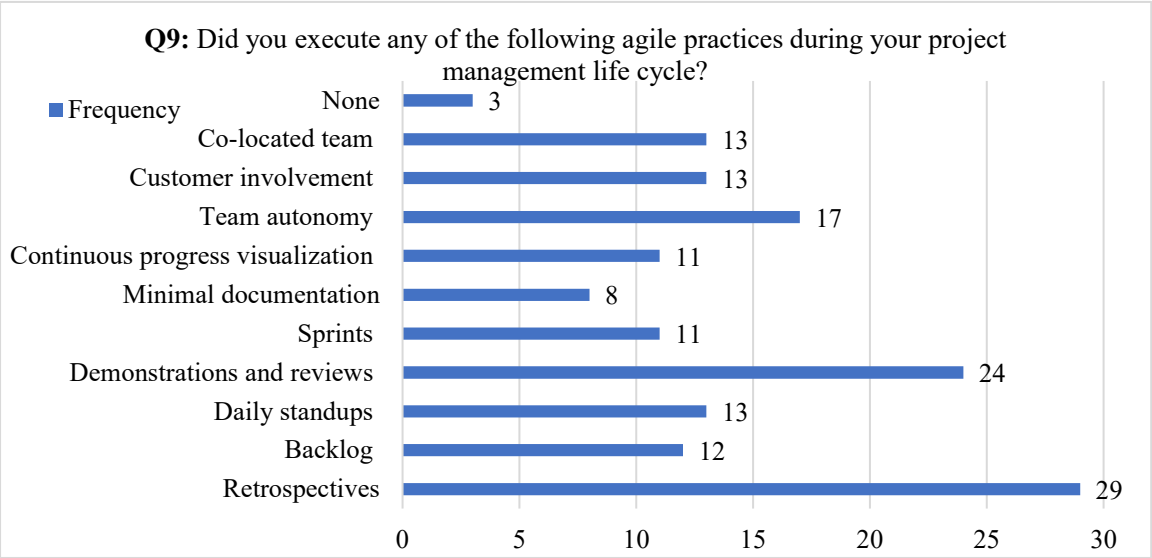


Source: self-developed based on SPSS results

familiarized or not familiarized at all with the methodologies. Which could be further investigated with the results of Q8 presented in **Figure 16**.

The survey highlighted, as shown in **Figure 16**, Scrum as the most popular Agile approach with 28,10% (n=16) identifying it as the methodology they have experience or knowledge with, followed by Kanban with 22,80% (n=13). As for the least popular, they are Extreme Programming and DSDM, with 5.30% (n=3), separately. But those percentages don't overlap the fact that 38.60% (n=22) of the respondents have no experience or knowledge of the mentioned agile approaches.

Figure 17: Agile practices executed by the respondents



Source: self-developed based on SPSS results

Table 10: Agile practices implemented

	Valid										
	,00	1,00	2,00	3,00	4,00	5,00	6,00	7,00	8,00	10,00	Total
Frequency	3	10	5	6	4	4	5	4	1	1	43
Percent	7,0	23,3	11,6	14,0	9,3	9,3	11,6	9,3	2,3	2,3	100,0

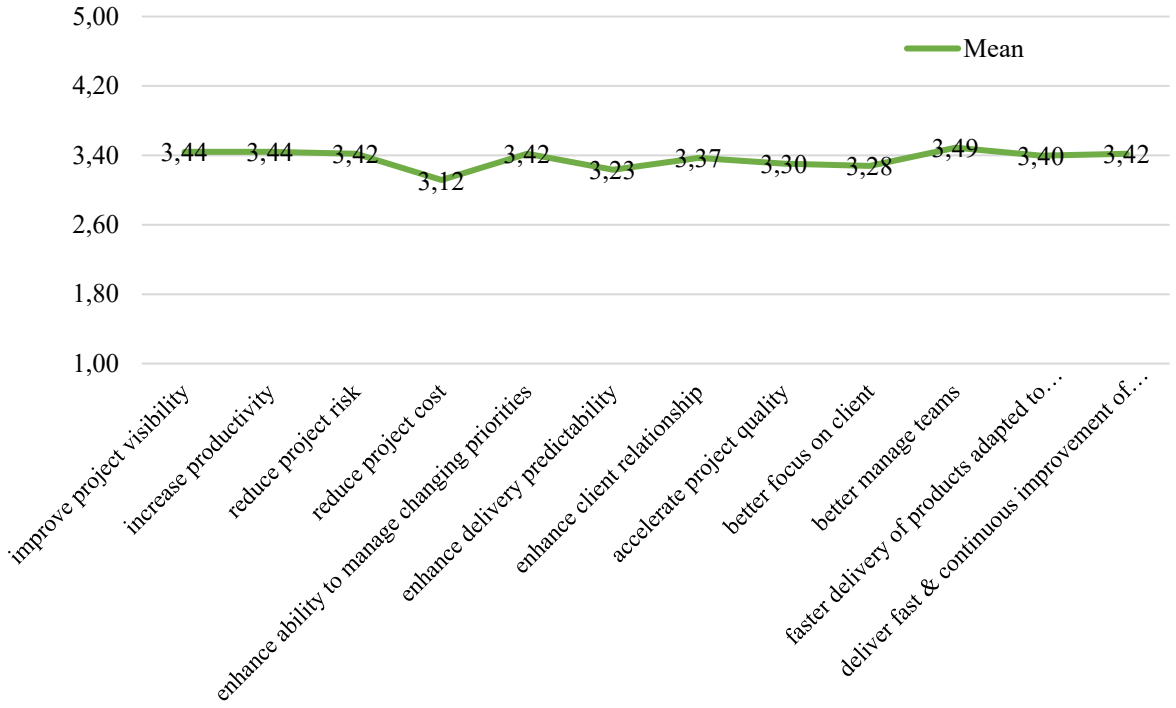
Source: self-developed based on SPSS results

Figure 17 exhibits Retrospectives as the most executed agile practice with 29 frequencies, followed by Demonstrations and reviews with 24 frequencies. While Daily Standups, Customer involvement, and Co-located team, come in the third position with 13 frequencies, separately. In the time, Backlog, Continuous progress visualization, Sprints, and Minimal documentation have 12, 11, 11, and 8 frequencies, respectively.

Only 3 of the respondents reported not executing any of the mentioned agile practices during their project management life cycle.

While **Table 10** demonstrates that 23.3% (n=10) of the respondents implemented only one agile practice into their project management lifecycle. Followed by 14% (n=6), 11.6% (n=5) who implemented 3, 6 and 2 practices, separately. The rest of the participants implemented 4, 5 or; 7 practices, 4 for each, and only 2 participants applied 8 and 10 practices. Only 3 of the employees reported that they used none of the mentioned practices.

Figure 18: Reasons for adopting agile practices



Q10: The following statements present reasons for adopting Agile practices. Rate them based on experience.

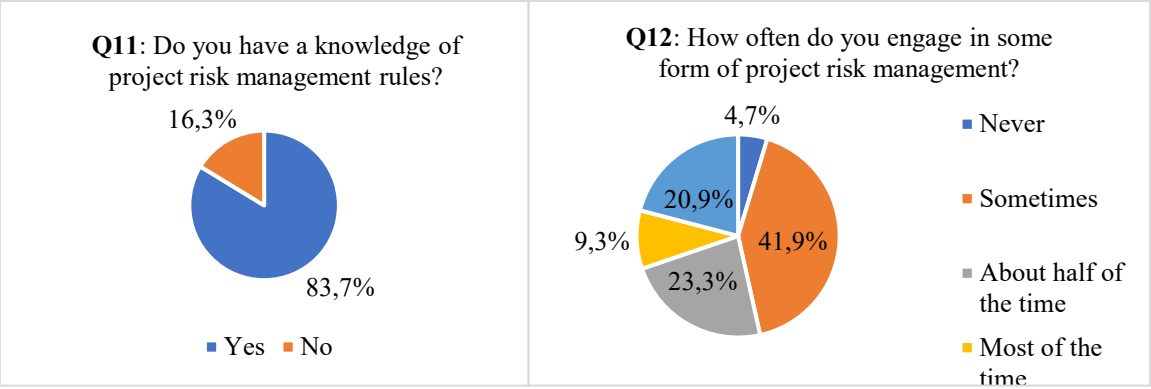
Source: self-developed based on SPSS results

[1-1,8[strongly disagree | [1,8-2,60[disagree | [2,60-3,40[neutral | [3,40-4,20[agree | [4,20-5] strongly agree

The results summarized in **Figure 18** show that improving project visibility, increasing productivity, reducing project risk, enhancing the ability to manage changing priorities, better managing team, faster delivery, and continuous improvement are the top agreed on reasons for adopting agile practices. While reducing project cost, enhancing delivery predictability and client relationship, accelerating project quality and better focusing on the client are the least agreed on or neutral choices for adopting those practices.

2.2. Project risk management.

Figure 19: Project Risk Management Culture

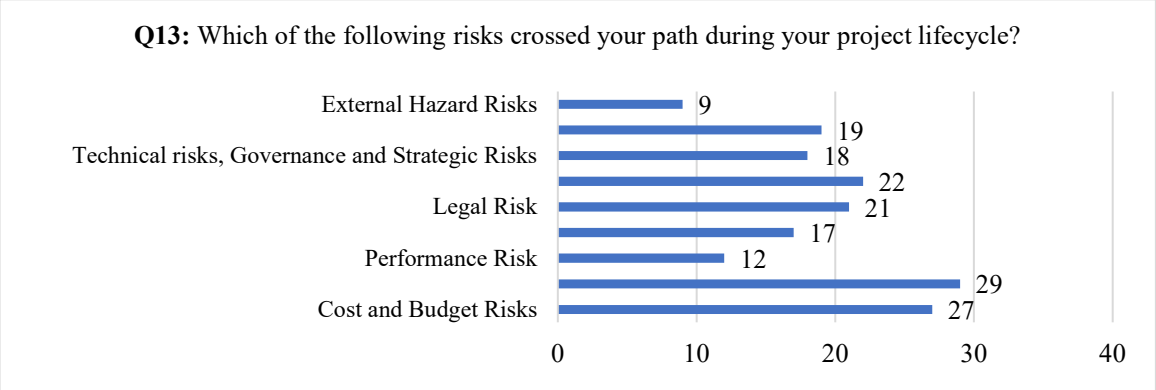


Source: Self-developed based on SPSS results.

Figure 19 resuming analysis results from Q11 illustrates that the majority of the employees 83.7% (n=36) have knowledge of PRM rules and only 16.3% (n=7) of them do not.

While results from Q12 indicate that their engagement in different forms of PRM is significant, cumulating 53.5% (n=23) of the employees participate about half of the time, most of the time, or always. Meanwhile, 41.9% (n=18) sometimes engage in risk management activities and only 4.7% (n=2) do not.

Figure 20: Project Risks



Source: Self-developed based on SPSS results.

Q13 results resumed in **Figure 20,** demonstrate that the most reported project risks are related to schedule with 29 frequencies, cost and budget with 27 frequencies. Followed by operational, legal, human, technical and market/commercial risks, with 22, 21, 19, 18, and 17 frequencies, respectively. While the least reported risks are performance and external hazard risks with only 12 and 9 frequencies.

Table 11: Risk management dimensions and key elements

	Statements (risk management key elements)	**% Of Agreement**		
		Disagree	Neutral	Agree
Culture	RM plan is developed and approved	7,0	14,0	79,1
	Roles and responsibilities of risk management are defined and risk owner is authorized to manage risks	11,6	34,9	53,5
	Risk-awareness culture is created and applied to the project. Project team reacts as expected	14	27,9	58,1
	Total Agreement	**63,56%**		
Process	Project objective is clearly identified and understood	7,0	9,3	**83,7**
	Risks are identified at the early project stage	25,6	20,9	53,5
	Diverse sources are considered for risk identification	9,3	14,0	76,7
	Opportunities are identified and explored	7	14	79,1
	Root causes and effects of risks are identified	20,9	27,9	51,2
	Likelihood and magnitude of risks are analyzed	16,3	23,3	60,5
	Risk control is documented and assessed	11,6	25,6	62,8
	Appropriate risk response is developed	7	20,9	72,1
	Risk response is designed for root causes of risk	4,7	41,9	53,5
	Emerging new project risks are identified proactively	9,3	37,2	53,5
	Timely and accountable execution of risk response	9,3	32,6	58,1
	Critical risks are reported to top management	9,3	9,3	81,4
	Clear communication is established for risk reporting	11,6	11,6	76,7
	Total agreement	**68,9%**		
Experience	Project resources for RM plan, skills, process and tools are continuously improved	11,6	23,3	65,1
	Sufficient internal qualified resources	14,0	46,5	39,5
	External consultant or experts used to assist managing project risks	16,3	41,9	41,9
	Formal and regular risk management training is provided	20,9	34,9	44,2
	Total agreement	**46,26%**		

Source: Self-developed based on SPSS results.

Table 11 above illustrates the results of Q14, which its main aim was to evaluate project risk management practices based on 3 dimensions that are: culture, processes and experience according to different key elements. The results showed, in terms of culture and processes, that the company has a strong presence of risk culture and that most of risk management processes activities were generally performed, scoring a total of 63.56% and 68.9%, respectively. Unlike the results of the 3rd dimension of experience, that scored a total of 46.26% which is below average, due to the lack of attention for formal training, or sufficient internal and external resources.

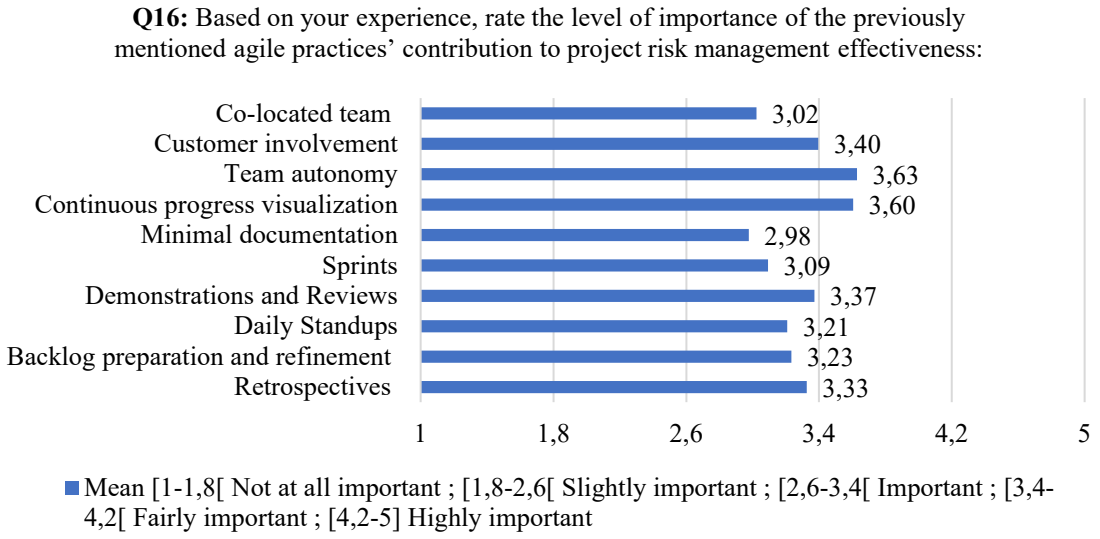
Table 12: Level of performance of projects risk management process

Statements	Frequency					Mean	Level of performance
	Not at all	slightly	somewhat	very	highly		
Risks that occurred comparing previously identified risks and non-identified risks	4	9	12	12	6	3,16	Medium
Risks actual exposure compared to expected exposure	3	10	10	15	5	3,21	Medium
Impact of risks without responses comparing expected impact and real impact	0	8	19	13	3	3,26	Medium
Impact of risks with responses comparing expected impact and real impact	2	7	15	11	8	3,37	Medium
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	3	8	13	13	6	3,26	Medium
Global						3,25	Medium
Mean: [1-1,8[not performant at all | [1,8-2,60[slightly performant | [2,60-3,40[somewhat performant | [3,40-4,20[very performant | [4,20-5] highly performant							

Source: Self-developed based on SPSS results

Table 12 above resumes the results of Q15, in which it indicates the level of performance of projects risk management process based on risk identification, analysis and evaluation, responses and risk management profitability. The results show that overall mean score for the performance of projects risk management process is medium (3.26) which means the projects are somewhat effective.

Figure 21: Level of importance of Agile practices to risk management performance



Source: Self-developed based on SPSS results

Figure 21 illustrates the importance of each of the mentioned agile practices to project risk management performance with a medium global mean score of 3,28 which indicates that these practices are averagely important to project risk management process.

The results show that customer involvement, team autonomy and continuous progress visualization are fairly important scoring 3.4, 3.63 and 3.6 respectively. While the rest of the practices scored a medium mean of importance, from 2.98 to 3.37.

2.3. Project success

Table 13: Project success against the components of project efficiency

How successful was the project in meeting	Frequency							Mean	Level of success
	1	2	3	4	5	6	7		
Q17: time goals	12	5	1	2	21	0	2	4,02	Mixed
Q18: budget goals	8	1	1	4	4	20	5	4,74	successful
Q19: scope goals	6	4	2	1	6	21	3	4,67	successful
Q20: quality goals	5	3	2	4	7	21	1	4,67	successful
Global								4,52	Successful

1: > 60% over goals 2: 45%–59% over goals 3: 30%–44% over goals 4: 15%–29% over goals 5: 1%–14% over goals 6: on goals 7: under goals

Table 13 above illustrates the project success meeting time, budget, scope and quality requirements, scoring a moderate level of success with 4,52 mean that indicates that projects are successful in terms of projects efficiency.

Table 14: Projects success as perceived by the stakeholders

Statements	Frequency					Mean	Level of success
	Failure	Not fully successful	Mixed	successful	very successful		
Q20: the project team's satisfaction with the project	1	3	11	22	6	3,67	Successful
Q21: the client's satisfaction with the project's results	0	0	10	26	7	3,93	Successful
Global						3,8	Successful
Q22: the overall success of the project	0	1	13	21	8	3,84	Successful
Mean: [1-1,8[failure | [1,8-2,60[not fully successful | [2,60-3,40[mixed | [3,40-4,20[successful | [4,20-5] very successful							

Source: Self-developed based on SPSS results

Table 14 above assembles the results of projects success ratings regarding the mentioned items. Where projects scored a global high mean of 3.8 regarding the mentioned

stakeholders' satisfaction, which indicated that stakeholders are majorly satisfied. With a final and overall successful project with a mean of 3.84.

3. Preliminary analyses of data suitability

3.1. Missing and extreme values or outliers

Different methods are used for the treatment of missing values. In this research, complete surveys were collected. This was possible because of the mandatory response function in Google Forms and also because of the mode of administration of the questionnaire which was administered online.

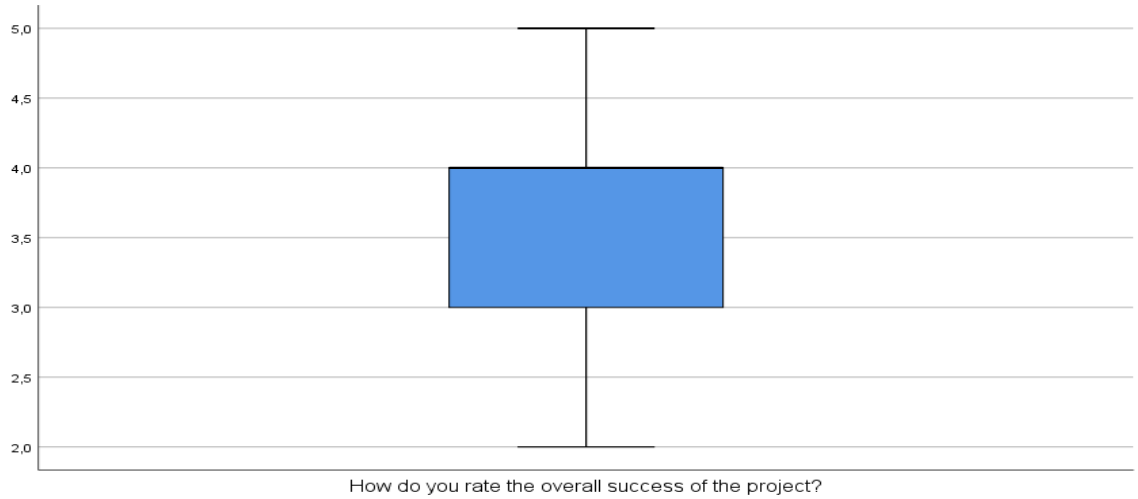
3.2. Extreme values or outliers

A search for extreme values or outliers was conducted on quantitative variables using a statistical tool called "The Boxplot" by John Tukey.

Outliers, which are data values that are very far from the other data values, can have a significant impact on our results. In general, outliers are easier to spot on a boxplot, they are indicated by asterisks (*).

The graph of the whisker box presented in **Figure 22** below, confirms the absence of asterisks next to the extremities, which means and confirm the absence of outliers or extreme values. All the box plots of this research's quantitative variables are similar.

Figure 22: Graphical representation of the Boxplot



Source: self-developed from SPSS analysis results

3.3. Normality and quasi-normality of data

- Normality of data

To assess the normality of the data, the Kolmogorov-Smirnov and Shapiro-Wilk tests were used, which are very powerful and significant in relation to the verification of the normality of the data. The results obtained are lower than the significance level (P-Value), so the hypothesis of normality of the data is rejected (check the normality table in Appendix B).

- Quasi-normality of data

The situation of non-normality of data is always frequent, so in order to match the data to be able to perform multivariate analyses, it was checked that the data follow a distribution close to normal (quasi-normality) by inspecting the skewness and kurtosis coefficients which should vary between [-1; +1] and [-1.5; +1.5] respectively. The results show a satisfactory univariate quasi-normality of the data (check the quasi-normality table in Appendix B).

4. Principal Components Analysis (PCA)

The reliability of this research's variables was tested by calculating the efficiency of the dimensions used in each the variables with a scale, proving the correlation between the items used in the question and proving the reliability of measurement scales. To do so, principal component analysis was used to see the efficiency of the dimensions of the variables and to stimulate their effect and to reduce dimensions. Followed by the alpha Cronbach test to prove the reliability of the measurement scales includes the items fixed as a dependent or independent variable.

4.1. Project Risk management performance scale

A principal component analysis was performed on all project risk management performance items. The results showed the existence of an average to high correlation between the items used and an accepted dimension with a proper value of variance that it is superior to 1 (1< 3,498) (see Appendix C).

The one-dimensionality of this scale summarized 69.95% of the initial information.

The KMO index was greater than 0.8 for (see Appendix C), indicating that all selected items were highly consistent. The partial correlations between the variables are therefore good. Bartlett's test in this case shows that the factorial model is appropriate for the dimension, so it is significant.

Moreover, the component matrix indicates that all items have a good structural coefficient, so this analysis is continued and all items are kept for further analysis.

The reliability test shows that the homogeneity of these scales is satisfactory, since Cronbach's alpha is higher than 0.8. Therefore, the analysis is continued. The tables for the rest of the analysis are in Appendix C.

4.2. Project Success

An initial principal component analysis was performed on project efficiency items. The results of the correlations showed a strong correlation of the 4 items (Q17, Q18, Q19, Q20)

By performing the principal component analysis of this sub-variable composed of 4 items, it was found that the total variance explained allows the maintenance of components whose eigenvalues are greater than 1.

The initial information was represented with one axe that summarized 82.298%. It was also found from the component matrix that all items are correlated with each other.

The KMO index is equal to 0.798, so it can be said that all the selected items are strongly consistent. The partial correlations between the variables are therefore good. The Bartlett test in our case is significant, it shows that the factorial model is appropriate.

Moreover, the component matrix indicates that the items have a good structural coefficient, so the analysis is continued and all the items are kept for a later analysis.

The reliability test shows that the homogeneity of the project efficiency scale is satisfactory, since Cronbach's alpha is 0.922. Therefore, the analysis is continued. The tables for the rest of the analysis are in (Appendix C).

Another principal component analysis was performed on the rest of the project success items (Q21, Q22, and Q23). The results of the correlations showed a medium to strong correlation of the 3 items.

By performing the principal component analysis of this sub-variable composed of 3 items, it was found that the total variance explained allows the maintenance of components whose eigenvalues are greater than 1.

The initial information was represented with one axe that summarized 64.807%. It was also found from the component matrix that all items are correlated with each other.

The KMO index is equal to 0.590, so it can be said that all the selected items are consistent. The partial correlations between the variables are therefore good. The Bartlett test in our case is significant, it shows that the factorial model is appropriate.

Moreover, the component matrix indicates that the items have a good structural coefficient, so the analysis is continued and all the items are kept for a later analysis.

The reliability test shows that the homogeneity of the project efficiency scale is satisfactory, since Cronbach's alpha is 0.698. Therefore, the analysis is continued. The tables for the rest of the analysis are in (Appendix C).

5. Hypothesis testing

The hypotheses of this research were tested by conducting simple regression analyses. The nature of the variables in the theoretical model allows to perform this analysis. The threshold recommended in the literature for this type of analysis is the degree of significance of ANOVA, which must be less than 0.05, as well as the adjusted R2, which explains the validity of the model and which must exceed 10%,

5.1. The impact of Agile practices on project success

A simple regression analysis was proceeded between the dependent variables of project success (project efficiency and project stakeholder's satisfaction and overall success), which were sorted out from the ACP results, and the independent variable agile practices.

A non-significant effect of agile practices on project success is recorded in the results in **Table 15**. It has no influence on both project efficiency (R2=0.015 < 0.10) (β = 0,123; Sig= 0,433) and project stakeholder's satisfaction and overall success (R2=0.013 < 0.10) (β = 0,113; Sig = 0,469). Consequently, the hypothesis H1 is rejected.

Table 15: Simple linear regression results 1

Independent variable	Dependent variable	R2	R2 adjusted	F	β	t	Sig
Agile Practices	Project success (project efficiency)	,015	-,009	,675	,123	,791	,433
	Project success (project stakeholders' satisfaction and overall success)	,013	-,011	,534	,113	,731	,469

Self-developed based on simple regression results

5.2. The Impact of project risk management performance on project success

A simple regression analysis was proceeded between the dependent variables of project success (project efficiency and project stakeholder's satisfaction and overall success) and the independent variable project risk management performance, which were sorted out from the ACP results.

A non-significant effect of risk management performance on project success is recorded in the results in **Table 15**.

It has no influence on project efficiency (R2=0.016< 0.10) (β = -0,127; Sig= 0.416) and project stakeholder's satisfaction and overall success (R2=0,025< 0.10) (β = 0.158; Sig = 0. 311), consequently the hypothesis H2 is rejected.

Table 16: Simple linear regression 2

Independent variable	Dependent variable	R2	R2 adjusted	F	β	t	Sig
Project risk management performance	Project success (project efficiency)	,016	-,008	,675	-,127	-,822	,416
	Project success (project stakeholders' satisfaction and overall success)	,025	,001	1,053	,158	1,026	,311

Self-developed based on simple regression results

5.3. The impact of agile practices on project risk management

A simple regression analysis proceeded between two independent variables: project risk management performance and agile practices

A significant effect of agile practices on project risk management performance is recorded in the results in **Table 16**.

It positively influences project risk management performance (R2=0.123 > 0.10) (β = 0.350; Sig= 0.021) which means that the more agile practices are implemented, the stronger project risk management performance, in a significant way, consequently the hypothesis H3 is accepted.

Table 17: Simple linear regression 3

Independent variable	Dependent variable	R2	R2 adjusted	F	β	t	Sig
Agile practices	Project risk management performance	,123	,101	5,728	,350	2,393	,021

Self-developed based on simple regression results

- **Summary of Hypothesis Testing**

Table 18: Summary of hypothesis testing

Hypothesis		Confirmation	
H1	Agile practices have a significant positive impact on project efficiency	No	Rejected
	Agile practices have a significant positive impact on project stakeholders' satisfaction and overall project success	No	
H2	Project risk management performance have a significant positive impact on project efficiency	No	Rejected
	Project risk management performance have a significant positive impact on project stakeholders' and overall project success	No	
H3	Agile practices have a significant positive impact on project risk management performance	Yes	Accepted

Self-developed based on simple regression results

Section 2: Discussion

The statistical test that was operated on the data set collected from the employees who were mainly interrogated about agile practices, project risk management, and project success, allowed us to make some findings in order to better understand the statistical relation between the variables.

According to the results, agile practices have no significant impact on project success in its two dimensions (project efficiency, stakeholders' satisfaction, and overall project success). In contrast to what has been reported by (Chelangat & Karanja, 2018; Sandstø & Reme-Ness, 2021; Younis & Younus, 2021; Muhammad, et al., 2021).

This can be explained by the low adoption of different agile practices through different project lifecycle processes. And also, as mentioned by Sandstø & Reme-Ness (2021) grouping all agile practices together – despite the fact that they all serve the same objective – can lead to erroneous assumptions about their effects. Therefore, the analysis should have been separated for each practice individually, to better understand the impact of each one of them on project success.

Furthermore, the research of Sandstø & Reme-Ness (2021) also highlights the fact that individual agile practices can have a variety of effects on project success. This means that the impact of Agile practices on project success is dependent on a variety of factors, including team size, culture, and project complexity. As a result, implementing an agile practice simply on the basis of its stated effects is not recommended. Practitioners should be mindful that project circumstances, context, implementation, and the combination of agile practices all have an impact on project success.

In addition, the success of a project depends heavily on the skills of the team and the organizational skills of the members (Thesing, Feldmann, & Burchardt, 2021).

Low ratings in the "experience dimension" indicate that RM has not gotten full attention by responsible parties, as shown by the lack of appropriately skilled resources (internal or external) and formal regular training (Baharuddin & Yusof, 2018). Which can explain that despite the fact that RM culture and processes are present in the projects of this study, a medium level of performance of PRM is registered. Resulting that PRM performance has no significant effect on either of the project success dimensions, rejecting H2 of this study.

Which is in contrast to previous research by Kishk & Ukaga (2008), Monteiro de Carvalho & Rabechini Junior (2013), Muchelule & Silas (2018), Wasswa & Namulindwa (2020), Sikweya & Njeru Njue (2021) that determined that there was a direct link between performant project risk management and project success.

Therefore, the establishment of proper training into risk management and providing sufficient external and internal resources will ensure that RM activities are observed and implemented properly so that project risks are managed and controlled optimally (Baharuddin & Yusof, 2018), resulting in a better positive impact on project success.

Finally, a significant positive impact of agile practices on project risk management performance was also revealed. This result confirms that agility, represented by its different practices, is an important factor for enhancing risk management performance. These results confirm what was said by Vieira, Hauck, & Matalonga (2020), most of the primary studies applied in practices, of adopting risk management in the context of agile are quite positive and naturally report an improvement in the efficiency of risk management.

Therefore, the results of this study synthesize the evidence on integrating agile practices into risk management. Which is also confirmed by the results reported by the respondents about the importance of adopting agile practices for a more performant PRM.

CONSLUSION

1. Main obtained results

The main objective of this research was to measure the impact of agile practices and project risk management performance on project success. We were led to address the case of Ooredoo, which is one of the main operators in Algeria, and hold many different projects.

To do this, we adopted a quantitative approach and conducted an online survey among respondents who are employees that worked on different projects at Ooredoo.

First, the univariate analysis allowed the identification of the main characteristics of the sample. However, we recall that the sample is mainly composed of 43 individuals occupying positions such as project managers, product owners, and project team members. The majority of the sample has between 1 and 5 years of experience in the company (46.5%).

The results allowed us to validate the assumptions that agile practices have a positive and significant impact on project risk management performance.

We reject the hypotheses which dictate that agile practices and project risk management performance have a significant positive impact on project success.

Therefore, this study's projects success is clearly affected by other factors.
Agile practices are applied in a variety of ways, with diverse durations, conditions, and combinations. These factors were not examined and are likely to have biased the reported effects discussed in this study.

Also, the medium level of PRM performance can be explained by the low scoring of proper RM training and provided resources, resulting in a non-significant impact on project success.

2. Recommendations

- The necessity for formal RM skills and awareness training to guarantee that project teams adopt RM methods and approaches. In addition to providing adequate external or internal resources to assist with project risk management.

- Increasing an agile culture for project management by implementing more agile practices and introducing different agile principles and methodologies, which could enhance project risk management performance and have a significant impact on different projects success.

3. Limits

Despite the obtained results, this research also had some limitations, including:

- The low response rate 33.08% which led to a limited sample (45 respondents to the questionnaire) for a company like Ooredoo Algeria, which holds more than 300 employees in the headquarters. Therefore, generalizing the results of this study to the entire population should be approached with caution.

- The non-ability to administer the questionnaire face-to-face because the company adopted a hybrid strategy of presently and remote working, therefore, there was a lack of availability of the employees.

- The confidentiality of internal documents that would have allowed a more in-depth analysis.

- The short period of time spent on conducting the questionnaire and the lack of collaboration by the concerned population.

- There have not been many academic works on the subject, and it was difficult to find a theoretical foundation from which to begin.

4. Possible extensions of the research

To enrich the avenues and paths of future research, the following implications are proposed:

- To add value to the assessment of the impact of the different variables, it is strongly recommended that future research include a larger sample size to test hypotheses.

- Future research could contribute to the analysis of project risk management performance by using different performance indicators.

- Also, future research in this context of agile can integrate variables that were not addressed in this study, such as agile principles implementation.

- A quantitative research design was used in this research. Future research could consider a qualitative analysis in order to better understand the relationship between the variables and the real reasons behind projects success.

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APPENDIX

APPENDIX A: THE QUESTIONNAIRE

Description:

This survey is carried out within the framework of an empirical research for the realization of an end-of-study project of Master 2 Entrepreneurship and Project Management at the National Higher School of Management.

This research aims to determine "the relationship between agile practices and risk management performance and its impact on project success". Answering this questionnaire will only take from 10 to 15 minutes. Your answers will be confidentially treated for purely academic purposes. Your collaboration by devoting time and efforts to answer this questionnaire are highly appreciated.
Thank you for your fruitful cooperation.

If you have any questions or comments, contact us at: chirine.mayouf@gmail.com

Section One	
Q1: Are you:	Female Male
Q2: Your work experience in Ooredoo Algeria? (One possible answer)	Less than 1 year Between 1 and 5 years More than 5 years
Q3: Your current department (One possible answer)	ERM & Quality Operational & Information Security Affaires Corporative Strategy Office Audit Technology Commercial Human Resources Financial Legal & Regulatory Procurement & Supply Chain
Q4: Which role better describes your current position? (One possible answer)	Project Manager Product Manager Risk Manager Project Team-member
Q5; Are you currently working or have you previously worked on a project?	Yes No

Would you like to continue this questionnaire in?	English French
Section 2: Agile methodology for project management	
Q6: Do you or have knowledge or experience with the agile methodology for project management?	Yes No
Q7: How familiarized do you feel with agile methodologies? (One possible answer)	Extremely familiarized Very familiarized Familiarized Not so familiarized Not at all familiarized
Q8: Which agile methodologies do you have experience or knowledge with? (Tavares, da Silva, & de Souza, 2019) (Multiple possible answers)	Scrum Kanban Extreme Programming (XP) Dynamic Systems Development Method (DSDM) Scaled Agile Framework (SAFe) None Others
Q9: Did you execute any of the following agile practices during your project management life cycle? (Agile Alliance & PMI, 2017; Sandstø & Reme-Ness, 2021) (Multiple possible answers)	Retrospectives Backlog Daily standups Demonstrations and reviews Sprints Minimal documentation Continuous progress visualization Team autonomy Customer involvement Co-located team None Others
Q10: The following statements present reasons for adopting Agile practices. Rate them based on experience. (One possible answer per line, with Likert scale: [1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree]) (Messager, 2013; Ciric, et al., 2019; Digital.ai, 2021)	Enhance ability to manage changing priorities Improve project visibility Reduce project risk Reduce project cost Accelerate project/product quality Better focus on client Better manage teams Increase productivity Enhance delivery predictability Enhanced client relationship

Section 3: Project Risk management	
Q11: Do you have a knowledge of project risk management rules?	Yes No
Q12: How often do you engage in some form of project risk management? (One possible answer with Likert Scale)	Never Sometimes About half of the time Most of the time Always
Q13: Which of the following risks crossed your path during your project lifecycle? (Corbel, 2012) (Multiple possible answers)	Cost and Budget Risks Schedule Risk Performance Risk Market and Commercial Risks Legal Risk Operational Risk Technical risks, Governance and Strategic Risks Human Risks External Hazard Risks Others
Q14: Based on your experience, rate the following risk management process activities (Baharuddin & Yusof, 2018). (One possible answer per line, with Likert Scale: Totally disagree, Disagree, Neutral, Agree, Totally Agree)	RM plan is developed and approved Roles and responsibilities of risk management are defined and risk owner is authorized to manage risks Risk-awareness culture is created and applied to the project. Project team reacts as expected Project objective is clearly identified and understood Risks are identified at the early project stage Diverse sources are considered for risk identification Opportunities are identified and explored Root causes and effects of risks are identified Likelihood and magnitude of risks are analyzed Risk control is documented and assessed Appropriate risk response is developed Risk response is designed for root causes of risk Emerging new project risks are identified proactively Timely and accountable execution of risk response Critical risks are reported to top management Clear communication is established for risk reporting Project resources for RM plan, skills, process and tools are continuously improved Sufficient internal qualified resources

	External consultant or experts used to assist managing project risks Formal and regular risk management training is provided
Q15: Rate the performance of your project risk management process based on: (Serpell, Ferrada, & Rubio, 2018) (One possible answer per line, with Likert Scale: Not effective at all, slightly effective, somewhat effective, very effective, highly effective)	Risks that occurred comparing previously identified risks and non-identified risks Risks actual exposure compared to expected exposure Impact of risks without responses comparing expected impact and real impact Impact of risks with responses comparing expected impact and real impact Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses
Q16: Based on your experience, rate the level of importance of the previously mentioned agile practices' contribution to project risk management performance: (One possible answer per line, with Likert Scale: Not at all important, slightly important, Important, Fairly Important, very important)	Retrospectives Backlog preparation and refinement Daily Standups Demonstrations and Reviews Sprints Minimal documentation Continuous progress visualization Team autonomy Customer involvement Co-located team
Section 3: Project Success Answer this section's questions based on your latest project. (Serrador & Turner, 2015)	
Q17: How successful was the project in meeting project time goals?	> 60% over time 45%–59% over time 30%–44% over time 15%–29% over time 1%–14% over time on time ahead of schedule
Q18: How successful was the project in meeting project budget goals?	> 60% over budget 45%–59% over budget 30%–44% over budget 15%–29% over budget 1%–14% over budget on budget

	under budget
Q19: How successful was the project in meeting scope requirements goals?	> 60% requirements missed 45%–59% requirements missed 30%–44% requirements missed 15%–29% requirements missed 1%–14% requirements missed Requirements met Requirements exceeded
Q20: How successful was the project in meeting quality requirements?	> 60% requirements missed 45%–59% requirements missed 30%–44% requirements missed 15%–29% requirements missed 1%–14% requirements missed Requirements met Requirements exceeded
Q21: How do you rate the project team's satisfaction with the project?	Failure Not fully successful mixed successful very successful
Q22: How do you rate the client's satisfaction with the project's results?	Failure Not fully successful mixed successful very successful
Q23: How do you rate the overall success of the project?	Failure Not fully successful mixed successful very successful

APPENDIX B: TABLES OF PRELEMINIARY TESTS

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Risks that occurred comparing previously identified risks and non-identified risks	,177	43	,002	,916	43	,004
Risks actual exposure compared to expected exposure	,220	43	,000	,906	43	,002
Impact of risks without responses comparing expected impact and real impact	,246	43	,000	,870	43	,000
Impact of risks with responses comparing expected impact and real impact	,189	43	,001	,910	43	,003
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	,186	43	,001	,915	43	,004
How successful was the project in meeting project time goals?	,335	43	,000	,749	43	,000
How successful was the project in meeting project budget goals?	,308	43	,000	,772	43	,000
How successful was the project in meeting scope and requirements goals?	,304	43	,000	,771	43	,000
How successful was the project in meeting quality requirements?	,278	43	,000	,775	43	,000
How do you rate the project team's satisfaction with the project?	,294	43	,000	,856	43	,000
How do you rate the client's satisfaction with the project's results?	,311	43	,000	,781	43	,000
How do you rate the overall success of the project?	,260	43	,000	,845	43	,000
a. Lilliefors Significance Correction						

Quasi-normality tests for quantitative variables	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Risks that occurred comparing previously identified risks and non-identified risks	-,153	,361	-,817	,709
Risks actual exposure compared to expected exposure	-,233	,361	-,832	,709
Impact of risks without responses comparing expected impact and real impact	,210	,361	-,476	,709
Impact of risks with responses comparing expected impact and real impact	-,150	,361	-,610	,709
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	-,227	,361	-,633	,709
How successful was the project in meeting project time goals?	-,308	,361	-,805	,709
How successful was the project in meeting project budget goals?	-,969	,361	-,572	,709
How successful was the project in meeting scope and requirements goals?	-,915	,361	-,751	,709
How successful was the project in meeting quality requirements?	-,850	,361	-,297	,709
How do you rate the project team's satisfaction with the project?	-,768	,361	,923	,709
How do you rate the client's satisfaction with the project's results?	,052	,361	-,364	,709
How do you rate the overall success of the project?	-,068	,361	-,468	,709

APPENDIX C: PCA ANALYSIS TABLES

Correlation Matrix – Risk Management Performance					
	Risks that occurred comparing previously identified risks and non-identified risks	Risks actual exposure compared to expected exposure	Impact of risks without responses comparing expected impact and real impact	Impact of risks with responses comparing expected impact and real impact	Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses
Risks that occurred comparing previously identified risks and non-identified risks	1,000	,741	,475	,562	,653
Risks actual exposure compared to expected exposure	,741	1,000	,630	,647	,708
Impact of risks without responses comparing expected impact and real impact	,475	,630	1,000	,452	,524
Impact of risks with responses comparing expected impact and real impact	,562	,647	,452	1,000	,808
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	,653	,708	,524	,808	1,000

Source: self-developed based on SPSS results

KMO and Bartlett's Test - Risk Management Performance		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,814
Bartlett's Test of Sphericity	Approx. Chi-Square	125,838
	df	10
	Sig.	,000

Source: self-developed based on SPSS results

Communalities - Risk Management Performance		
	Initial	Extraction
Risks that occurred comparing previously identified risks and non-identified risks	1,000	,680
Risks actual exposure compared to expected exposure	1,000	,803
Impact of risks without responses comparing expected impact and real impact	1,000	,520
Impact of risks with responses comparing expected impact and real impact	1,000	,700
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	1,000	,795
Extraction Method: Principal Component Analysis. - SPSS		

Total Variance Explained - Risk Management Performance						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	3,498	69,953	69,953	3,498	69,953	69,953
2	,621	12,419	82,372			
3	,481	9,621	91,993			
4	,222	4,448	96,441			
5	,178	3,559	100,000			
Extraction Method: Principal Component Analysis. - SPSS						

Source: self-developed based on SPSS results

Component Matrix [a] - Risk Management Performance (Component1)	
Risks that occurred comparing previously identified risks and non-identified risks	,825
Risks actual exposure compared to expected exposure	,896
Impact of risks without responses comparing expected impact and real impact	,721
Impact of risks with responses comparing expected impact and real impact	,837
Benefits and costs comparing cost of the real impact of the risks and the cost expected and the cost of the application of responses	,892
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Source: self-developed based on SPSS results

Reliability Statistics - Risk Management Performance		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,891	,891	5

Correlation Matrix – Project efficiency					
		How successful was the project in meeting project time goals?	How successful was the project in meeting project budget goals?	How successful was the project in meeting scope and requirements goals?	How successful was the project in meeting quality requirements ?
Correlation	How successful was the project in meeting project time goals?	1,000	,728	,674	,676
	How successful was the project in meeting project budget goals?	,728	1,000	,771	,831

	How successful was the project in meeting scope and requirements goals?	,674	,771	1,000	,894
	How successful was the project in meeting quality requirements?	,676	,831	,894	1,000

KMO and Bartlett's Test – Project efficiency		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,798
Bartlett's Test of Sphericity	Approx. Chi-Square	143,982
	df	6
	Sig.	,000

Communalities – Project efficiency		
	Initial	Extraction
How successful was the project in meeting project time goals?	1,000	,707
How successful was the project in meeting project budget goals?	1,000	,845
How successful was the project in meeting scope and requirements goals?	1,000	,853
How successful was the project in meeting quality requirements?	1,000	,887
Extraction Method: Principal Component Analysis.		

Total Variance Explained – Project efficiency						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	3,292	82,298	82,298	3,292	82,298	82,298
2	,393	9,829	92,127			
3	,221	5,516	97,642			
4	,094	2,358	100,000			
Extraction Method: Principal Component Analysis.						

Component Matrix [a] – Project efficiency	
	Component
	1
How successful was the project in meeting quality requirements?	,942
How successful was the project in meeting scope and requirements goals?	,924
How successful was the project in meeting project budget goals?	,919
How successful was the project in meeting project time goals?	,841
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Reliability Statistics – Project efficiency	
Cronbach's Alpha	N of Items
,922	4

Correlation Matrix – Project stakeholders' satisfaction and overall project success				
		How do you rate the project team's satisfaction with the project?	How do you rate the client's satisfaction with the project's results?	How do you rate the overall success of the project?
Correlation	How do you rate the project team's satisfaction with the project?	1,000	,296	,415
	How do you rate the client's satisfaction with the project's results?	,296	1,000	,675
	How do you rate the overall success of the project?	,415	,675	1,000

KMO and Bartlett's Test - Project stakeholders' satisfaction and overall project success		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,590
Bartlett's Test of Sphericity	Approx. Chi-Square	32,044
	df	3
	Sig.	,000

Communalities - Project stakeholders' satisfaction and overall project success		
	Initial	Extraction
How do you rate the project team's satisfaction with the project?	1,000	,433
How do you rate the client's satisfaction with the project's results?	1,000	,714
How do you rate the overall success of the project?	1,000	,798
Extraction Method: Principal Component Analysis.		

Total Variance Explained - Project stakeholders' satisfaction and overall project success						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	1,944	64,807	64,807	1,944	64,807	64,807
2	,745	24,826	89,633			
3	,311	10,367	100,000			
Extraction Method: Principal Component Analysis.						

Component Matrix [a] - Project stakeholders' satisfaction and overall project success	
	Component
	1
How do you rate the overall success of the project?	,893
How do you rate the client's satisfaction with the project's results?	,845
How do you rate the project team's satisfaction with the project?	,658
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Reliability Statistics - Project stakeholders' satisfaction and overall project success	
Cronbach's Alpha	N of Items
,698	3

APPENDIX D: REGRESSION TABLES

Correlations			
		Projectefficiency	AgilePractices
Pearson Correlation	Projectefficiency	1,000	,123
	AgilePractices	,123	1,000
Sig. (1-tailed)	Projectefficiency	.	,217
	AgilePractices	,217	.
N	Projectefficiency	43	43
	AgilePractices	43	43

Model Summary [b]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,123[a]	,015	-,009	1,87457	,015	,626	1	41	,433
a. Predictors: (Constant), AgilePractices									
b. Dependent Variable: Projectefficiency									

ANOVA [a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,201	1	2,201	,626	,433[b]
	Residual	144,075	41	3,514		
	Total	146,276	42			
a. Dependent Variable: Projectefficiency						
b. Predictors: (Constant), AgilePractices						

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,211	,493		8,538	,000
	AgilePractices	,091	,115	,123	,791	,433

Correlations			
		ProjectSTK	AgilePractices
Pearson Correlation	ProjectSTK	1,000	,113
	AgilePractices	,113	1,000
Sig. (1-tailed)	ProjectSTK	.	,235
	AgilePractices	,235	.

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,113[a]	,013	-,011	,60893	,013	,534	1	41	,469

a. Predictors: (Constant), AgilePractices

b. Dependent Variable: ProjectSTK

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,198	1	,198	,534	,469[b]
	Residual	15,203	41	,371		
	Total	15,401	42			

a. Dependent Variable: ProjectSTK

b. Predictors: (Constant), AgilePractices

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,719	,160		23,211	,000
	AgilePractices	,027	,037	,113	,731	,469

a. Dependent Variable: ProjectSTK

Correlations

		Projectefficiency	RMperformance
Pearson Correlation	Projectefficiency	1,000	-,127
	RMperformance	-,127	1,000
Sig. (1-tailed)	Projectefficiency	.	,208
	RMperformance	,208	.
N	Projectefficiency	43	43
	RMperformance	43	43

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,375	1,068		5,033	,000
	RMperformance	-,260	,316	-,127	-,822	,416

Correlations			
		ProjectSTK	RMperformance
Pearson Correlation	ProjectSTK	1,000	,158
	RMperformance	,158	1,000
Sig. (1-tailed)	ProjectSTK	.	,155
	RMperformance	,155	.

Model Summary [b]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,158 [a]	,025	,001	,60516	,025	1,053	1	41	,311

a. Predictors: (Constant), RMperformance

b. Dependent Variable: ProjectSTK

ANOVA [a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,386	1	,386	1,053	,311[b]
	Residual	15,015	41	,366		
	Total	15,401	42			

a. Dependent Variable: ProjectSTK

b. Predictors: (Constant), RMperformance

Coefficients [a]									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3,473	,345		10,069	,000			
	RMperformance	,105	,102	,158	1,026	,311	,158	,158	,158

a. Dependent Variable: ProjectSTK

Correlations			
		RMperformance	AgilePractices
Pearson Correlation	RMperformance	1,000	,350
	AgilePractices	,350	1,000
Sig. (1-tailed)	RMperformance	.	,011
	AgilePractices	,011	.

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square	F Chang	df1	df2	Sig. F Chang
1	,350 [a]	,123	,101	,86604	,123	5,728	1	41	,021

a. Predictors: (Constant), AgilePractices

b. Dependent Variable: RMperformance

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,296	1	4,296	5,728	,021[b]
	Residual	30,751	41	,750		
	Total	35,047	42			

a. Dependent Variable: RMperformance

b. Predictors: (Constant), AgilePractices

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2,807	,228		12,318	,000			
	AgilePractices	,127	,053	,350	2,393	,021	,350	,350	,350

a. Dependent Variable: RMperformance