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A THEORETICAL AND EMPIRICAL COMPARATIVE ANALYSIS OF WATERFALL, AGILE AND HYBRID PROJECT MANAGEMENT METHODS IN DIGITAL PROJECTS: THE CASE OF CONSOLUT

Διπλωματική Εργασία

της

Μπομπότα Αικατερίνης

Θεσσαλονίκη, Οκτώβριος 2023

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Τμήμα Διεθνών και Ευρωπαϊκών Σπουδών, Πανεπιστήμιο Μακεδονίας, 2019

Διπλωματική Εργασία

υποβαλλόμενη για τη μερική εκπλήρωση των απαιτήσεων του

ΜΕΤΑΠΤΥΧΙΑΚΟΥ ΤΙΤΛΟΥ ΣΠΟΥΔΩΝ ΣΤΗΝ ΕΦΑΡΜΟΣΜΕΝΗ ΠΛΗΡΟΦΟΡΙΚΗ

Επιβλέπων/ουσα Καθηγητής/τρια
Μιχαήλ Μαντάς

Εγκρίθηκε από την τριμελή εξεταστική επιτροπή την 01/11/2023

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Μπομπότα Αικατερίνη

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Περίληψη

Στόχος της παρούσας έρευνας είναι η κατανόηση του τρόπο με τον οποίο επιλέγονται και καθιερώνονται οι μεθοδολογίες διαχείρισης έργων και αν η σωστή μεθοδολογία συνδέεται με βελτίωση της απόδοσης και του αποτελέσματος του έργου, μέσω μιας πολυκριτιριακής σύγκρισης τριών διαφορετικών προσεγγίσεων. Η σύγκριση αφορά τη σημασία τους στη συνολική επιτυχία ενός ψηφιακού έργου, τον τρόπο με τον οποίο οι μεθοδολογίες υποστηρίζουν τις συνεργαζόμενες ομάδες καθώς και αν η υποστήριξη αυτή ανταποκρίνεται στις θεωρητικές προσδοκίες κάθε μεθοδολογίας, οδηγώντας σε επιτυχή έκβαση του έργου.

Για την εκπλήρωση του ερευνητικού στόχου, ακολουθήθηκε η μεθοδολογία της συστηματικής βιβλιογραφικής ανασκόπησης, σε συνδυασμό με ποσοτική μελέτη περίπτωσης που διεξήχθη μέσω ερωτηματολογίων, με στόχο να γεφυρωθεί το ερευνητικό κενό σχετικά με τις υβριδικές προσεγγίσεις, το οποίο προέκυψε από τη βιβλιογραφική ανασκόπηση. Ο μελετώμενος πληθυσμός της ποσοτικής έρευνας αποτελούνταν από ειδικούς του κλάδου, οι οποίοι είχαν προηγουμένως συμπεριληφθεί σε έργα που υλοποιούνταν με τη βοήθεια της υβριδική μεθοδολογίας που ανέπτυξε η consolut, με την ονομασία Prisma.

Τα ευρήματα της έρευνας υποδεικνύουν την πολυπλοκότητα τόσο σε τεχνικό, όσο και σε επίπεδο απαιτήσεων, το κόστος σε σχέση με τους περιορισμούς του προϋπολογισμού, τον χρόνο σε σχέση με τις μικρές προθεσμίες, τον βαθμό αποδοχής της διαχείρισης των αλλαγών, τη σύνθεση της ομάδας, τη διαχείριση κινδύνων, το μεθοδικό προγραμματισμό, την ευελιξία, την ικανοποίηση του πελάτη και το πλαίσιο παρακολούθησης, ως τα κύρια κριτήρια που επηρεάζουν τα έργα και την επιλογή της μεθοδολογίας.

Τα αποτελέσματα της έρευνας αναδεικνύουν επίσης τη σημασία της φύσης του έργου, βοηθώντας στην κατάλληλη επιλογή μεθοδολογίας, λαμβάνοντας υπόψη τη μοναδικότητα των αναγκών κάθε έργου. Έτσι, οι υβριδικές προσεγγίσεις που συνδυάζουν χαρακτηριστικά τόσο των παραδοσιακών όσο και των ευέλικτων προσεγγίσεων, επιτρέπουν στους οργανισμούς να προσδιορίζουν τις ανάγκες του έργου, ξεπερνώντας την πολυπλοκότητα και οδηγώντας στην επιτυχία του.

Λέξεις Κλειδιά: Project Management Methodology, Agile, Waterfall, Hybrid, IT Project, Digital Project, SAP Activate, Systematic Literature Review, Case Study

Abstract

The aim of the research is to gain a better understanding of how IT companies select and establish project management methodologies (PMM) and if the right methodology is linked to an improvement in the project performance and outcome, through a multi-criteria comparison between three different categories of PMM in terms of their importance in the overall successful outcome of a digital project, as well as the way project management methodologies support the collaborative project teams, and if this support corresponds in the theoretical expectations of each methodology, and eventually lead to a successful project outcome.

In order to fulfil the research goal, the research methodology in this thesis followed a systematic literature review (SLR) complemented with the contribution of a quantitative case study conducted via self-administered questionnaires, aiming to bridge the research gap on hybrid approaches, which emerged from the literature overview. The studied population of the quantitative research was consisted of consolut employees field practitioners, who have previously been included in projects managed with the hybrid methodology developed by consolut called Prisma.

The findings of the research, indicate technical and requirements complexity, cost in relation to budget constraints, time in relation to tight deadlines, degree of change management acceptance, team synthesis, risk handling, methodological provision for planning, flexibility, customer satisfaction and monitoring framework, as the main criteria which affect the projects and the methodology selection. The research results also highlight the importance of the project nature, assisting in the proper methodology selection, considering the uniqueness of each project needs. Thus, the custom based hybrid approaches combining characteristics of both traditional and agile approaches, enable organizations to identify the project needs and allocate them to certain methodology characteristics, overcoming complexity and leading to project success.

Keywords: Project Management Methodology, Agile, Waterfall, Hybrid, IT Project, Digital Project, SAP Activate, Systematic Literature Review, Case Study

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First, would like to thank my supervisor, Mr. Madas for the valuable guidance and the accurate and detailed feedback during every step of the writing process of this thesis, as well as the agility in the communication approach.

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Last and most importantly, I would like to thank my family and particularly my parents and mainly my sister, for being there for me and supporting me during this demanding period, my partner Grigoris, my fellow student in the MSc program of University of Macedonia Panagiota Dimitriadou, who supported me with her calmness and knowledge and also my friends, for their understanding and patience and who I might have neglected, due to the extensive hours I had to dedicate in writing this thesis.

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List of Abbreviations

PMI – Project Management Institute

PMM – Project Management Methodology

TPM – Traditional Project Management

SLR – Systematic Literature Review

IT – Information Technology

ASDM – Agile Software Development Methods

ERP – Enterprise Resource Planning

SAP – Systems, Applications & Products in Data Processing (ERP System)

CSF – Critical Success Factors

EO – Entrepreneurial Organization

ASAP – Accelerated SAP

SME – Small-Medium Enterprise

KSAIM – Knowledge Management System Agile Implementation Methodology

DT – Design Thinking

ARC – Audit Review Control

KPI – Key Performance Indicators

QUOROM – Quality Of Reporting Of Meta-analyses

PRISMA – Preferred Reporting Items for Systematic reviews and Meta-Analyses

SPSS – Statistical Package for the Social Sciences

1 Introduction

1.1 Project management – main challenges

According to the Project Management Institute (PMI): "project management is the application of knowledge, skills, tools and techniques to project activities to meet the project requirement" (PMBOK Guide 4th edition, PMI, 2008, p.443). An activity with significant relevance to the project management field is amongst others the project requirements identification, while handling the fragile project environment, so as to achieve a minimal to no affection of it (PMBOK Guide 4th edition, PMI, 2008). In this context, the project is defined as "a temporary endeavor undertaken to create a unique product, service or result" (PMBOK Guide 5th edition, PMI, 2008, p.442).

Project management needs to ensure that a project is supported in terms of trustworthiness and effectiveness as far as quality is concerned (Markopoulos et al., 2005). There are factors that can affect different aspects of a project, and in case any of them changes, the project balance might be affected (PMBOK Guide 4th edition, PMI, 2008). Thus, project management methodologies (PMMs) are utilized, in order to achieve this. PMI defines project management methodology, as: "set of methods, techniques, procedures, rules, templates, and best practices used on a project" (PMBOK Guide 4th edition, PMI, 2008).

The goal of the project management, and subsequently of the project management methodologies adoption, is to follow and combine certain processes, ensuring a successful project outcome and not just identifying and scheduling requirements. This situation can gain even more complexity, in regards to software project management, whose nature is vague and not substantial, thus the requirements identification might be more challenging (Markopoulos et al., 2005).

In this context, it is highly challenging to identify a way to achieve a successful project, when the main objectives affecting it are contradicting (Hu & He, 2014). More precisely time, cost and quality, as well as other constraints interfere with the project and challenge the project outcome, due to their interdependence and lack of valuable tools or capabilities (Hu & He, 2014). The quality of a project can be severely affected by criteria conflict when time and cost constraints are both present (Nowpada, 2011).

Although the project management methodologies have been accused of inducing costs in projects, either directly or due to delays, this is only true, if the selected

methodology is not appropriate for the specific case. Hence, the allocation of project management methodology, organizational type and project seems to be the most difficult, but at the same time the most important task and target in project management in general. (Markopoulos et al., 2005).

A plethora of project management methodologies (PMMs) have been designed and are still designed, which are used from project management practitioners across various sector, forming groups of approaches with similar characteristics. The key challenge for an organization, is to select the appropriate methodology and identify the reasons that lead to this decision.

1.2 Problem statement

An efficient and successful project management methodology selection is a vital decision for an organization, since some of the main factors that affect the success of a project depend on this decision. It is therefore crucial, to establish a decision regarding the project management methodology the organization will adopt for developing projects.

The decision that has to be taken, in terms of project management methodology adoption, is mainly the choice between traditional or agile approach and is a key decision for an organization, since it is associated with attributes like the cost and effort required, as well as possible risks. These factors, when not handled properly can affect the success of the project (Kononenko and Lutsenko, 2018).

It is also important to highlight that, beyond project efficiency, the success of a project relies on the stakeholders satisfaction, resulting in customer satisfaction which depends on the project outcome (Serrador and Turner, 2015). Thus, the project management methodology to be adopted, has to be more than guidelines for completing the project within time and budget, but instead a tool that can influence other parameters, ensuring that wider success measures are achieved (Turner and Zolin, 2012, Serrador and Turner, 2015).

The PMM selection is considered a decision of high importance when it comes to project success, but unfortunately the choice is not always right, thus it does not always lead in a project performance improvement or customer satisfaction. And this defines the **problem statement** of this master thesis.

1.3 Research Objectives and Questions

The aim of this master thesis is to gain a better understanding of how companies select and establish PMMs and if the right PMM is linked to an improvement in the project performance and outcome, as far as digital projects are concerned. This research has three objectives:

- **Objective 1:** Understand how project management strategy is selected based on the existing PMMs.
- **Objective 2:** Investigate how specific attributes, like the skills in existing teams, risks and project's complexity, affect the selection of a project management methodology.
- **Objective 3:** Explore the impact of a hybrid PMM, consolut Prisma, to the success of projects performed by consolut, a company specialized in SAP consulting.

To address the three objectives of the research, seven research questions (RQ) were identified to be examined during the systematic literature review and the case study analysis based on questionnaires to *consolut* employees. The questions relevant to the first and second objectives are answered through the systematic literature review, while the questions relevant to the third objective are answered through the empirical questionnaire based case study analysis, as appears in the following table.

Table 1.1 Research Questions

Objectives	Research Questions (RQ)	RQ Answer
1	1. How is the situation diagnosed of whether to follow a specific PMM (e.g. Waterfall, Agile) or a Hybrid, custom specific approach?	SLR
2	2. How do skills on existing teams relate to PMMs? 3. How do risks and project complexity handling relate to PMMs?	SLR
3	4. Is the business organizational structure related to the level of authority in the primary project roles? 5. Are factors like the business experience and business role influencing the way project members evaluate the adopted PMM? 6. Is the adopted PMM handling project complexity efficiently and how this relates with the project success? 7. Are the perceived benefits of the adopted PMM contributing to successful project outcomes?	Empirical Survey

1.4 Contribution

This thesis, is aiming to a synthesis of multi-criteria comparison between three different project management methodologies in terms of their importance in the overall successful outcome of a digital project, as well as the way project management methodologies support the collaborative project teams, and if this support corresponds in the theoretical expectations of each methodology.

The methodologies studied, are:

- Waterfall Project Management Methodology, a Traditional Project Management (TPM) Methodology
- Agile Project Management Methodology
- Hybrid Methodology, both from theoretical and practical perspective, through the case of "consolut Prisma" developed by the SAP consulting company consolut, in order to facilitate SAP implementation projects.

The master thesis topic covers a broad field of research and contributes both from the systematic literature review perspective, but also from the questionnaire based survey in the case study, that is conducted for consolut Prisma hybrid methodology, among consolut employees professionals of the sector. The analysis of the literature carried out, could be a source of motivation, for other researchers, as well as a guide or framework on how to manage literature and data as research publications and sources.

Last but important as well, this master thesis could assist the industry professionals in identifying existing problems and gradually overcoming them, by expanding the adoption of different project management methodologies, suitable for IT, software development or ERP implementation projects and ensuring the best possible outcome, by utilizing the most useful characteristics and tools of each method.

1.5 Overall Methodology

This thesis utilizes a combination of qualitative and quantitative research methodologies, aiming to successfully add value on the studied field, regarding project management and the selection of project management methodologies in digital projects. For this reason, both a systematic literature review and a case study were orchestrated.

In more detail, in terms of methodology, in the first introductory chapter the identification of the research area, the problem definition and thus the research objectives and contribution are being set.

In the second chapter the theoretical background of the research areas is analyzed, in order to set the ground for the third chapter, where the systematic literature review is conducted. In this chapter the systematic literature review scope is defined, the methodology selection and research process model is justified, and the literature is accordingly handled, with the use of tools like the Scopus database for the literature research and filtering, as well as the Excel spreadsheets, which were utilized to assist in the execution of concept-based filtering of the sources, leading to the eventually 45 selected sources for the literature discussion and review.

Research gaps identified, lead to the need for an alternative methodology to further investigate on the research area. This was succeeded in the fourth chapter, with the consolut hybrid methodology case study, conducted with the use of quantitative methodology and particularly through a self-administered questionnaire based survey. In this chapter the research instrument -questionnaire with closed type questions- was established, followed by respondents and business profiling of the sample and last by the results analysis with the use of statistical analysis tools, in order to lead to useful conclusions.

Last, in the fifth chapter the overall research conclusions are presented, as well as the total research implications, objectives fulfillment from both methodologies and future research suggestions.

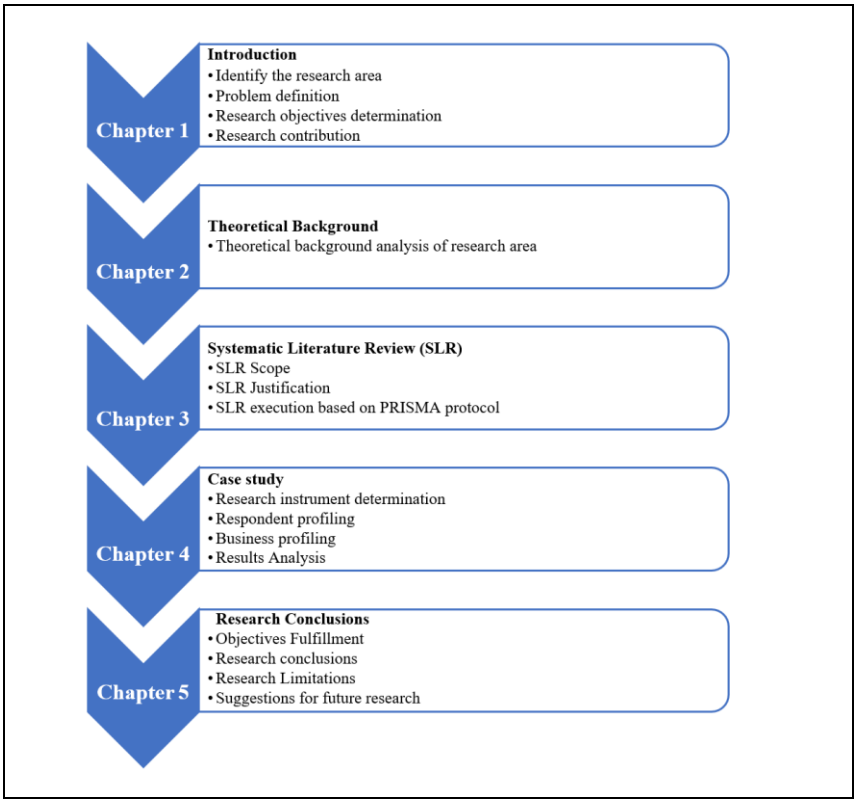

Figure 1.1 Methodology steps per chapter

1.6 Thesis Overview

This master thesis is structured in five chapters. The goal of this thesis is to adequately answer the previously stated research questions in the context of the research objectives in the field of project management methodology or indicate research gaps for further research. This will be orchestrated by the use of systematic literature review (SLR), for utilizing the existing literature appropriately and through a case study with a questionnaire based survey. Table 2 illustrates the approach adopted in relation to the problem statement formulation and research objectives to be addressed by this thesis.

The first chapter introduces the research field. It starts with the basic framework of the project management methodology challenges and presents the definition of the problem, research questions and master thesis' contribution to this field through the systematic literature review (theoretical part) and the *consolut* case study (practical part), as well as the structure of the thesis.

In the second chapter the theoretical background for the project management methodologies, traditional, agile, as well as hybrid methodologies are presented. Also, key information about PMI proposed methodology are included in this chapter.

The third chapter focuses on the application of systematic literature review methodology as the core research framework. By choosing the specific concept of PRISMA, a search is conducted to select articles and review them according to the main concept, highlighting the impact PRISMA protocol has on the research output and its relation to the objective of this master thesis. Then the research process, the overview and results of the systematic literature review are described in detail, which include the inclusion and exclusion criteria, synthesis, description and analysis of the theoretical output of the methodology. Last, the research results interpretation is presented.

Chapter four presents the consolut case study with the form of an empirical survey executed with questionnaires. It defines the methodology approach and the tools used to accomplish the research and the results analysis, aiming to produce valuable results.

The master thesis ends with the conclusions of the research in chapter five, both for the theoretical part and for the conclusions extracted from the questionnaire-based survey in consolut. It also includes the analysis of the research objectives fulfillment, as well as the research implications and suggestions for further research, deriving from existing literature gaps or research constraints.

In conclusion, the Survey Design is the following:

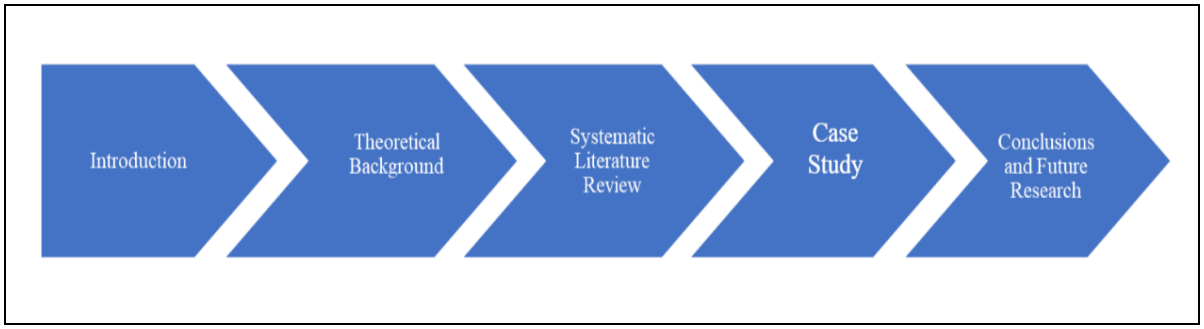

Figure 1.2 Survey Design

Table 1.2 Thesis Structure

Thesis Structure	
Chapter 1st	**Introduction** • Overview of the research context • Objectives and justification of the Thesis

Chapter 2nd	**Theoretical Background**
	• Theoretical background of PMM
	  ○ Waterfall methodology
	  ○ Agile methodology
	  ○ Hybrid methodology

Chapter 3rd	**Systematic Literature Review based on PRISMA** • Establishment of Literature Selection Criteria • Formulation of Search with Keywords/Phrases • Search Process • Results Discussion
Chapter 4th	**Case Study** • Research methodology • Questionnaire formulation aligned to the objectives of analysis • Participants profiling • Statistical analysis • Presentation of results
Chapter 5th	**Conclusions** • Analysis of research objectives fulfillment • Research conclusions • Research Limitations • Future research suggestions

2 Theoretical Background

In this chapter the theoretical and contextual background of PMMs according to the existing literature will be described.

2.1 Project Management Methodologies

The PMM relates to project success, highlighting that if a PMM is not complete, the quality of the relevant project will be affected, leading in deviation from the desired project success (Joslin et al., 2015). The perception that project success and project management success is the same, is mistaken. Although these two concepts relate, project success involves project management success with the form of efficiency as well as the project outcome with the form of effectiveness and impact (Serrador and Turner, 2015, Joslin et al., 2015, Judgev et al., 2001, Shenhar et al., 1997). The project success criteria are measurable and they are known in the literature as “the iron triangle”, including cost, time and quality (Joslin et al., 2015). In similar context, the “triangle of objectives” introduced by Dr. Martin Barnes, illustrates the relationship between cost, time and quality, highlighting the importance of management decisions in project management, since emphasizing on one objective might contradict with the progress of another (Lock, 2007).

According to Lock (2007) the way project managers handle the three key objectives representing the main factors for failure or success of a project, regarding cost, time and quality or performance, is the basis on which project managers and their work is usually evaluated. It is also essential for the project management to have the capability of identifying not only the key objectives, but also their association and the dynamics between them.

In similar context, highlighting the negative correlation between time, cost and quality, Hu & He (2014) suggest an optimization model of those three parameters, aiming to assist in critical relevant decisions. The negative interrelation of time, cost and quality can induce uncertainties, lead in criteria conflict in a project (Nowpada et al., 2011), since it is evident that in case of increased equipment or human resources needs, the cost is increased due to increased working hours or equipment functionalities requirements.

At the same time, a project with less human resources or equipment, might require more time to time to be completed, leading in more working hours and increased costs. Thus, the cost objective, for instance, needs to be examined in terms of ability to finish within budget the work planned, in order to avoid profit loss regarding the allocated human resources (Lock, 2007). Although, not only these three variables affect the success of projects (Attkinson, 1999). Many more criteria and metrics have been identified in the literature since then, as for instance the satisfaction of stakeholders and customers from the project outcome (Serrador and Turner, 2015).

The PMI methodology

The Project Management Institute (PMI) in the USA published for the first time the original Project Management Body Of Knowledge (PMBOK) and launched the certification of project management professionals in the 1980s. PMI's flagship text is the PMBOK Guide (Jamali and Oveisi, 2016). The first PMBOK was published in 1987 and PMI revised by publishing the PMBOK Guide in 1996, publishing again new editions in 2000, 2004 and 2008. In frequent periods, PMI publishes updated versions. The latest was published in 2021. In the sixth edition of PMBOK Guide which was published in 2017, it is the first time "agile" content is incorporated into the text and not just referenced in examples (PMBOK Guide, 2021).

It is evident, that the PMI disciplines have evolved from the 1st PMBOK Guide edition (1987) until the 7th PMBOK Guide edition (2021), but the core project management elements are still included in the fundamentals of the PMI strategy, which amongst others include project team, participants and stakeholders, as well as project life cycle.

- Project Life Cycle

Project Life Cycle is "the series of phases that a project passes through from its initiation to its closure" (PMBOK Guide 5th edition, PMI, 2008, p.554). The uniqueness of each project leads to a certain degree of risk. In order to quantify and track the progress during a project, the majority, if not all, of the project management methodologies, divide the project lifecycle in phases. The logic behind this division, is as explained, to effectively monitor the development in each phase. The sequence of the

phases execution depends on the methodology and the methodological approach, which are going to be explained next.

The phases of the project lifecycle are in general four. These phases are the Introduction, Growth, Maturity and Decline/Retirement illustrated in detail, in Figure 2 (PMBOK 7th edition, 2021).

It is important to outline, that during the lifecycle, a project may be subject to change and the project team should adopt accordingly. The project team should continuously evaluate the progress of the project and guide towards the intended outcome, while ensuring that the project remains aligned to the business needs (PMBOK Guide, 7th Edition, 2021).

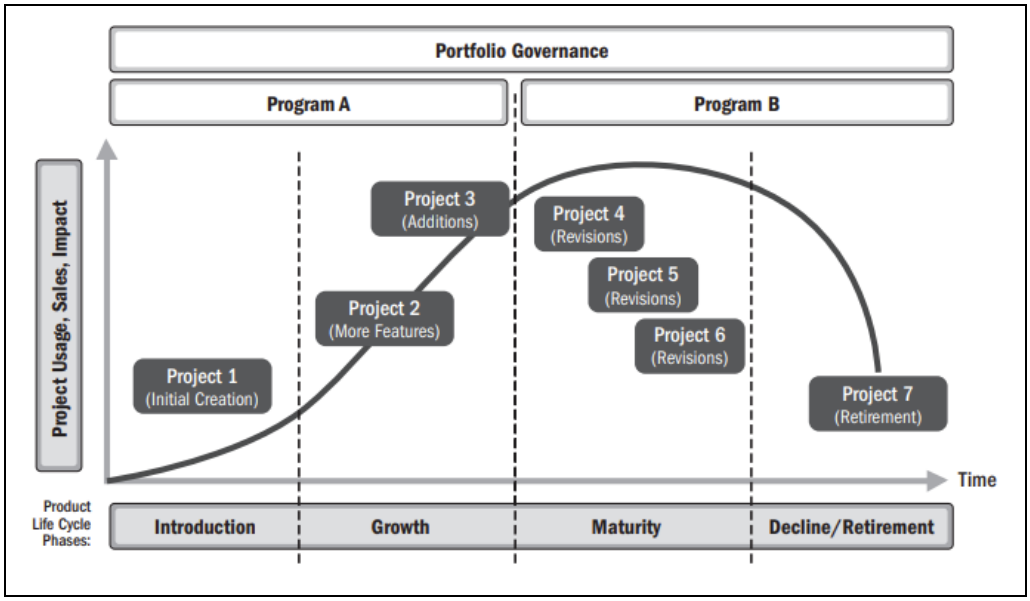

Figure 2.1 Sample Product Life Cycle (PMBOK Guide, 2021)

- Project Stakeholders

Stakeholder according to PMI is: “an individual, group, or organization who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project” (PMBOK Guide 5th edition, PMI, 2008, p.554). Stakeholders as an entity can entail both people and organizations, directly or indirectly affected by a project. According to PMI (PMBOK 7th edition, 2021) examples of project stakeholders can be the project manager alongside with the project team and the project management team suppliers, customers and end users.

The proposed stakeholder engagement plan, is a component of the project management plan, highlighting the framework according to which the stakeholder involvement in the project is handled, and initiate either before or at the beginning of the project, and carry on throughout the project life cycle (PMBOK 7th edition, 2021).

Stakeholders can influence the project and different sides of it in various ways, as for instance, they can influence the scope, schedule, project plan and team by suggesting a new functionality or by withdrawing a requirement. Last, it is important to highlight, that relatively late in the project management research, the stakeholder satisfaction was identified as a measurable indicator of project success (Serrador and Turner, 2015).

- Collaborative Project Team

Project teams consist of participants of all the sides involved in the project, who own diverse skillset regarding knowledge and experience, leading to a tendency to accomplish more through collaboration. Within a collaborative project team environment, an "own" culture can be established, which while aiming the team's main target, which is the optimal contribution to deliver the desired outcome, facilitates individual's and team's learning and development, as well as alignment with guidelines and organizational culture (PMBOK Guide, 2021).

- PMI Strategy Evolution

A significant attribute that has evolved in the PMI strategy, is that so far it was structured according to business processes. These processes could formulate stable principles, which could be documented, analyzed, evaluated and thus combat risks and boost efficiency. Although, the processes descriptive characteristics, could possibly not ensure the full value delivery landscape in the rapidly developing project management sector. Therefore, the new concept shifts towards a more principles-based approach, aiming to highlight the importance of outcomes, which contributes in delivering more value to the organization and the stakeholders than deliverables, while at the same time incorporating support to effective project management strategies.

According to 7th PMBOK (2021), the PMI Code of Ethics and Professional Conduct, is based on four values, identified as vital amongst the project management community, which are responsibility, respect, fairness, and honesty.

The 12 principles of project management align to the values of the PMI Code of Ethics and Professional Conduct. Facilitating a list of principles, required the collaboration of project practitioners from different industries, cultural backgrounds, organizations and organizational roles, in order to introduce the guidelines for project management efficiency.

- Project Management Principles

The principles statement encapsulates commonly shared aspirations in the project management field. It provides guidelines for the project teams and stakeholders involved, without obligation to follow a strict plan, but remaining aligned in a broad spectrum of principles. Since they have a guidance role, the degree of adoption depends on circumstances and factors relevant to each project. Although there is no conflict among the principles, overlapping is possible, and not only among them. Overlapping is also possible with the general management principles, since both focus on value delivery.

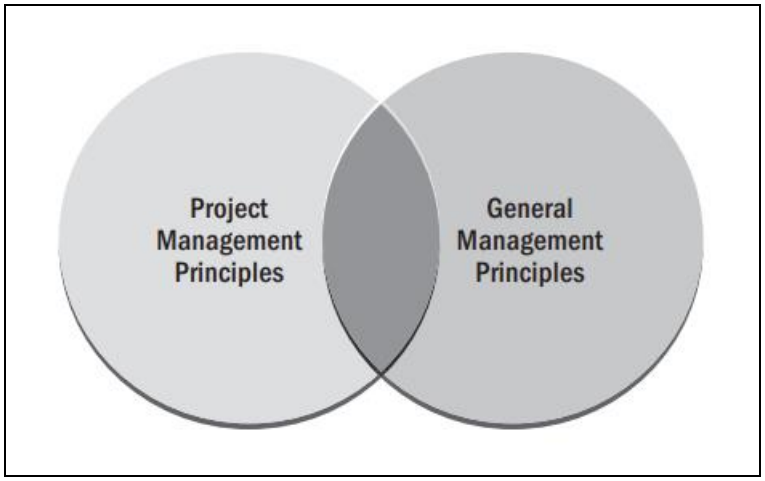

Figure 2.2 Overlap of Project Management and General Management Principles (PMBOK Guide, 2021)

The 12 principle labels, according to PMI (PMBOK Guide, 7th edition, 2021), in random order of significance are:

• Stewardship: Be a diligent, respectful, and caring steward, including responsible and trustworthy compliance with internal and external guidelines, relevant to sustainable awareness in social, financial and technical terms.

• Team: Create project team environment based on collaboration of individuals with diverse backgrounds, aiming to efficiently facilitate the desired outcome delivery.

• Stakeholders: Effectively engage with stakeholders for contributing in the value delivery and influencing the performance during the project.

• Value: Focus on value through constant evaluation and adjustment aiming to maximize the expected outcome's value.

• Systems Thinking: Recognize and evaluate the project as a system of interdependent interaction and respond to the interactions ensuing that their impact allows the project teams to leverage positive outcomes.

• Leadership: Demonstrate leadership behaviors through supporting not only the team but also individual needs based on ethical values and contributing in the positive outcome.

• Tailoring: The project development approach should be based on the context of each unique project and the project success depends on that. Thus, the desired outcomes are only produced by determination of an adaptable project methodology throughout the project.

• Quality: Ensure quality into processes and deliverables that assist in alignment with project needs and objectives, by fulfilling requirements and stakeholders' anticipations.

• Complexity: Project teams should identify possible complexity during the project lifecycle and effectively respond by reducing it's impact.

• Risk: Continuous evaluation of the possible opportunities and threats and optimization of risk responses for ensuring positive impacts in the project and the outcome.

• Adaptability and Resiliency: By embracing them in the team's approach, the response to evolving conditions, absorption of impacts and quick recoveries from drawbacks advances the project work.

• Change: Enable change to achieve the envisioned future state by maintaining a structured approach oriented in change, assisting individuals and groups involved in the transition from the current condition to the target future condition.

The PM² methodology

PM² is an open project management methodology developed by the European Commission. Its purpose is to support project teams in handling projects in an effective way and deliver solutions and benefits to stakeholders and to their organizations (CoEPM², 2021). This provides PM² with higher rates of successful projects. This methodology has been formed according to the needs of European Union Institutions and the respective institutional projects, but is applicable to projects in any organization, since it is a light and easy-to-implement methodology, enabling project teams to tailor according to any custom needs.

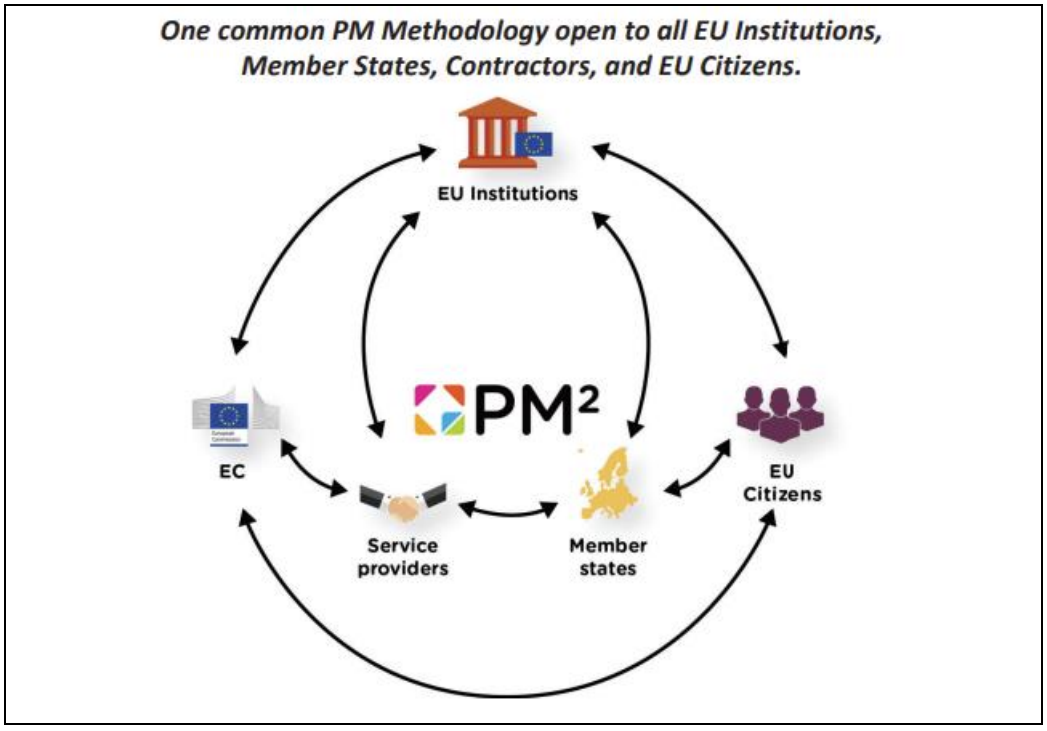

Figure 2.3 Open PM² Synergies (pm², 2021)

The PM² methodology is based on following project governance model, which is a set of processes during the project lifecycle that enables producing a set of standard project management documents (Ribeiro-Lopes et al., 2022). The project phases of the PM² are based on the same concept as the PMI methodologies. Thus, the Project Life Cycle in PM² is divided in four phases, The Project Life Cycle in PM² is divided in four phases, Introduction, Growth, Maturity and Decline/Retirement. The activities of a particular phase may overlap with activities of other phases.

Software Development Lifecycle Models

The above two methodologies from PMI, which had set the milestones for project management field development, as well as the PM² from the European Commission, incorporate a set of guidelines and principles that can and should be followed in project management sector, relevant for diverse industries and types of projects. It also needs to be clarified, that the traditional, agile and hybrid approaches are not only used in software development projects. Depending on the method, they can add value on projects in various industries, as for instance: in the construction of a building and many more. It is evident though, that in the context of this thesis, those methodologies are approached from digital projects perspective, thus the impact they have on the software development lifecycle and systems development lifecycle encompassing software development, (Nayan, 2010) is being examined.

Furthermore, according to Nayan (2010), the innovation of models in systems development lifecycle projects, derives from software development projects, even though the first includes the latter. Also, it is nessesary to point out the difference between methodology and model. The methodology describes the perspective according to which actions should be performed, whereas the model describes the actions that are required to be performed. So a model is descriptive whilst a methodology is prescriptive (Nayan, 2010).

In addition to that, Gemino et al. (2021), stresses out the difference between the terms approach, methodology and practice. In more detail, according to Gemino et al. (2021) and several other researchers (Boehm and Turner, 2003; PMI (2017); Reich et al., 2013) project management approach refers to an abstract term to describe the high level design and management of a project including the characteristics and principles it complies with. The methodology term, as previously stated is a: “set of methods, techniques, procedures, rules, templates, and best practices used on a project” (PMBOK Guide 4th edition, PMI, 2008). Methodology is according to Gemino et al. (2021) includes practices, which are defined as “techniques or procedures used to manage an aspect of methodology within a project”.

Last, the categorization of the models consists of three main categories, is described below:

- Linear model, which is described by sequential permanent succession of stages after their completion
- Iterative model, where all the stages are considered potentially revisited in the future by incorporating a concept of constant improvement throughout the project's lifecycle
- Combined model, which is a combination of a linear and iterative model, where it is accepted that the iterative approach can be discontinued at a particular stage.

The categories depend on the sequence and succession of the phases during the project lifecycle.

In general, according to Nayan (2010), the linear models tend to affiliate more to projects that are providing software that is either providing back-end functionality, usually as a service to other applications or software that provides service to an end-used or end-application, while on the contrary, the iterative models tend to be more suitable to software that provides visual interface to end users, which is typically used for a graphical user interface front-end application.

2.2 Traditional Project Management Approach

The traditional approach key characteristics are the linearity and predictability which identify it, in terms of project planning and executing (Gemino et al., 2021). Extensive planning and optimization in order to ensure success, by completing the project within the time, budget and scope agreed, is the key goal for the TPM approach (Špundak 2014, DeCarlo, 2004, Shenhar and Dvir, 2007, Gemino et al., 2021). This approach was one of the first chronologically and a plethora of projects were handled based on guidelines of TPM approach for decades (Larman and Basili, 2003, Gemino et al., 2021). The traditional project management approach is usually referred to as Waterfall Methodology.

Waterfall Methodology

The waterfall project management methodology, or Top-Down approach is considered a linear sequential lifecycle model (Jamous et al.,2021). The predecessor of the waterfall is called cascade model and was developed by Benington in 1956 (Benington, 1956, Nayan, 2010), but the waterfall approach as known today, was first

proposed in 1970 by Dr. Winston W. Royce (Royce,1970). Initially, stages should not overlap, and each phase should be completed before the next step starts (Royce,1970).

The waterfall approach considers that project lifecycle is precisely divided into successive phases. Overlapping and revisions between phases were initially, on theoretical level, reluctantly possible, usually allowing feedback between sequential steps.

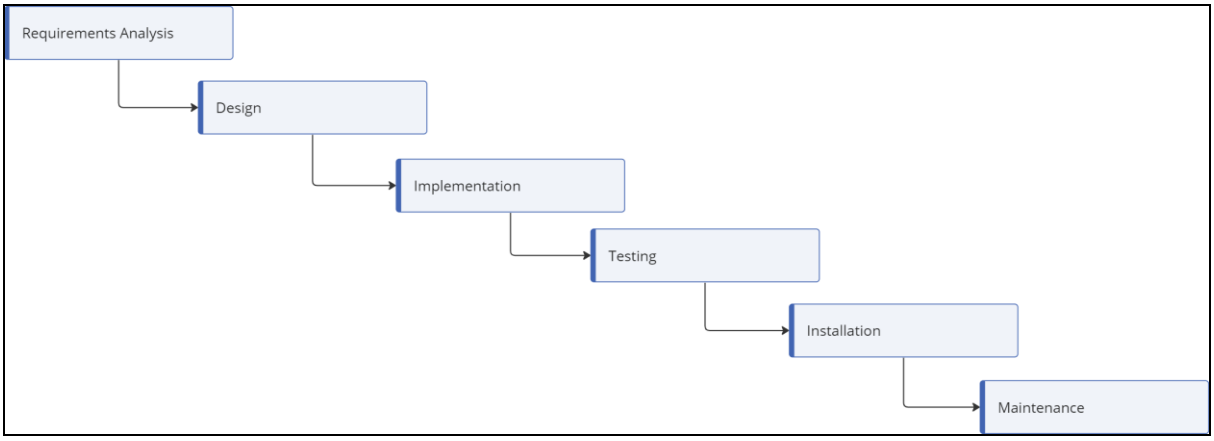

Figure 2.4 Waterfall PMM phases (Bhavsar, 2016)

Royce (1970) identified that it was possible to face difficulties when waiting for each phase to be complete, hence he enhanced the model by providing a feedback loop, so that each stage can be revisited. This concept was further enhanced by providing a more complex feedback loop, as appears in the following figure, while at the same time enabling it to bypass specific stages, if the testing was justifying such need (Nayan, 2010). This enhancement led to possibly return to the requirements phase when ambiguities occur in the design phase, or return to the Desing phase, in case required changes are located in the Validation phase.

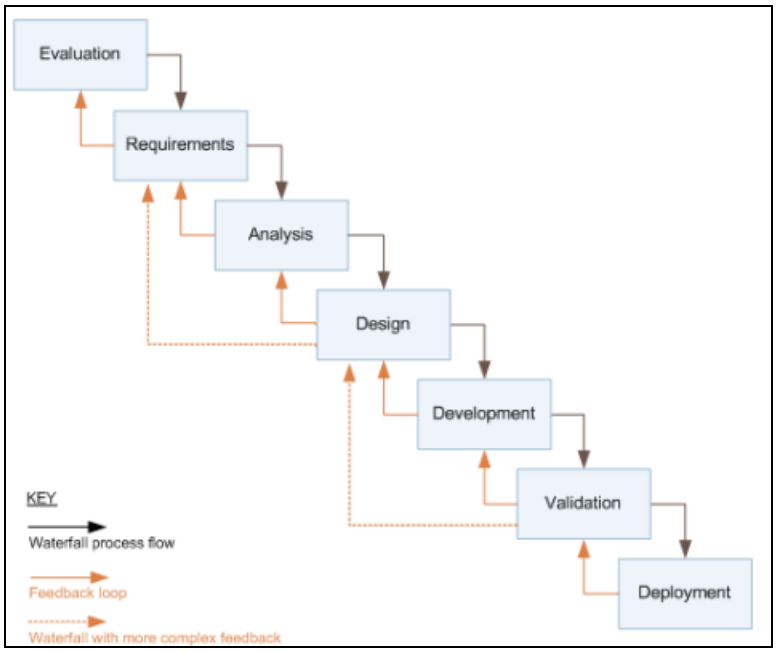

Figure 2.5 Waterfall model with Royce's iterative feedback (Nayan, 2010)

It is in general based on a step by step creation approach, emphasizing on the planning and on the planning maintenance, since duration and budget are strictly predefined. Control monitoring is strict throughout the project, orchestrated with the use of detailed documentation and reviews.

The requirements analysis and design are very important in this approach. From many it is accused as a non-flexible method in terms of requirements handling, considering the fact that the project lifecycle design in waterfall, requires precise identification of the project requirements and proposed solution design, with a clear and well defined goal to be succeeded at the end of the project from early in the initiation phase (Lei et al.,2017).

It is evident, that the Waterfall methodology approaches the project management practice, as if the project team is accurately informed about the requirements and needs from very early in the project lifecycle, with only goal to fulfill them, thus changes in requirements are preferred to be avoided (Lei et al., 2015) The waterfall approach is focused on quality, aiming with the linear execution of the phases and requirements establishment, to ensure efficiency. Although, the methodology imposes disadvantages due to the requirements definition, since the early establishment might cause uncertainty.

The waterfall model was further enhanced in 1988 by Birrel and Ould. The b-model they devised and discussed about, was an extension and attachment to the

waterfall model of the operational life-cycle of the waterfall model, aiming to ensure the development stages of the software or the system consider as integral part the constant improvement of the software or the system, as well as it could evolve as part of the development stages (Nayan, 2010).

Consequently, the b-model could be considered as a waterfall approach modification, by enhancing a spiral model within the waterfall approach, suiting appropriately to the same kind of projects waterfall methodology does, as software development projects, which provide service to other application, as for instance back-end functionality software development projects. Last, Birrel and Ould suggested that there should be provision for possible as spin-offs of the initial system, so that further enhancements of future obsolete systems can be possible in the future.

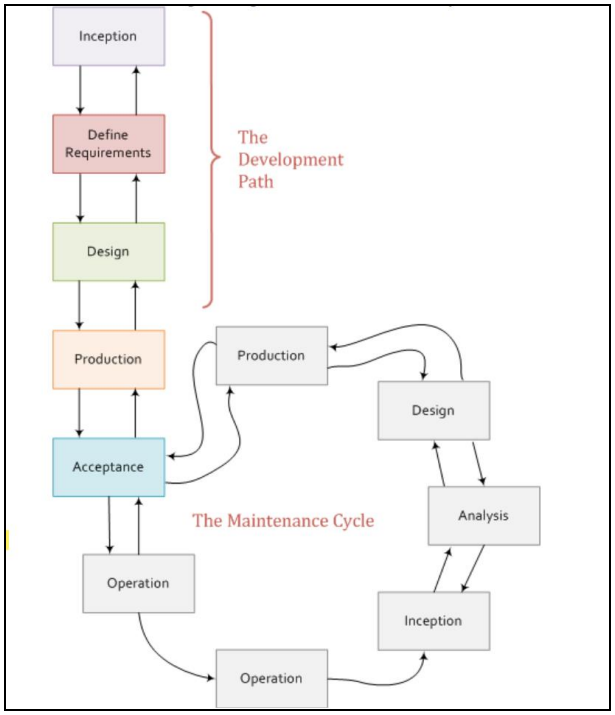

Figure 2.6 The b-model extends waterfall model by Birrel and Ould in 1988 (Nayan, 2010)

In the following years, further variations of the waterfall model were discussed and presented in this field. These include the V-model, which was developed by NASA and first presented in 1991 in NCOSE symposium in Tennessee (Forsberg et al., 1991), that depicts the waterfall model in V shape. The left part of the V represents the user requirements evolution, aiming to downsize them as part of the definition process and the

right part of the V representing the integration of the system components into successive levels of implementation (Nayan, 2010). The structure of the model indicates that the deeper the V, the more complex the system, since there is a larger number of stages representing the decomposition levels. The V-model can also be further enhanced as a three dimensional model, containing a z-axis relevant to components with a multiple deliveries association. A significant strength of the V-model is that it can be successfully used in vary large scale projects, due to the decomposition of each stage and the participants involvement (Nayan, 2010).

A variation of the V-model can be the vee+ model, which includes attributes like user involvement, risks and opportunities in the previously mentioned z-axis of the V-model, as well as the vee++ model, which further enhances the vee+ model with crossover processes, with a decomposition analysis and resolution process in the left side and with a verification analysis and decomposition process added to the right side of the V (Nayan, 2010).

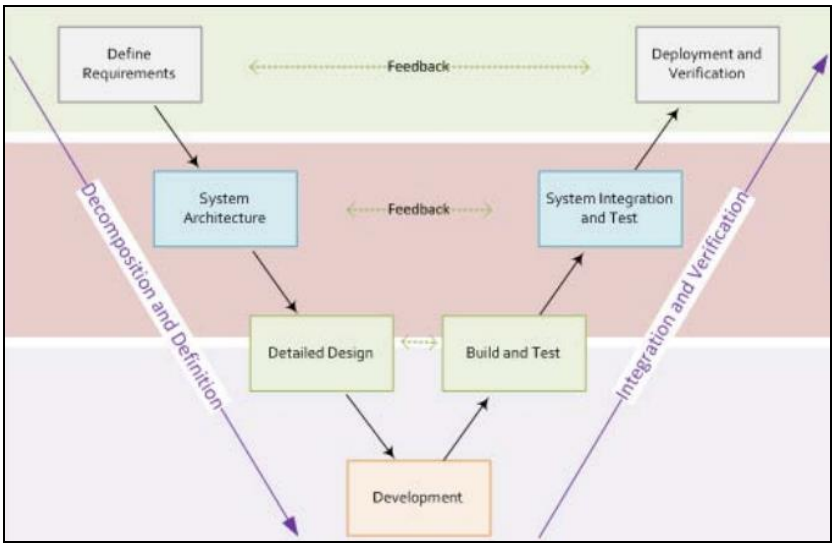

Figure 2.7 The V-model (Nayan, 2010)

2.3 Agile Project Management Approach

According to Fernandez and Fernandez (2008), the PMI Institute, highlighted the need of a more "decentralized" project management approach in 2005, only a few years after the release of the Agile Manifesto in 2001. The agile approach introduced through the manifesto, aims to highlight the importance of project collaborative team but also

the flexibility needed in order to achieve feasibility in a project, where complex or uncertain circumstances require this (Fernandez and Fernandez, 2008).

The Agile Manifesto, was introduced from 17 methodologists who identified the similarities in their method proposals, forming them under the “agile” spectrum, which as term derives from the “combination of light and efficient” (Awad, 2005). The Agile Manifesto follows 12 principles, which as appeared in the official website, are the following:

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

In a more compact form, the principles can be summarized in four key points (Darrin and Devereux, 2017): “Individuals and interactions over process and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, responding to change over following a plan”. It is evident, that the principles do not comply with the TPM approach, and although the agile approach might

seem undisciplined, incorporates a fixed set of principles to be followed, which in fact can be valuable when applied to agile systems engineering projects (Darrin and Devereux, 2017).

Opposing to the waterfall approach, which percepts reworking on deliverables or changes in requirements as the main cost contributor of a project, the agile approach identifies failure in terms of quality or deliverables as the key attribute influencing the cost of a project, since change is perceived as something that is expected and is manageable due to the agile approach structure (Karlesky, 2008). Further than this, the agile practices entail characteristics that identify the majority of the agile methodologies, as for instance the development iterations, enabling the project members to split a large project or task in smaller ones. The iteration concept resembles to the traditional approach linear phases, but instead the iterations can include similar tasks or activities, in case of nessesary changes, identified from metrics that could assist in effort estimations reconsideration due to the changes (Karlesky, 2008). Last, another innovation of the agile approach is the recognition of the human factor as a vital attribute for projects, and subsequently for project success, as individuals but mainly as components to the agile project team (Highsmith and Cockburn, 2001), especially considering the skillset of the team members (Awad, 2005).

The Agile approaches have shifted the software development projects, since the iterative approach of the agile methodology, facilitates an environment where, the end-user is more involved, the software product deliveries are more frequent and changes are not considered a drawback (Dingsoeyr et al. 2012). Challenging environments lead the focus of researchers and industry specialists in agile software development methods (ASDMs).

Further, a demonstration of indicative Agile methods is being presented, including predecessors of the currently well known agile approach, as well as the most frequently used agile methodologies.

- Rapid Application Development

Rapid Application Development (RAD) model could be considered a predecessor of agile approach. RAD was developed in 1991 by James Martin and it is considered a methodology for iterative development targeting to speed up the software development process, whose core mechanism is prototype. This approach promotes collaboration by

ensuring that stakeholders participate actively in the project lifecycle development and that decisions are not centralized.

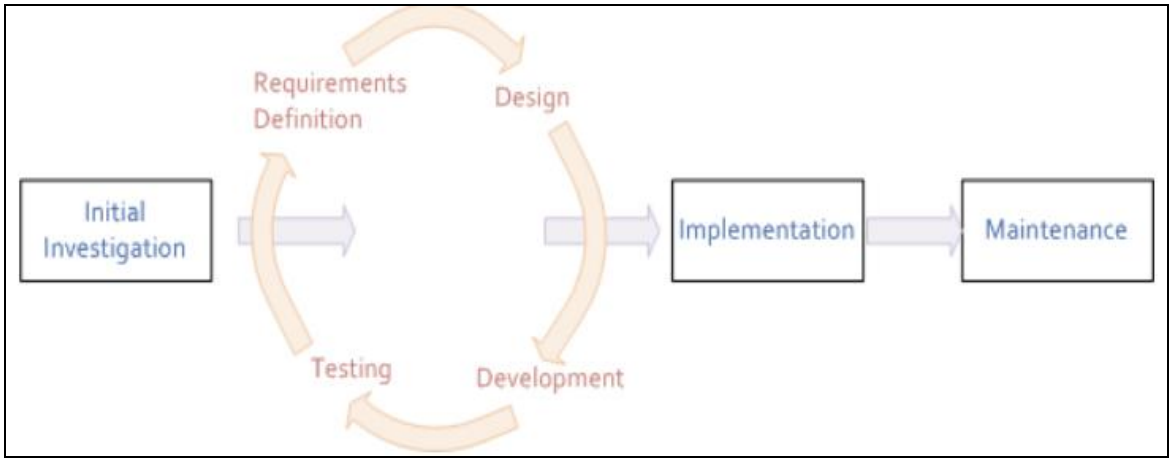

Figure 2.8 Rapid Application Development Methodology (Nayan, 2010)

In similar context, it is worth mentioning that agile methodologies are basically including agile practices, metrics for measurements and decisions. The various agile methods, consist amongst others of Agile Unified Process (AUP), Extreme Programming (XP), Lean Development (LD), Kanban and Scrum. Based on the survey by PMI Pulse of the Profession, XP, Lean and Scrum are the most famous agile approaches, with Scrum to be the most widely used of the three.

Table 2.1 Agile Methods most used in organizations (PMI, 2017)

Agile Method	PMI Pulse of the Profession
Lean	67%
Scrum	55%
XP	42%

For this reason, a brief description of the most used agile methodologies will follow.

- Extreme Programming (XP) methodology

It is the oldest wide-spread agile software development methodology, launched by Kent Beck. This incremental methodology does not include an initial design phase, although this could lead to cost increase, if new incompatible requirements occur in next phases. It is guided by user-driven requirements and functionality, assisted by a business "champion" with the role of conduit (Nayan, 2010). Aiming to minimize the costs mentioned, the lifecycle includes practices like tight feedback loops and small releases. These small spiral steps are included in the lifecycle for considering extra new requirements. Last, the development is based on pair programming. This technique portrays a significant role in the attempt to increase the quality of code and the productivity, as well as to train workforce, since in this case the programmers share the screen and keyboard, with the one being in the "driver" who is typing and the other in the supervisor role, called "navigator" and switching roles periodically (Hofmann et al., 2018).

- Lean Development (LD)

This approach aims in delivering a project early with a minimal functionality. The concept, according to Nayan (2010), that can accurately describe where the LD is based on, is "80% today is better than 100% tomorrow".

- Kanban

Kanban is a lean production technique devised from the Toyota Production System, adapted to software engineering in the late 2000s (Poppendieck, 2003). It is is focused on limiting the development work in progress by visualizing the development aiming to lead in time reduction. The concept on which Kanban is based, is "start with what you have". The Kanban board enables the visualization of the whole workflow and facilitates collaboration amongst multiple teams and individuals, while encouraging the adoption of characteristics from XP or Scrum.

- Scrum

It is an agile method that emphasizes to the management of software development projects. The Scrum method (Beck et al., 2002) assumes that software development is a complex and unpredictable process and therefore simulates it as a "black box" rather than

a well-defined process. Key features of the approach are: small teams, flexible schedules, frequent checkpoints, good collaboration, and others.

Scrum was created to address both the problems caused by changes in requirements, and those arising from risks in software projects. It was first mentioned as a new approach in product development in a Harvard Business Review study in 1986 has increasingly become one of the most used methods in Agile methodology. According to Rodriguez (2019) Scrum consists of events and artifacts, composing the structure of the methodology, incorporating the key points of agile methodology theoretical background regarding communication, flexibility and frequent checks.

Table 2.2 Events of Scrum (Rodriguez, 2019)

Scrum Events Description	
Sprint	The increment in which the development process is splitted.
Sprint planning	The meeting before each sprint to plan and organize the deliverables of the following sprint.
Daily Scrum Meeting	Daily brief meeting of Scrum team to plan the day.
Sprint Review	Inspection of the work done within the sprint.
Sprint Retrospective	Scrum team meeting to access the way of working.

The events are complemented by the scrum key artifacts, which are:

- The sprint backlog, a list with the work which is planned for the sprint
- The product backlog, which contains the work plan for the next product release
- The increment which summarizes the outcome of each sprint, including all the tasks completed during the sprint.

The way the events and artifacts are formulating Scrum methodology is depicted in the figure below.

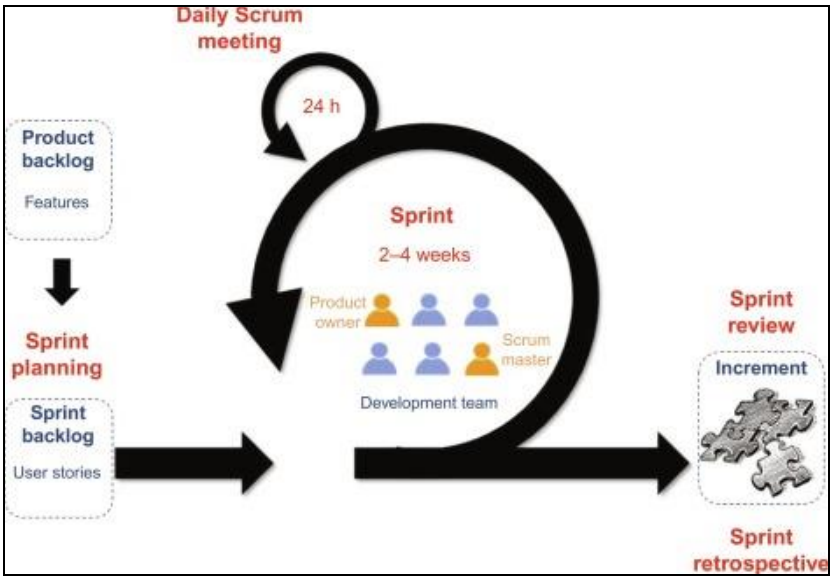

Figure 2.9 The Scrum process (Rodriguez, 2019)

Larger companies show a tendency to follow defined development methodologies to ensure quality during the development process. The choice of methodology often depends on whether they fit on the system itself to be developed. Thus the development team is severely constrained as to which methods are appropriate, which may affect the development time. A software development team tries not to stray from the schedule in order to deliver the software on time, as well as having to meet al.l product requirements. Finding a way to develop a quality product is a challenge (Beck et al., 2002).

Agile methodologies have emerged to complement all these requirements of modern companies. They contribute to the timely delivery of a system to the customer and respond more directly to changes to the broader environment and variations in system requirements and specifications. In addition, agile methodologies make it possible to avoid unnecessary processes which burden the project, either financially or in terms of time, increasing at the same time productivity. These qualities of agile practices, made them particularly popular in the software development cycle gaining the attention of the software industry (Beck et al., 2002).

2.4 Hybrid Project Management Approach

The increased tendency for digitalization, leads organizations to incorporate software solutions for business purposes. The implementation of these solutions, requires a framework that can facilitate successful results, in other words a stable and reliable

methodology to be followed during these projects. The increased needs, as well as the fact that the existing approaches in the project management industry might fail responding to specific project constraints, lead to the conclusion that the need for new methodologies emerges.

Project management of IT projects is rapidly turning into a complex and multidimensional process. Complexity is meant to be associated with the use of specialized software tools, teams' management and handling of continuous implementation changes. Nowadays, software deliverables tend to emphasize to intelligence and automation principles, requiring the integration of different software modules, which perform different functions.

At the same time, the team needs to incorporate professionals with different skills in order to deliver each of the aforementioned modules or technologies. Team management requires an in depth management of capabilities. The project success nowadays cannot be assessed only by the timeline and budget success. Many more dimensions related to the definition of project success can be proposed (Sohi et al.., 2016).

Independently of which methodology will be selected, it must be adapted in order to fit the project management strategy, thus to ensure the successful outcome of the projects, otherwise a specialized methodology will have to be developed. In a constantly changing IT and business environment, any methodology, which was ideal in some conditions, may no longer be effective in others. In this case, a hybrid approach or a customized methodology should be possible (Bhavsar, 2016). A hybrid approach in project management which combines characteristics both from traditional project management methodologies and agile methodologies, seems to be the most valid approach, for getting the most out of both methodologies (Fernandez et al., 2008).

The definition of the project life cycle phases sequence in hybrid methodologies varies. There are four main hybrid combinations that systematically adopt traditional and agile project managements phases according to Reiff et al. (2022), which are briefly described below:

- The water-scrum-fall methodology, developed by West. This combines waterfall and scrum methodologies, according to which a structural framework is provided by the waterfall approach and for the development phase scrum methodology is used.

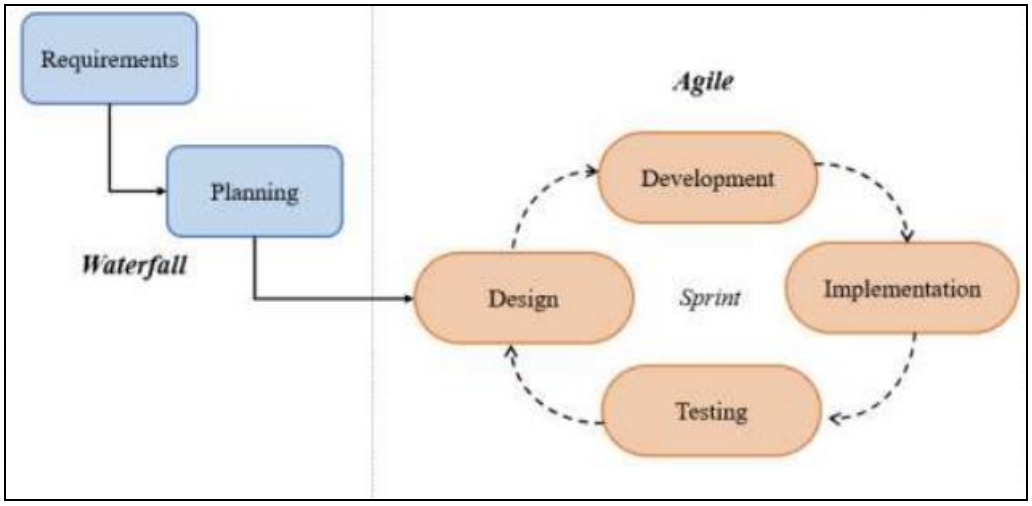

Figure 2.10 . The water-scrum-fall methodology (Nayan, 2010)

• The waterfall–agile methodology, which although is very similar to the water-scrum-fall proposed by West, differs in the final phase of the project life cycle, since it is still within the agile approach.

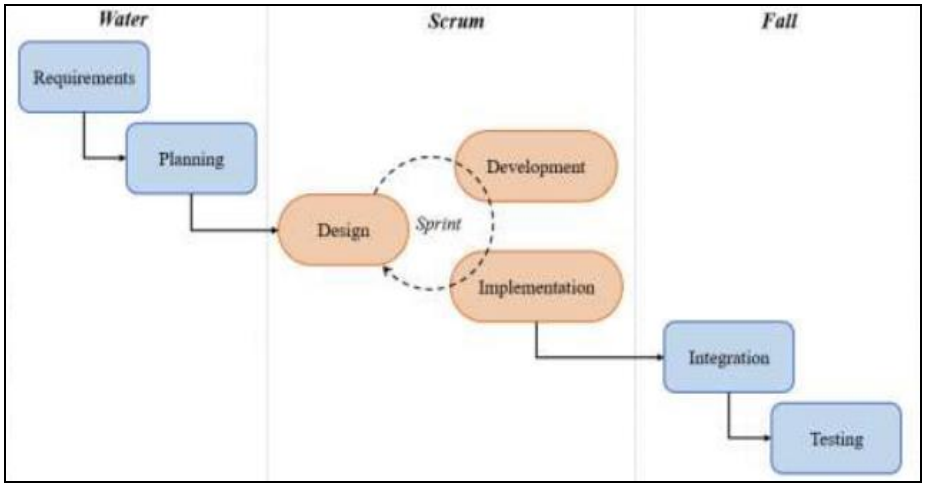

Figure 2.11 The waterfall-agile methodology (Nayan, 2010)

• The hybrid V-model by Hayata & Han, which again is very similar to the water scrum-fall, in the context of using a traditional approach in the initial and final phases and an agile, and particularly scrum, in the in between phases. Although, this methodology is not based on the waterfall approach, but on another TPM approach, the V-model. The idea here, is to execute the project phases with a

"higher abstraction level" according to the traditional approach and the more detailed phases according to the agile approach.

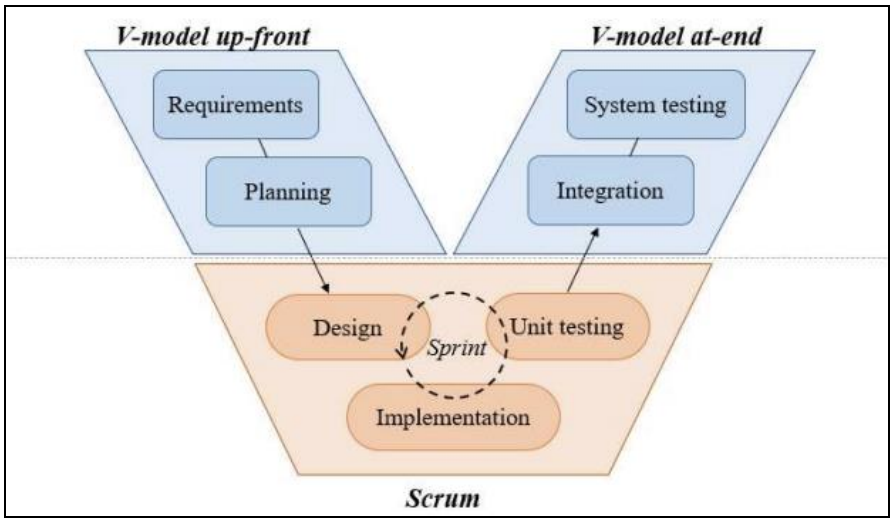

Figure 2.12 The Hybrid V-model methodology (Nayan, 2010)

• The agile-stage-gate (or scrum-stage-gate) methodology, was devised by Cooper in the late 1980s. This methodology breaks the development process into increments, with minimal planning, incorporating this way the agile approach, aiming to maximize speed and flexibility, but ensuring the nessesary structure deriving from traditional stage-gate process, on which it relies.

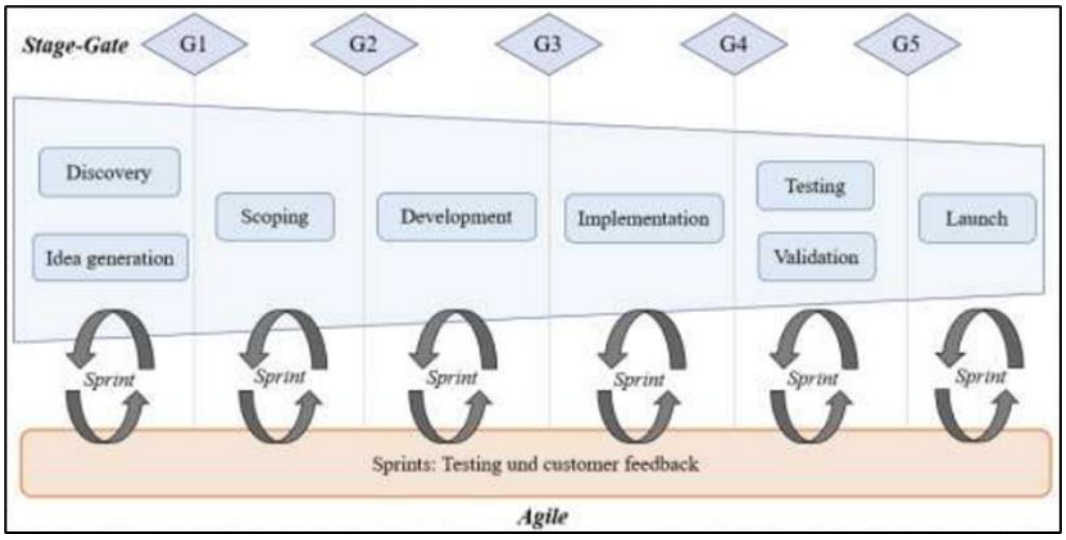

Figure 2.13 The agile-stage-gate methodology (Nayan, 2010)

SAP Activate Methodology

ERP projects are a particularly complex category of IT projects, which presents particular difficulties and peculiarities. The reasons that contribute to the success or failure of these projects are presented in detail in literature. The ERP systems implementation projects, are often complex projects, since multiple enhancements in the software configuration should be performed in order to cover possible necessities for custom solutions, because an ERP system assists the daily business activities and requirements. The key project phases could be summarized in four phases: planning, implementation, stabilization and improvement (Shanks, 2000).

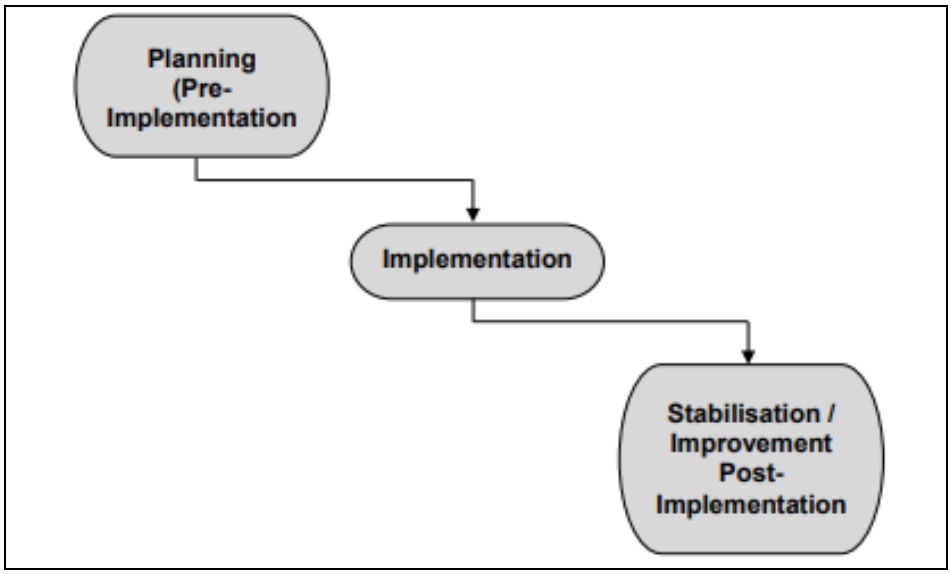

Figure 2.14 ERP implementation project phases (Shanks, 2000)

According to (Kronbichler, 2009) the Critical Success Factors (CSF) for an ERP project include among others the:

- Commitment and support by the upper management
- Project management
- Change management
- Reorganization of business processes
- Training
- Composition and competencies of the project team
- Communication and cooperation
- Management of Legacy Systems and data

• Leadership and effective decision making
• Tools and skills of the vendor/implementation consultant
• System development, testing and troubleshooting
• User involvement and support in the project

The SAP Activate is an Agile oriented method, which emphasizes on frequent quality checks to address risks going through the following phases: Discover, Prepare, Explore, Realize, Deploy and Run. The main components of the method are workstreams, deliverables and tasks. The implementation road map is designed in project phases (x-axis) and work streams (y-axis) as presented in the figure below. Each field represents an activity to be executed as part of a certain work stream, and within a certain project phase.

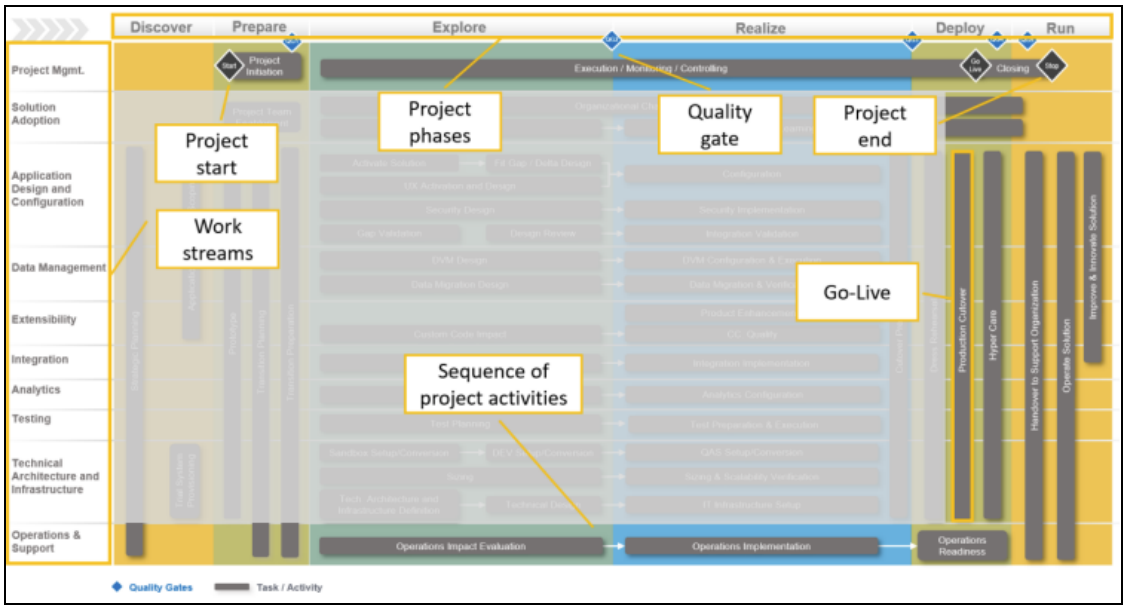

Figure 2.15 SAP Activate road map structure - components (Public SAP, Q1 2023)

A workstream is a collection of deliverables which may span multiple phases (Kronbichler, 2009). According to SAP publication (Public SAP, Q1, 2023), the term also includes the groups or the semantically related activities to the deliverables and the implementation roadmap is structured in the following workstreams:

• Project management: performs project and quality management tasks, including the project planning.

• Solution adoption: includes the strategy and learning paths definitions, as well as the organizational change management and the enablement of the project team.

• Application design and configuration: Identification and design of functional changes based on a fitting the requirements to the standard SAP S/4 HANA functionalities.

• Data management: includes data migration or load from source systems.

• Extensibility: this workstream refers code adjustments tha are required.

• Integration: ensuring that proper integration in the final system.

• Analytics: refers to analytics requirements cover.

• Testing: the test planning and execution is considered in this workstream, ` including the user acceptance.

• Technical architecture and infrastructure: ensuring the technical architecture and infrastructure compatibility with the target systems and possible future extensions with integration with other SAP products.

• Operations and Support: adjustments in IT operational processes or tools to e nsure safety as well as training provision.

As shown in the Figure below, each phase consists of a number of tasks following mostly a sprint method reaching at the end a quality gate at which the deliverables are checked for their quality.

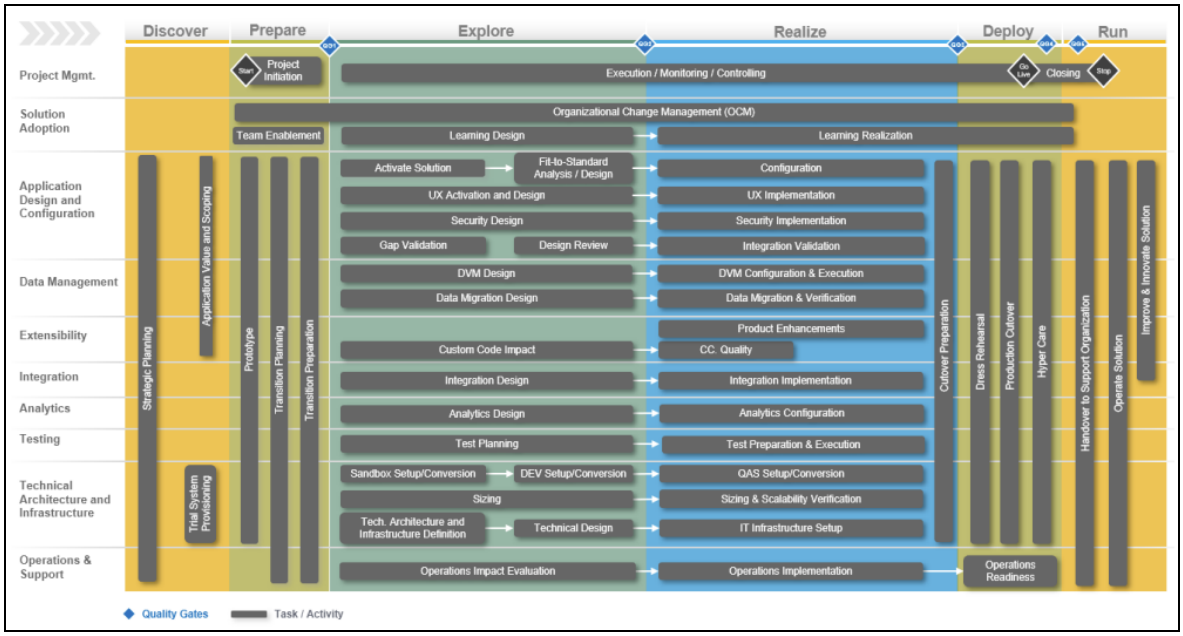

Figure 2.16 SAP Activate road map structure: tasks & phases (Public SAP, Q1 2023)

This method is proposed from SAP for projects implementing SAP S/4 HANA. According to Public SAP (Q1, 2023):

• In the Discover phase an overall digital transformation strategy and implementation plan is established. Customers gain familiarity with benefits the new solution could bring in their daily business.

• In the Prepare phase the implementation planning strategy is arranged identifying the technical and functional intervention required.

• In the Explore phase the technical and functional requirements and solutions to be implemented are planned and documented.

• In the Realize phase technical requirements are prepared and key users trained accordingly.

• In the Deploy phase the readiness of the system is assured and the project go-live takes place.

• In the Run phase after the project is finished, the system could be further supported and optimized according to customer's needs.

The consolut Prisma methodology, which will be studied in chapter 4 of this thesis, is based on the SAP Activate methodology for SAP implementation projects.

Prisma (consolut) method

The methodology of consolut Prisma is another ASAP methodology built for SAP implementation projects by the consulting company consolut. The method was developed in the last 7 years and has many similarities to SAP Activate. Prisma of consolut focuses more on customer needs, seeking also to address user preferences and requirements.

Prisma of consolut follows a SAP Activate baseline approach, but essentially is a hybrid method and actually a combination of an in majority waterfall methodology with a few agile characteristics. More precisely, the agile characteristics of Prisma consolut, are located in the realization phase of projects.

It sets the agile oriented phases but each phase is following a WBS structure based on the waterfall method. Then fills in each phase with specific tasks and deliverables based on the project objectives (ERP maintenance, re-design, digitalization).

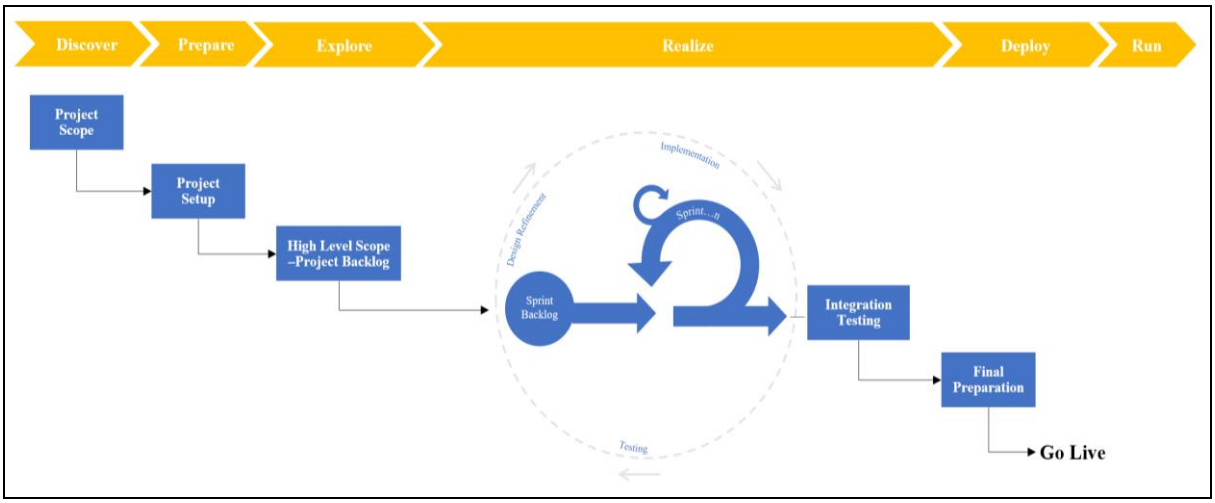

Figure 2.17 The consolut Prisma methodology (consolut GmBh)

Before initiating, the project specific measures are defined in terms of documentation, custom code analysis, usage logging, data cleansing, business partner implementation and several other attributes, depending on the relevancy to each project.

Last, according to the representation of hybrid methodologies described above, the Prisma consolut methodology structure of phases, resembles to the waterfall-agile model, as described from Reiff et al. (2022).

3 Systematic Literature Review

In this chapter, the adopted methodological framework is analyzed. The survey design, the search protocol and publication selection criteria of the sources used are presented, according to the methodology principles. Last, a presentation of systematic literature review results and conclusions is following to complete the chapter.

Through this survey the most important factors, which affect the decision for the right project management in software development projects, are unveiled.

3.1 Systematic Literature Review Definition

Systematic review is defined, as: "the use of explicit, systematic methods to collate and synthesize findings of studies that address a clearly formulated question" (Higgins et al., 2019). Due to the fact that the research has been dramatically expanded, and the available sources volume has been increased, the data retrieved from literature might conflict, leading to uncertainty. Consequently, systematic literature reviews can assist in this attempt to assess and further extend the theoretical background of a specific field, since systematic reviews of literature incorporate "a methodical, replicable and transparent approach" (Siddaway et al., 2019).

Petticrew and Roberts (2006) define systematic reviews as literature reviews that adopt and follow a strict set of scientific methods and focus in assessing and combining all relevant studies in order to deliver an answer for a specific research question. Therefore, this methodology, according to them, is not just a simple literature search, but a scientific tool instead that can be used to evaluate, summarize, and share the results and implications of otherwise of research amounts that could be possibly hard to manage (Petticrew and Roberts, 2006).

In the same context, Kitchenham et al. (2007) point out the positive effects of the systematic literature review in software engineering research, since high quality SLR empowers the construction of databases with primary studies related to specific topic areas aiming to answer specific and well defined research questions.

3.1.1 Systematic Literature Review as a research tool

The reasons for exploring, assessing and synthesizing data in order to answer a research question through a systematic literature review were summarized from

Siddaway et al. (2019) based on conclusions previously drawn from other researchers. Briefly, the fact that SLRs synthesize results of multiple individual studies in a way that simple reviews do not, leads to a synthesis of a body of studies, which elaborates the way and reasons these studies align and provides with solid and sturdy conclusions, responding to the questions that were initially set. Moreover, with this type of review, the results are not a collection of contradictive information, selected through a literature review, rather a synthesis of critically assessed sources, evaluated and integrated in a way to add more value in the respective research field (Baumeister 2013, Baumeister & Leary 1997, Bem 1995).

The systematic methodology incorporates a predefined search process, usually based on a particular protocol, which provides with a framework not only for the sources assessment and synthesis, but also for the results presentation. In this direction the use of inclusion and exclusion criteria, and the way studies are excluded from the research is clearly stated. This process enables replicability of the research, eliminating bias and subjectivity (Siddaway et al., 2019).

Another aspect to be considered, according to the review of Siddaway et al. (2019) is the way the research synthesis is facilitated. Depending on the existent literature relevant for the topic, as well as on the nature of the research questions, the selection of qualitative or quantitative approach is considered significant. It is thus important, to identify if a systematic review of the literature is the right tool to use, or another type of analysis, as for instance meta-analysis, which is quantitative review, used for synthesizing empirically tested studies based on the same hypothesis.

It is important to mention, that the use of systematic reviews was initially not common in many fields except medicine and social sciences. In recent decades, however, their use has been exponentially increased in computer science (Silva et al., 2014). A systematic literature review has considerable effects in IT research, since the studies involved are handled in a way which enables their contribution with robust conclusions in the respective research field. However, it is pointed out, that the main drawbacks of systematic reviews is that they require more effort than other literature reviews

In this direction, according to Moher et al. (2009), the Quality Of Reporting Of Meta-analyses (QUOROM) Statement was proposed, aiming to address the meta-analyses reporting of trials in the healthcare sector research, in 1996. This tool is considered as the predecessor of the Preferred Reporting Items for Systematic reviews

and Meta-Analyses (PRISMA) protocol. The team which revised this set of principles, was aiming to incorporate a guide for both meta-analyses and SLR, thus devised the PRISMA in 2005.

In this context, PRISMA provides the research community with two tools and an information body. The two tools, are the incorporated in the PRISMA statement, which includes a checklist and a flow diagram. The checklist includes 27 items relevant for the systematic literature review, while the flow diagram represents the desired flow of information through the research phases of the review, and different templates are provided, in order to address the type of review and sources (PRISMA Statement Organization, 2021).

3.2 Search Protocol

In this master thesis, the PRISMA methodology will be followed to conduct the Systematic Literature Review. The PRISMA Flowchart demonstrates the whole process of gradually defining strict and clear criteria of inclusion/exclusion of research papers in the systematic review, so that the researcher can reach the final body of these and processes them appropriately (PRISMA 2020). This process is divided into four phases so that the researcher's work is more organized.

Table 3.1 Stages of PRISMA Protocol (PRISMA, 2020)

PRISMA Flowchart Phases	
1	Identification
2	Screening
3	Selection based on criteria
4	Included Studies

However, the researcher is obliged to clearly define, in detail and in a clear way, the search expressions to be used at the beginning, both to the reader and to the subsequent researcher, so that the repetition of the systematic review is possible, to verify

its validity. Use of quotation marks, operators (AND, OR, NOT) and other search assistance tools is also feasible. Beyond the Flowchart phases, on the basis of PRISMA, specific protocol steps that the researcher should follow, are precisely defined (PRISMA 2020). The SLR Steps according to PRISMA Analysis Protocol, include specific sets of activities, aiming to fulfil the SLR and answer the research questions.

Table 3.2 SLR Steps according to PRISMA Protocol (Silva et al., 2016)

Systematic Literature Review Steps	
1	Research question formulation
2	Establishment of inclusion and exclusion criteria for the review
3	Relevant literature search
4	Evaluation and selection of studies
5	Recording the data
6	Presentation of results
7	Interpretation of results

3.3 Search Process

3.3.1 Publication Selection Criteria

In the context of the research objectives, which were defined in the previous chapter, the master thesis focuses on the use of traditional, agile or hybrid PMM methods in digital and software development projects. In order to serve the purpose of this master thesis, the PRISMA protocol is used to facilitate the SLR methodology in international literature related to the issue, deriving from Scopus database. After the first step regarding the research questions formulation in Chapter 1, the establishment of inclusion and exclusion criteria is performed and followed by the third step, which is the relevant literature search. The publication selection was performed with the following restrictions:

1. The publication year of the articles must be between the year 2015 and 2022.
2. The editorial language must be English.
3. The articles must be published either in a scientific journal or as a stand-alone article or last as conference proceedings.

So, the mentioned points, form the inclusion criteria of the methodology. Accordingly, the following criteria are the publication selection exclusion criteria:

1. The related publications were published before 2015.
2. The language is not English.

The search was performed to Elsevier's Scopus bibliographic database. Through Scopus , in addition to access to the database with abstracts and citations for scientific articles, it is possible to search more than 22,000 scientific journal titles and the Internet (through the Scirus mechanism), as well as to automatically link to the full text of the article. Scopus is updated daily and covers various areas of science and technology, especially Computer Science which is related to the purpose of this master thesis.

For the SLR sources selection, specific keywords were used: “project management”, “project management methodology”, “waterfall method*”, “agile method*”, “hybrid method*”, “SAP Activate”, “agile implementation methodology”, “waterfall implementation methodology” and “IT project” in combination with the specific symbol «*», in order to enrich the search and thus enable the results to include different aspects of the keywords, as well as abbreviations.

Initially, the search in Scopus revealed in total 618 articles on the search topics, using the above mentioned keywords in combination to orchestrate the following search phrases:

- “Project Management” AND “Waterfall method*”
- “Project Management” AND “Agile method*”
- “Project Management” AND “Hybrid method*”
- “Project Management method” AND “IT project”
- “SAP Activate” AND “method*”
- "Agile implementation method*" OR "Waterfall implementation method*"

The following filters were used in the search engine of Scopus:

- Peer-reviewed journals
- Scientific journals
- Conference proceedings

3.3.2 Evaluation and selection of studies

The fourth step of the SLR methodology according to PRISMA Protocol is the evaluation and selection of studies.

In this phase, additional filters on language (English) and the date range, from year 2015 to 2022 were set. Further than this, the type of publication further depreciated the results. Then, the search criteria were mainly focusing on the different project management methodologies (waterfall, agile, hybrid) and studying the abstracts and full texts of the articles for information related to the objectives of the review. In this master thesis, all literature included in the study was read and summarized by one researcher, who assessed to ensure it was relevant to the study.

Continuing, each article was examined to identify whether it fits the purpose of the review and whether it includes common content with other articles. These phases of filtering the results, led to 45 articles that met the objective of the review. According to PRISMA Flow Diagram, the selection of studies for a Systematic Literature Review Process is depicted by clear inclusion and exclusion criteria in the following stages.

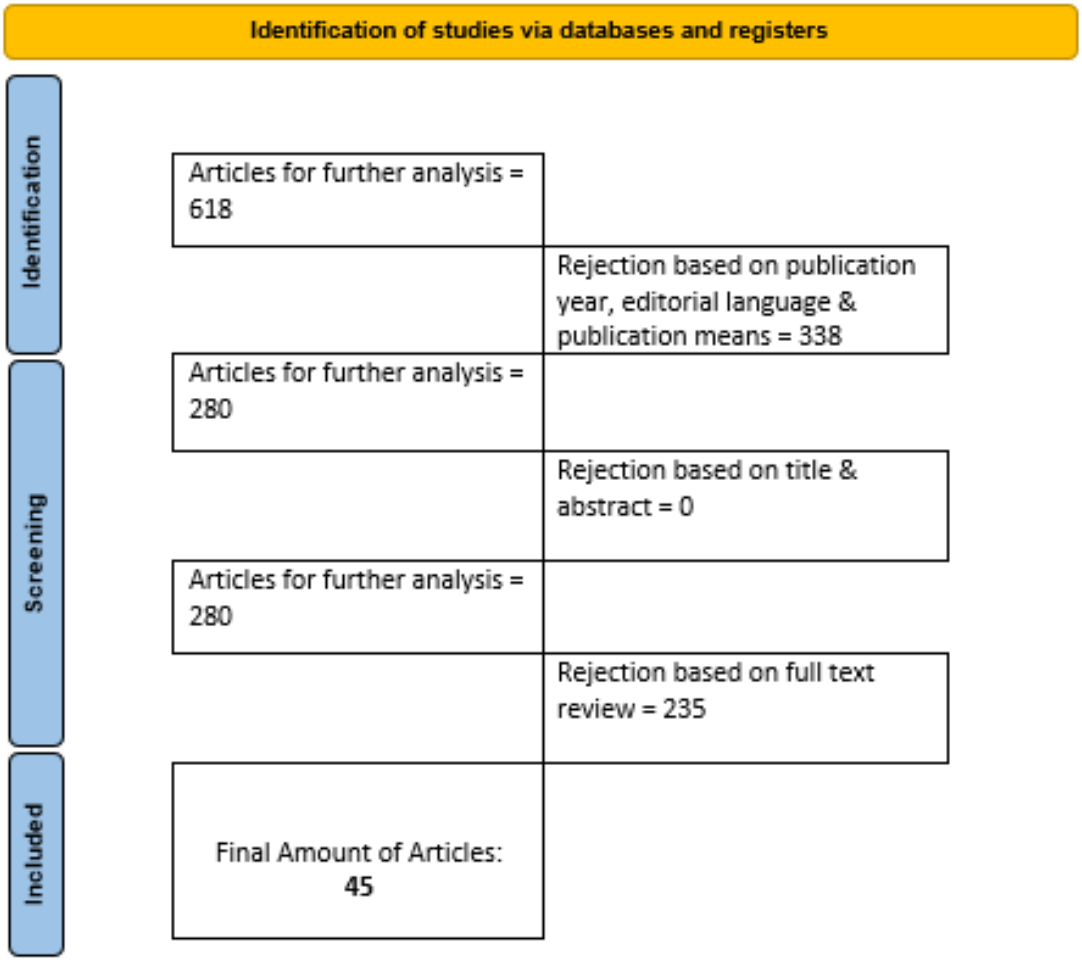

Figure 3.1 Criteria for inclusion/exclusion of articles according to PRISMA 2020

The three levels of analysis and rejection of articles which where mentioned above, have been performed in each search phrase. As mentioned, a total of 618 articles were found in the search using Scopus and based on the above keyword combinations. The final sample size was 45.

At the first level of the protocol, the initial results are checked against the exclusion criteria. For example, for the search phrase "Project Management" AND "Waterfall Method*", 100 articles were initially retrieved. Then, the publication year of the article against the restriction of year 2015 to 2022 was checked, the editorial language which must be English and the publication means, since it has to be published in a scientific journal as a stand-alone article or conference proceedings. After the first phase filtering, 50 out of the 100 articles had to be excluded.

At a second level, the title and the abstract is validated of whether it matches to the objectives - keywords of the search. In the case of the search keywords of "Project

Management" AND "Waterfall Method*" all the 50 articles that remained from the previous step are relevant therefore eligible for the final round of evaluation.

At a third level, the whole article was reviewed. In the context of the example for the search phrase "Project Management" AND "Waterfall Method*", the content of 39 articles appears as not relevant. Concluding, 11 out of 50 articles are short listed for this part of the search: "Project Management" AND "Waterfall Method*". The search protocol can be analyzed accordingly for all the included search phrases, as they appear in Figure 3.2.

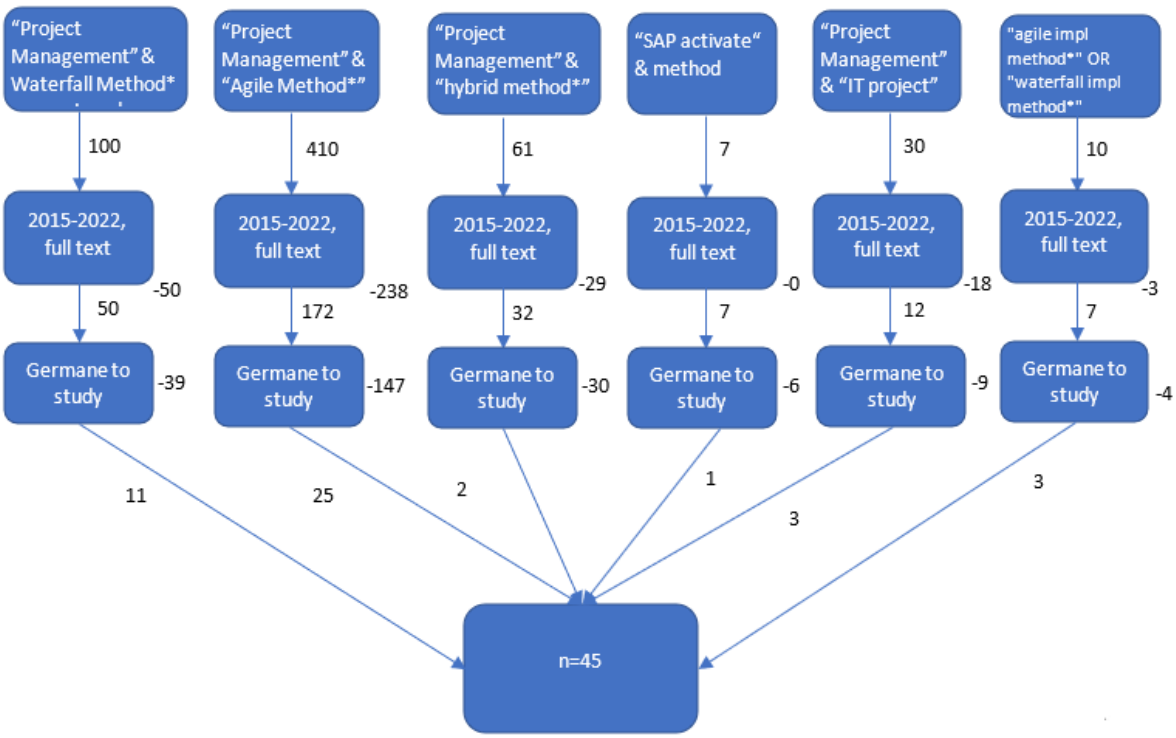

Figure 3.2 Criteria for inclusion/exclusion of articles based on search phrase

In the charts below, from the sample of 45 articles considered for the Systematic Literature Review, it can be observed that Project Management Methodologies was a topic that occupied researchers within the studied period. Although it is clear, that nearly 50% of the literature sources (n=20) were published during or after the pandemic which started in the end of 2019 and affected the majority of developed countries, thus the ongoing or planned for the future IT projects, including SAP Implementations. Last, the majority of the sources were Researches (n=14) and Case Studies (n=12).

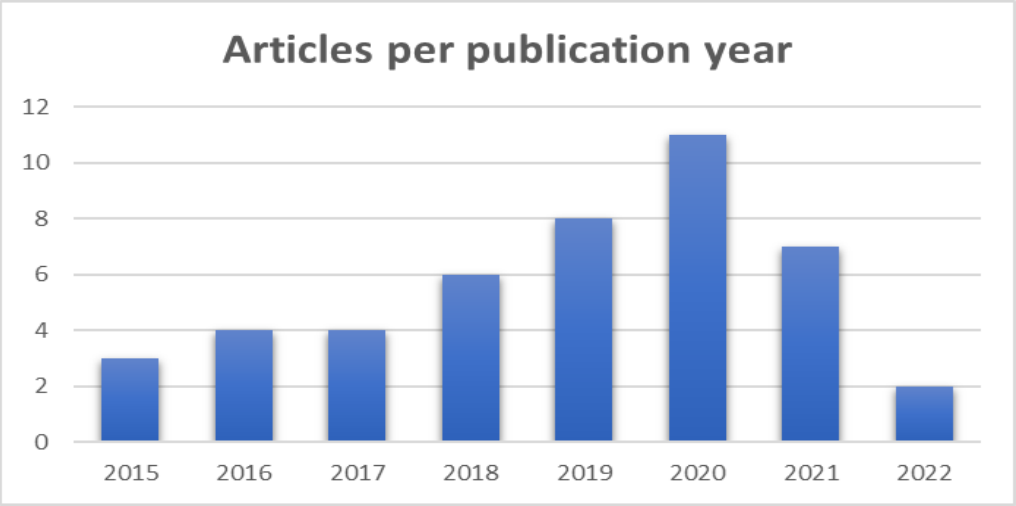

Figure 3.3 Distribution of the Publication Year of the Selected Articles

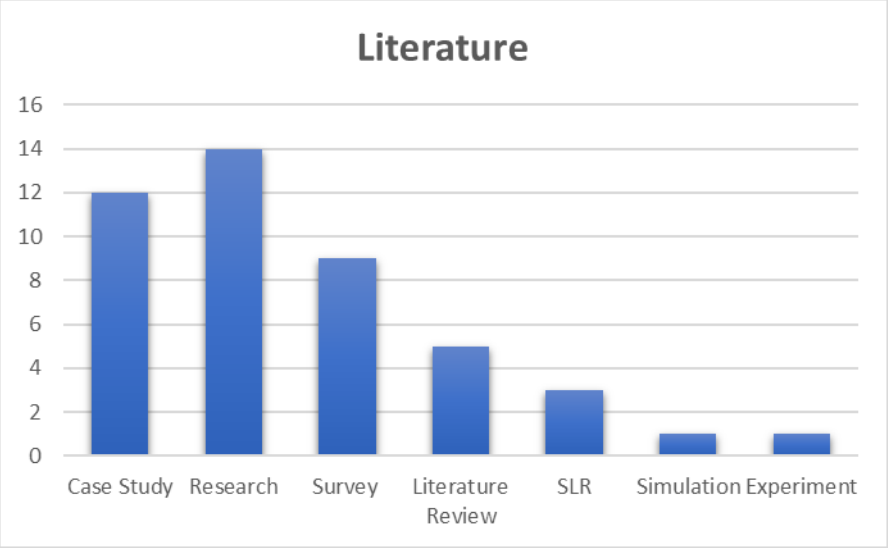

Figure 3.4 Distribution of the Research Method of the Selected Articles

3.3.3 Risk of bias

Although the systematic methodology and presentation, aim to minimize subjectivity and bias (Siddaway et al., 2019), as the range of search focusing on the concept of project management is extensive, it is possible that an insignificant amount of articles were studied in random order. As a result, bias towards specific publications may have limited the availability of publications and data for analysis. Additionally, the review was conducted by one researcher, a fact that might have also influence in the possibility of bias towards specific publications.

3.4 Literature Review Results

3.4.1 Results of individual studies

The fifth step of the PRISMA protocol regarding data recording was performed next. The filtering of the articles was executed in stages, considering first exclusion criteria, then the title and abstract, and at the final stage the whole article's key concepts. At each stage of the analysis, observations were recorded in a spreadsheet, indicating the decision to use or reject the article, the type of methodology used in the research, the objectives and the key findings. In cases of uncertainty, the article was re-evaluated at a later stage for reaching a final decision.

The sixth step of the PRISMA protocol constitutes the presentation of results. The observations of the literature that was finally selected and considered for the systematic literature review, according to the process described above, are demonstrated in detail in the following table. The objectives and key findings of each source is explained, followed by an overview discussion of the literature, around the key concepts of this thesis and the findings in the studied publications.

Table 3.3 Summary of the systematic literature review results

No	Paper	Type of Method	Type of Project	Paper Objective	Key Findings
1	Yel et al. (2022)	Case study	Fuzzy risk assessment method	Assessment of projects and IT teams with the help of 3 instrument methods	Risks and complexity challenge the project success and are associated both to the human factor but also to operational criteria.
2	Santos and de Carvalho (2022)	Literature review	Survey to large projects	Benefits and drawbacks from applying agile methodology in large scale projects	The issues caused by the use of agile approaches in large scale projects, can be grouped in six categories and benefits in three categories.
3	Nguyen and Fagerstroem (2021)	Case study	Implementation project	Clients and consultants collaboration when waterfall approach is adopted.	The Waterfall method can cause unenviable chain effects to the collaboration of teams, which in turn can affect both the design phase and project outcome.
4	Chakravarty and Singh (2021)	Research	Framework for managing software defects based on Waterfall PMM	Identifying quality metrics for agile approach	Quality metrics are vital for project monitoring.
5	Thesing et al. (2021)	Research	Study of different industry sectors,	Provision of a PMM approach decision model	• Waterfall ○ long-term planning

			company sizes and project managers	and identification of perceived waterfall and agile characteristics	○ compact team structure ○ the more abstract the initial requirements are the more they will be misinterpreted and will cause incorrect decisions ○ customers enforced to specify all the requirement details from the beginning • Agile ○ short-term planning ○ Success depends on the teams self-organization ○ High capacity requirements of project members • Custom model for a specific project ensures that the methodology is a key success factor
6	Kordova et al. (2021)	Survey	Study of 70 projects	Identification of project success criteria and possible PMI principles relationship	• Following the PMI approach can contribute positively in project success • Project size and importance lead to more

				with project success.	attention and subsequently to successful outcomes • Scrum methodology is more successful than Waterfall in the projects evaluated in this paper.
7	Bambauer-Sachse and Helbling (2021)	Research	Survey on IT projects in Switzerland	Analyze the impact of agile methodologies in customer satisfaction	Agile approaches are linked with more satisfied customers than TPM approaches.
8	Jamous et al. (2021)	SLR	Combination of methodologies to manage the complexity of projects	Combination of Waterfall and Agile methods to overcome project complexity	Hybrid methodologies can combine the best characteristics of both waterfall and agile approaches and succeed in complex projects management.
9	Garcia et al. (2021)	Survey	Survey with 206 project managers testimonials	Analysis of the possible contribution of the entrepreneurial orientation (EO) of organizations, in the use of Agile methods in project management.	Innovation oriented business environments can enforce the use of Agile methods, due to certain existing characteristics.
10	Agrawal and Chari	Research	Study on 49 selected projects	Association of the overall effort with the project	Audit Review Control (ARC) can estimate the overall project effort and thus the project

	(2020)			success in waterfall approach	outcome.
11	Mitropoulos et al. (2020)	Simulation	Experiment with a new PMM which includes Waterfall	Combination of Waterfall & Agile methods simulation	When an agile spiral model includes waterfall processes and key principles, it becomes faster.
12	Aleinikova et al. (2020)	Survey	Study of public sector projects	Comparing Waterfall & Agile	The paper proposes the use of agile methodologies as a better fit in software development for project management in the public sector, in the context of avoiding mistakes which induce extra costs.
13	Hanief et al. (2020)	Experiment	Risk assessment method based on interviews	The creation of a project management support tool.	Based on waterfall methodology, the researchers documented the steps of a project management system creation, aiming to assist on the project schedule management.
14	Faisal Abrar et al. (2020)	SLR	Survey to large projects	Identification of the de-motivators when applying Agile methods to large projects.	Identified 15 de-motivators for agile adoption in large scale projects and categorized them on continent and decade level.
15	Chovanova et al. (2020)	Literature review	Survey on management of product development	Agile method evaluation	Evaluation of the agile methodologies based on existing literature

16	Dietel and Heine (2020)	Research	Agile framework for Public Sector projects	Identify the extent to which the agile methodology fits in the bureaucratic organizations of public sector	The framework proposed by the researchers suggest that, switch to hybrid methodology for ensuring compatibility with the bureaucratic public sector is the solution for achieving flexibility in public sector projects.
17	Tam et al. (2020)	Research	Agile model	Identify the factors that influence a successful on-going agile project.	The research indicates that team capability and customers involvement are the main success contributors of agile on-going projects.
18	Mkoba and Marnewick (2020)	Research	Test framework of Agile projects in South Africa	Proposing a conceptual framework to audit agile projects implemented using Scrum methodology	For achieving successful projects with agile approaches, a framework for auditing guidance is proposed by the researchers.
19	Kraljić and Kraljić (2020)	Case study	SAP implementation based on agile practices	Key elements of SAP ERP implementation methodologies	The paper indicates the lack of studies and practices combining agile approaches and ERP projects implementation, emphasizing on the differences between Agile and Waterfall elements.
20	Kosztyán et al.	Research	Risk assessment tool	New matrix-based tool for	The risk effects of a project are more likely

	(2020)			risk analysis proposal, which handles risks dependency, effects on scheduling performance and flexibility level	handled when the hybrid approach is utilized to manage this project.
21	Pradhan and Nanniyur (2019)	Research	Framework for managing software defects based on Waterfall PMM	Presentation of the challenges in measuring software quality using hybrid methodologies	The lack of metrics for software quality developed within the hybrid methodology approach, leads the researchers to the proposal of a framework for this purpose.
22	Hidalgo (2019)	Case study	Research project	Examine the application of agile – scrum in interdisciplinary collaborative projects	Agile adoption is suited to self-organized, adaptive and flexible environments, which are open in changes and complexity handling
23	Hayat et al. (2019)	Literature review	Literature review on application of Agile PMM	Agile (scrum) application benefits in software development projects.	Scrum methodology affects positively the risk, cost, product quality, time needs and scope of the project.
24	Mamoghli & Cassivi (2019)	Case study	ERP project to a Canadian SME at the textile industry	Agile methodologies in ERP implementation projects	Integration of agile approach in ERP projects implementation is a potential solution in limitations.
25	Perdana et al.	Research	Agile -based	Design of Knowledge	Agile based methods can be successfully used

	(2019)		Knowledge Management methodology	Management System Agile Implementation Methodology (KSAIM)	in creation of knowledge sharing systems.
26	Azar et al. (2019)	Research	Agile based method for Health care systems	Software System Agile Implementation in Healthcare Sector	Agile implementation leads in interpersonal interaction and engagement of all project members, which is a key for project success and is in follow with Agile theoretical framework.
27	Hassani et al. (2018)	Research	Hybrid methodology for digital projects	A multicriteria analysis on waterfall, agile and hybrid approaches.	In the digital transformation era, the researchers attempt to highlight the importance of PMM in successful modern projects, with an analysis on the advantages and disadvantages of each approach.
28	Dingsoeyr et al. (2018)	Case study	IT project in Norway combining agile and traditional method	Identification of the agile methodology performance in a very large scale project	Agile approach when used in very large scale projects is applied as a combination of agile and waterfall.
29	Chari and Agrawal (2018)	Research	Study on 49 selected projects	Requirements importance for the project outcome in waterfall approach	The resolution of incorrect requirements leads in decreasing defects within a project but at the same time in new requirements generation, although the generation of new requirements

					results in more defects and thus increased effort requirements for the project completion.
30	Tripp and Armstrong (2018)	Survey	Interviews with Agile practitioners	Identify the reason for tailoring agile methodologies and the association with project success	Organizations need to identify the most immediate pain points, justify the selected agile methodology, and define the metrics used to evaluate project performance.
31	Dingsoeyr et al. (2019)	Literature review	Literature review on application of Agile PMM	Identify the challenges when using agile in large scale	Intersectoral empirical research data are required in order to extract conclusions for the eligibility of agile methods in large scale projects
32	Pereira and Russo (2018)	SLR	Literature review on application of Agile PMM	Evaluation of the integration of agile methodologies and Design Thinking (DT)	Integration of agile and other approaches like DT result in better communication of developers and customers
33	Patanakul and Rufo-McCarron (2018)	Case study	SLR on Projects governance	Explore how the transition from waterfall to agile was performed in organizations	The transition from waterfall to agile approaches, leads to challenges.
34	Heikkilä et al. (2017)	Case study	Large telecommunications company	Identify the way agile methodologies can be adopted to handle large	Agile approach in large scale projects can be successful if the higher level planning is not agile.

				scale projects	
35	Lei et al. (2017)	Literature review	Literature review on application of Agile PMM	Identify which of the two agile methods, Kanban or Scrum is better	Both Kanban and Scrum lead to successful projects, but Kanban handles project schedule better.
36	Lappi et al. (2019)	Research	SLR on Projects governance	Research relevant to the projects handling during government digitalization	The research highlights the association between e-governance level and operations in ICT projects
37	Raith et al. (2017)	Survey	Experiment with web-based project-management-tools	How project management browser-based tools are used in agile phases between distributed teams	Browser-based tools are utilized to facilitate communication between distributed teams and have both positive and negative outcomes.
38	Kisielnicki and Misiak (2017)	Case study	Case study to a Telecom company of Agile vs Waterfall approach	Compare agile and waterfall approach in Business Intelligence (BI) systems implementation projects	Agile approach is more effective according to user's experience, since it adds more value in less time when compared to waterfall.
39	Schar et al. (2016)	Case study	Case study in 50 projects	Investigate how Scrum (agile) and Hermes 5 (waterfall) can be combined	A new requirements handling process can facilitate the effective operability of the scrum based software development process.
40	Tripp et al. (2016)	Survey	Data collection from 252 software-	Association of agile methods to the employee	There is a positive correlation of agile practices adoption and employee satisfaction.

			development professionals	satisfaction	
41	Rasnacis and Berzisa (2016)	Case study	Industry case study	Identification of a framework for agile PMM adoption, based on project team characteristics	Project team characteristics, like motivation and team structure can combat the agile possiitive effects, if not addressed and correctly with the agile characteristics.
42	Anguelov and Angelova (2016)	Survey	IT projects in Bulgaria	Methodological approach for effective IT project management in Bulgaria	Both agile and waterfall approaches are implemented, and depending on specific characteristics, both can be efficient.
43	Serrador and Pinto (2015)	Survey	Questionnaire based with members of the PMI institute, and members of project management teams at LinkedIn	Evaluation of the agile use in organizations in the spectrum of project success in terms of efficiency and stakeholder satisfaction	The level of agile methodology adoption in a project impacts efficiency, stakeholder satisfaction, and general perception performance in the project
44	Romano and Da Silva (2015)	Survey	IT Projects in Brazil	Identification of the negative and positive effects of agile PMM adoption in the development team	Effects both positive and negative, mainly positive in inter-team communication and motivations induced.
45	Stettina and Hörz	Case study	Case study in selected	Understand how portfolio	Agile approach is usually first adopted in a

	(2015)		projects	management is handled in organizations adopting the agile software development approach.	single project and then in an agile framework on the organization level.

3.4.2 Overview of Literature

The following subchapter introduces the discussion of the systematic literature review findings and summarizes the results, based on the key findings and concept of each publication, as presented on the previous table.

Project Management and Waterfall Methodology

Chari and Agrawal (2018), identified an association between requirements resolution and project defects, by reviewing 49 selected projects, where the project methodology was TPM oriented (Waterfall). In more detail, it was identified that, more effort is required when working on the resolution of a wrongly defined requirement, since the change requests are related with increased effort, which imposes a positive association with the overall project defects. When the requirements were wrongly defined, resolving them leads to defects decrease, but when the requirements were simply not stated completely, the effect on defects was minimal to not observed. This finding was important, since it highlights the value that well defined requirements provide in projects where the waterfall methodology is used for to manage them.

Nguyen and Fagerstroem (2021), attempted to understand how the collaboration is facilitated between customers and consultants within a project team, when the waterfall model is selected for the project management, through a case study. The findings indicate that the human factor affects the way collaboration is succeeded. Further than that, possible solution and business requirements conflicts due to misinterpretation or lack of proper assessment might affect the successful collaboration between the two groups, which in the context of the plan-based waterfall methodology can induce additional delays and thus influence the collaboration in the design phase of the project and possibly the project outcome.

Project Management and Agile Methodology

The research from Tam et al. (2020), highlights the importance of teams capabilities and customers involvement as the key contributors of success in active agile projects. In similar context, and verifying the above finding of Tam et al. (2020), according to the study of Garcia et al. (2021), which is based on empirical evidence, there is significant contribution of entrepreneurial orientation (EO) in the use of agile

methods in project management. Accordingly, the characteristics of organizations with adopted EO, are quite similar with the ones considered compulsory in the adoption of agile approaches in project management. The EO is characterized by innovativeness, risk taking, proactiveness, autonomy and competitive aggressiveness (Garcia et al., 2021). These characteristics enable team members to adopt in ever-changing situations without expecting managerial approval or guidance (Garcia et al., 2021). In the same context, Rasnacis and Berzisa (2016) developed a methodology for identification of the project team characteristics, which could affect the success of an agile methodology adoption. In more detail, with the methodology, which was proposed and tested through a case study, a preliminary analysis of the project team characteristics, like structure and incentive should be performed. Then, by adopting them accordingly in the agile approach characteristics, the maximum efficiency of the agile PMM adoption can be succeed (Rasnacis and Berzisa, 2016).

Tripp et al. (2016) conducted research, which resulted in acknowledging the positive association of the agile project management approaches, the software development practices and the perceived characteristics of the project participants' position. According to the researchers, there is direct association between the agile methodology and employee satisfaction, due to the high perceived autonomy of the project members (Tripp et al., 2016). Also, agile has a positive impact on efficiency and stakeholder satisfaction, thus in the performance received form the project. The main instruments that facilitate this quality of vision induced, leading in these results. Surprisingly, and opposing to other research results, it was identified, that team experience and project complexity did not appear to moderate the project success (Serrador and Pinto, 2015).

In the majority of organizations examined by Stettina and Hörz (2015), before an agile framework was adopted, the agile approach was initially successfully adopted in single projects. In another survey (Tripp and Armstrong, 2018) it was identified that organizations by assessing previous project work performance, might end up in adopting agile methodologies. The researchers further proved, that there is a pattern between the initial motive for agile methodology adoption and the finally adopted agile methodology by the organization, through a correlation analysis (Tripp and Armstrong, 2018). The studied methodologies were combination of agile concepts and it is important to mention, that project performance was noticeably improved when the combined agile

methodology was adopted, although their adoption does not imply automatic project success, since the project team requires time to readjust (Tripp and Armstrong, 2018).

The effects an agile approach implementation caused in the development team were identified in the research of Romano and Da Silva (2015). The results highlight the positive impact in the internal communication and team bonding, the competency in recognizing goals and tasks, the advanced capabilities of tasks effort estimation as well as the strengthened motivation for undertaking projects and tasks, but indicated also some drawbacks, as the still not sufficiently agile trained team (Romano and Da Silva, 2015).

Hidalgo (2019) attempted to explore the agile methodologies adoption in research collaborative projects. The results indicated, that in self-organized, flexible and adaptive environments, the agile methodology adoption seems to respond well in the projects challenges, while at the same time concerns were raised, including time and resources constraints, trust between the project members in relation to the project members autonomy, and the organizational culture of the research organizations employing the project members, which usually deviates from the flexible ideal environment, according to agile practices. The scrum principles, as followed by multiple teams, contributed positively, ranging in different levels of positive contribution, in the project implementation and defects combat (Hidalgo, 2019).

Scrum methodologies portray positive influence in multiple project attributes, as risk and cost handling, product quality, usability and required development time and in general the whole project scope (Hayat et al., 2019), while Lei et al. (2017) pointed out the lack of literature based statistical evidence on the assessment of Kanban and Scrum methodologies, in terms of the quantitative factors indicated by PMI (PMBOK 4.0) regarding “budget handling”, “risk control”, “quality of the project”, amount of available resources”, “clear project scope” and “schedule handling”. The results of the empirical survey they conducted highlighted Kanban’s superiority in terms of project scheduling, while in general both of the methodologies manage successful projects (Lei et al., 2017).

Raith et al. (2017) investigated the way communication is succeeded when web-browser based tools are used, in the context of distributed teams and agile approach. The results indicate that although these tools may assist in requirements identification, they sometimes include disadvantages, mainly in the communication establishment.

Agile Methodology at large scale projects

The de-motivators for the agile software development models adoption in large-scale development teams were presented in the study of Abrar et al. (2020). The study indicated that the de-motivators vary among different countries and continents, as well as through the time. More precisely, the most critical de-motivator in both decades was the "lack of agile experts" during the two decades from 1993 until 2013 (Abrar et al., 2020). Regarding the continents distribution, implications in "team feedback" emerged as a critical factor in Asia and the "lack of effective communication and team orientation" in Africa according to Abrar et al. (2020). In the rest continents, the evidence indicate that the "lack of agile experts" is the most critical de-motivator, since this was also the most met factor among the study strategies, as well as the "lack of commitment support and management" and the "continuous testing and integration" of the agile software development models Abrar et al. (2020).

Heikkilä et al. (2017) in a case study of software development system implementation project in a telecommunications company, investigated the way agile approaches were utilized in the large scale context. It was identified, that not all of the agile elements are eligible for such large projects, as the use of simple backlogs and informal communication (Heikkilä et al., 2017). The study led to the conclusion that agile approaches can be adopted in large scale projects if the higher level planning is not agile oriented, and thus contribute positively in the project, in terms of reducing the required development time, increase flexibility, motivation and planning efficiency as well as improve communication (Heikkilä et al., 2017). Last, the perceived drawbacks, included effort planning and lack of the autonomous team concept understanding (Heikkilä et al., 2017). In similar context Santos and de Carvalho (2022) identified advantages and disadvantages of agile application in large scale projects. The researchers grouped the advantages and disadvantages in three and six categories respectively, in order to assist in further quantitative research in the field.

In the research of (Dingsoeyr et al., 2018) besides the highlighted lack of research based advice on how to implement agile methodologies at very large scale projects, the need for combination of agile and traditional methods in such projects was analyzed. The most useful agile characteristics utilized in the case studied from the researchers was the customer involvement as well as the coordination between teams, the software

architecture and development approach as an iterative and continuous process and last the project management adaptiveness in the needs of each phase (Dingsoeyr et al., 2018).

Agile Methodology and ERP Implementation projects

Mamoghli and Cassivi (2019) in a case study, while highlighting the lack of sufficient research on the topic, identify the possible contributions of agile methodologies in an ERP implementation project in a small-medium enterprise (SME). The agile practices were not always followed strictly, while hybrid approaches were also utilized in specific project phases, since the integrator included hybrid additions in their approach. The study results indicated that, the user had interference with the system from early in the project life cycle and the requirements were easily and accurately communicated (Mamoghli and Cassivi, 2019).

Kraljić and Kraljić, (2020) point out that there is no universally accepted and tested ERP implementation methodology and that the research on this field and in the Information Systems in general, is neither adequately documented nor scientifically explored. Furthermore according to Kraljić et al. (2020), no sufficient material exists in the academic literature regarding the impact of agile methodologies in ERP implementation projects, although these projects include both software development and systems development, depending on the circumstances. The way ERP implementations are executed, require cross-functional teams communication, in order to communicate the requirements, a situation which resembles the way agile methodologies approach project teams. Other than this, the so called SAP Activate Methodology, which was devised by SAP for SAP ERP Implementation projects was until recently waterfall oriented. Although, Kraljić et al. (2020) pointed out the mapping of one to one waterfall and agile terminology related to ERP implementation projects, so as to enable teams to get involved with agile approaches.

Comparisons of Waterfall and Agile Methodologies

In a research conducted by Kisielnicki and Misiak (2017) in the context of the key assumption that, traditional PMM like waterfall are not as effected as they used to be, due to the increased market needs, it was recognized that agile approaches are perceived as more efficient and valuable in terms of quality and time. In more detail, the researchers assessed the performance of the two approaches in BI system implementation

projects, and the results highlight the superiority of agile method regarding involvement of users, fast product delivery, thus cost and time efficiency, system requirements understanding, teamwork and product quality (Kisielnicki and Misiak, 2017). In the context of combining a process-based with a plan-based methodology, Schar et al. (2016) proposed a new analysis of agile requirements process, as a complement to the Hermes framework, aiming in cooperability and compliance with Scrum based software development process.

Both waterfall and agile methodologies are applied in IT companies for software engineering projects in Bulgaria, and the most common agile method is Scrum, based on the results of the methodological approach developed by Anguelov and Angelova (2016). The results indicate that project management methodologies of both approaches can be effective, if allocated appropriately, based on indicators like project cost and financial risk loss, project success and timeline keeping (Anguelov and Angelova, 2016).

Thesing et al. (2021) presented an empirical study combining literature analysis and empirical research which was performed in projects from different industry sectors, company sizes and age groups of project managers. This paper, after presenting the way project management specialists perceive the waterfall and agile characteristic, contributed with a decision model as an assistant to the sector specialists in identifying the proper project management approach, between waterfall and agile, based on scope, time, costs, organization and project team (Thesing et al., 2021). This model could also inform about the characteristics of the two approaches that are more suitable for each phase, in cases a hybrid methodology should be considered.

According to the findings (Thesing et al., 2021), the waterfall approach is perceived as a model with concise team and short-term planning. There is emphasis on the requirements, due to problems in the next project phases in case of vagueness. Also, strong relation with uncertainties from customers in the initial phases are observed, due to the requirements uncertainty of the customers, in the early stages those are established in waterfall approach. The agile approach is perceived as promoting adaptability due to the iterative nature of the approach, contributing this way in the project success. The practitioners capabilities and knowledge of each approach was also pointed out.

Kordova et al. (2021) attempted to identify the criteria for a successful project accomplishment in a study where 70 different IT projects were examined. The successful project according to Kordova et al. (2021), was identified as the one with punctual

delivery and preserved quality in terms of customers requirements satisfaction. Their research indicated, that the projects which are aligned with the principles of the PMBOK seem to enjoy more successful outcomes, that Scrum methodology leads to better results than the waterfall methodology in the examined projects and highlighted the importance of attention in projects, as the large and significant projects, which draw the participants attention, seemed to have better results. Last, no evidence supported that the project managers experience affected the outcome.

In addition to that, the research from Bambauer-Sachse and Helbling (2021) indicates that, agile methodologies can succeed in customer satisfaction, and perform better than the plan driven traditional methodologies, while the results of Pereira and Russo (2018) highlight the impact on customer satisfaction, by empowering communication with developers, integrating agile with other approaches like the digital thinking (DT). In this context, it is important to mention that Patanakul and Rufo-McCarron (2018) in their study, seek to raise awareness of the threats implied, when the transition from waterfall to agile methodology was attempted. The main, amongst others, of the key concepts on which those threats could be grouped, are: change management, training accessibility, commitment and alignment with agile techniques (Patanakul and Rufo-McCarron, 2018).

Project Management and Hybrid Methodology

According to the (Hassani et al., 2018) study, a hybrid model is proposed for the digital projects in the current era of digital transformation, which can adopt in all sizes of projects, involves customers, clarifies the requirements at the initiation phase, but allows modifications in later stages, and is eligible for improvements during the project life cycle or even versions of the methodology to be followed, if the complexity requires this. The advantages deriving from this, are the visibility of project status, the continuous and regular adoption in the new circumstances and the customer satisfaction. The major disadvantage of this proposed methodology, according to Hassani et al. (2018), is the customers' lack of willingness to go through unknown versions of an unknown methodology, during a complex project.

According to Jamous et al. (2021), the disadvantages of waterfall and agile approaches in complex projects, as well as an assessment on specific methodologies – combinations of the two, lead to the conclusion that, hybrid methodologies appear to

combine the best characteristics of both waterfall and agile approaches and succeed in complex projects handling. The parameters highlighting the hybrid approaches effectiveness are: inter-team coordination, flexibility, adaptability, predictability, dependency awareness, the adjustments on every team size, the predictable budget, the flexible contact type, the estimable duration, the adaptive scope and the low uncertainty levels (Jamous et al., 2021). It is clear, according to the study results that the disadvantages of each one of the two existing approaches are covered by the hybrid approaches (Jamous et al., 2021).

Last, according to the simulation results of Mitropoulos et al. (2020), based on theoretical evidence from literature, the combination of agile and waterfall characteristics in software development projects is the key for faster and more efficient software development models. In more detail, when the core principles of waterfall methodology are followed, incorporating flexible agile elements the results are more satisfying.

Software Development projects in public and healthcare sectors

In the context of software development projects in the public sector, a comparison between waterfall and an agile oriented flexible methodology was performed (Aleinikova et al., 2020). The study revealed that classic TPM oriented methodologies like waterfall, tend to become obsolete due to the lack of flexibility in response to unavoidable changes, leading to unreasonable resources consumption. The agile approaches on the contrary, emerge as the ideal solution for software development oriented projects.

Lappi et al. (2019) in the context of public sector digitalization, identified the incompatibility of non-traditional project management methodologies with the tools required from the public sector for roles and tasks determination. This is also confirmed with the research of Dietel and Heine (2020) in the same context. Dietel and Heine (2020) highlight the need for research in the agile methods applicability. The agile approach and bureaucracy are incompatible, as indicated by the research conducted by Dietel and Heine (2020). The conflicts of the agile concepts and bureaucracy principles, include among others the strict hierarchies and commands of the public sector, the rule based approach in communication and the extended documentation policies (Dietel and Heine, 2020). Although, they provided a framework for ensuring flexibility, fast and user oriented work in the bureaucratic public sector projects, aiming to succeed better projects results. This could be facilitated by switching to hybrid methodology.

An agile approach Knowledge Management System Agile Implementation Methodology (KSAIM) was successfully used for implementing a knowledge management system in a healthcare sector facility (Perdana et al., 2019). The use of this method, facilitated knowledge sharing, which was vital for the outcome of the project. In similar context, an agile approach in software development system implementation in healthcare sector, has led to successful outcomes by engaging the medical facility staff member, and reinforcing the environment to align with the agile theoretical framework, with interdepartmental interpersonal communication and collaboration (Azar et al., 2019)

Project Management Methodologies and Risks Handling

Yel et al. (2022) orchestrated a software development project risk assessment, with the use of fuzzy risk assessment tools. The paper evaluated projects with both agile and waterfall approaches of software development models and the findings indicated that the possibly induced risks are associated with multiple factors. These include the human factor in relation to the teams skills and the organizational characteristics, various operational attributes of the projects including changes throughout the project life cycle. The conclusion highlights the importance of the combination of right project, right team and methodology allocation, since it appears to combat errors and further possible delays induced.

Hanief et al. (2020) attempted to develop a project management system, aiming to facilitate in project schedule management and risks and threats elimination. Interviews of the project members and project monitoring through archived timeline data, assisted in their work. In the proposed system, the project key performance indicators (KPIs) can be utilized, so as to retrieve useful information for the project and the project status monitoring and decisions making, will be facilitated with reduced uncertainty and thus risk.

Last, in (Kosztyán et al., 2020) research, in the context of a risk analysis tool which was proposed by the researchers, a comparison between traditional, agile and hybrid project management techniques, it is verified that the methodology which leads to the highest amount/ratio of survived projects, is the hybrid methodology. Kosztyán et al. (2020) defined as survived projects the ones remaining attainable after the simulation process executed by the researchers. The hybrid methodology according to their findings did not achieve to mediate and enable a software development project to overcome the

possible risk effects in all the applied cases, although the flexibility assured with the hybrid methodology adoption and the adequacy of the method in managing projects, are key contributors in regards to project survival, due to risks handling, scheduling performance and achieving attainable projects (Kosztyán et al., 2020).

Project Auditing

Agrawal and Chari (2020), in a second review of archived data from these 49 projects, highlight the impact of audit review control (ARC) of project efforts in the estimation of a project outcome, when the waterfall approach is adopted. Furthermore, they identify a relationship between projects defects, overall project effort and project outcomes and they suggest, that since there is ARC effort availability at the early phases of the project, it is reasonable to consult this, for tackling possible threats to the successful project outcome.

Mkoba and Marnewick (2020) in their empirical research highlight the lack of guidance, relevant for the field of agile projects auditing in project management best practices and the limited amount of studies in this relatively new research area. A conceptual framework for auditing agile projects is proposed, since the auditing principles relate more to the processes of the traditional system and software development studies, and the field's practitioners need this guidance, in order to assist by the project's auditing in the project's success

In a similar context of lacking guidelines and metrics for evaluating software developed within a hybrid project management methodology approach, Pradhan and Nanniyur (2019) suggested a quality metrics framework (PIER - Prevention, Inspection, Evaluation, Removal), to define the metrics indicated for hybrid approaches, by measuring and enforcing quality throughout the project life cycle and at phases where important decisions need to be taken.

Chakravarty and Singh (2021) highlighted through a literature research the importance of quality metrics, identified them in traditional approaches and examined their applicability in agile approaches.

3.5 Results Interpretation

To conclude, in this sub-chapter the final step of the PRISMA Protocol, regarding the interpretation of the results is being performed.

Traditional methodologies as presented in the studied sources entail both advantages and disadvantages. According to the literature, the waterfall methodology is a by-nature structured sequential process where the requirements are set upfront. The model focuses in the well documented detailed planning and design of the project lifecycle. After the planning is firmed, the software development process can start. In order for the waterfall methodology to add value in an executed project, the requirements must be well defined and understood by the team members communicating with the customer/user team. In these cases, the projects are executed successfully, since the model is quite simple, the phases of the project are clear and well defined, while they include a review stage at the end of each phase, and the only iteration possible is between phases, only in case it is required.

On the contrary, some elements of the waterfall approach that are accounted as advantages, could be considered as drawbacks when examining the approach through a different prism. The structured and sequential approach indicates that, once each phase of the project is finished and tested, no changes are easily accepted. This is considered as a significant drawback of this method, since the method can not adequately address quick changes (Mitropoulos et al., 2020). Considering the fact that, the requirements are set in the initial phase, where ambiguities might affect the decisions made, this is an important drawback. This situation, increases the uncertainty and risks (Hassani et al., 2018) as well as customer concerns in the initial phases (Thesing et al., 2021) and the project outcome is more likely to be affected negatively, if changes are requested, due to the unplanned induced cost (Chari and Agrawal, 2018), or due to chain effects from the initiation phase, which might threaten the overall project success (Nguyen and Fagerstroem, 2021). The extra cost for these cases, does not only include the software development changes, but also the change in terms of documentation. Last, another reason for possible negative effects of the waterfall approach, is the lack of actual software or system, until relatively late in the project lifecycle (Hassani et al., 2018) and thus the lack of customer involvement .

It is obvious from the results, that the waterfall approach has significantly high impact in project success when the objective is structure and planning, but imposes weaknesses in flexibility and adaptability, time and cost handling, and customer involvement. This weaknesses of waterfall approach are project attributes that the agile approach attempts to address in software development in the age of the digital era. Due to

the increased needs of framework for system or software development projects from industries, a plethora of organizations switch from waterfall to agile approach, or in a "more agile oriented" approach. In this direction, awareness in terms of the threats implied through the transition from waterfall to agile is enforced. The threats are mainly located in change management, training accessibility and commitment and alignment with agile techniques (Patanakul and Rufo-McCarron, 2018).

The agile approach shifts from the traditional and process-oriented and completely documented concept, to a more people-oriented concept, which highlights the importance of the project team and requires less documentation. The team capabilities are also a significant aspect in agile, and are considered as a key contributor in success and efficiency in projects (Tam et al., 2020, Rasnacis and Berzisa, 2016). The people-oriented focus of agile projects alongside with the autonomy provided and the improved team communication team (Romano and Da Silva, 2015), contribute also in an in general higher customer and stakeholder satisfaction than the traditional approaches (Tripp et al., 2016, Serrador and Pinto, 2015). The importance of well trained in agile approaches team members was also highlighted in this context, by multiple researchers.

In relation to the team characteristics, the organizational characteristics of the project environment is another factor that affects the agile implementation. This means, that the business organizational approach needs to be in alignment with the "agile mindset" and hence to be characterized by innovativeness and autonomy (Garcia et al., 2021). The customers in agile are more involved and are considered as part of the project collaborative team.

Agile approaches are perceived as more efficient and valuable in terms of quality and time (Kisielnicki and Misiak, 2017). Due to the iterative approach, changes are not addressed as emergencies, but as a natural part of the project lifecycle, responding more effectively to them than the waterfall approach does (Mitropoulos et al., 2020). The iteration and customer involvement, lead to more frequent assessment of the deliverables and thus in increased productivity and software quality, since the feedback provided throughout the project life cycle, and not only in the end, or after a certain period of time within the implementation phase, lead in high quality, lower costs since no change requests will be performed in an extensive part of the software and thus customer satisfaction. The above stated results, indicate that agile approaches are perceived to be more successful (Kisielnicki and Misiak, 2017; Tripp and Armstrong, 2018; Kordova et

al., 2021; Bambauer-Sachse and Helbling, 2021) and after assessment in completed projects, many organizations turn to agile (Stettina and Hörz, 2015; Tripp and Armstrong, 2018).

Although, agile approaches seem to not respond well in large scale environments, when the teams are not adequately agile trained (Abrar et al., 2020), or in cases where extensive backlogs and informal communication had to be forced in large software projects (Heikkilä et al., 2017).

In such cases, where flexibility or other agile elements, as team collaboration and customer involvement are required, but agile approaches are not totally eligible for a project, either due to large scale or due to the organization of the project environment, which could be totally contradicted to the agile principles, as for instance in the bureaucratic public sector where extensive documentation is required for transparency (Lappi et al., 2019; Dietel and Heine, 2020) the combination of agile and waterfall approaches is encouraged, since multiple researchers concluded that the combination of the two approaches leads to more successful projects (Dingsoeyr et al., 2018, Mitropoulos et al.,2020, Yel et al., 2022, Kordova kai kostyan Schar et al.,2016).

An interesting finding that emerged from the research, is that the mixing (hybridization) of a traditional methodology with an Agile methodology is increasingly accepted by practitioners, leading in successful projects. Hybrid models combine the process driven characteristics deriving from traditional approaches in terms of planning and gathering requirements, but at the same time respond well to complexity, due to flexibility deriving from the iterative and people-oriented agile perspectives in other phases of the project, resulting in an approach that includes the advantages of both approaches, making up for any disadvantages (Jamous et al., 2021; Hassani et al., 2018; Mitropoulos et al.,2020)

Audit review control (ARC) of all methodologies emerges as necessity, due to the association it appears to have with the projects defects and hence the project success (Agrawal and Chari, 2020). In the agile approaches though, there seems to be no sufficient guidance or framework, with minor exceptions, of frameworks proposed for auditing the agile projects (Mkoba and Marnewick, 2020). In similar context, not extensive research has been conducted in the field of agile and public sector interoperability. It is evident that the bureaucratic character of the public sector is not ideal for agile approaches (Dietel and Heine, 2020), opposing to organizations with

entrepreneurial organizations and characteristics (Garcia et al. 2021), since the organizational structure and elements need to generally be in alignment to the adopted methodology. The contribution of innovative, autonomous and proactive entrepreneurial orientation in the organization, could support the use of agile methods (Garcia et al. 2021). Although, according to literature, it is possible to adopt hybrid approaches in these cases, so as to ensure flexibility (Dietel and Heine, 2020).

To conclude, in the literature, it was also identified that conceptual frameworks exist, that can be used from the organizations in order to identify which methodology can suit their needs, and different frameworks and tools, although limited for agile and hybrid approaches, can be used in order to asses the performance of an already applied methodology. Furthermore, the findings from the systematic literature review indicate the association between the business organizational orientation, team structure and skills with the adoption of a project management methodology. The importance of risks and complexity in the project success is also highlighted. Moreover, the literature indicates that an ideal methodology does not exist, and in each case the project nature should (Yel et al., 2022) be evaluated in order to select the most suitable methodology between waterfall and agile approach (Anguelov and Angelova, 2016) or in other cases to devise or adopt an existing hybrid approach to meet the project needs (Thesing et al., 2021).

As a result, the adoption of new approaches or the adoption of a hybrid project management method in software project management needs to be further explored, since the studied sources indicate that, it offers benefits and solutions in cases of uncertainty, vagueness and complexity in the modern software development sector. Last, it is important to highlight that the researchers need to focus on the relatively new area of agile and hybrid approaches and assist with research and tools in the assessment of their products, as well as in their expansion in new fields, like public sector or the ERP implementations, which due to the lack of extensive sources can be identified as a research gap.

4 Case Study

In this chapter, a case study for the methodology developed by the company consolut is conducted. Based on the systematic literature review in chapter 3, hybrid methodologies emerge as necessity in the increased needs for digitalization and more research is required on ERP implementation methodologies, so the hybrid methodology Prisma developed by consolut will be examined. The methodology is used for SAP implementation projects, and the empirical research will be focused in the assessment of the method in terms of project members satisfaction, project outcomes and perceived benefits.

For the data collection quantitative methods were used and the research instrument was questionnaire with closed type questions. Then, the results are analyzed followed by the analysis conclusion. The objective of the research, as described in chapter 1, is to explore the impact of the hybrid PMM, consolut Prisma, to the success of projects performed by consolut, by answering the following questions:

• Is the business organizational structure related to the level of authority in the primary project roles?

• Are factors like the business experience and business role influencing the way project members evaluate the adopted PMM?

• Is the adopted PMM handling project complexity efficiently and how this relates with the project success?

• Are the perceived benefits of the adopted PMM contributing to successful project outcomes?

Last, the target audience of this study and empirical survey results analysis, includes project management field practitioners, SAP consultants and consulting firms, students in relevant fields and researchers interrested in hybrid methodologies for SAP (ERP) implementation assessments.

Research methodology

According to Robson (2002), case study is a “strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple source of evidence”. According to Yin (2003), “case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context”. According to Hartley (1994), a case study is “a detailed investigation,

often with data collected over a period of time, of one or more organizations, or groups within organizations, with a view to providing an analysis of the context and processes involved in the phenomena under study".

Therefore, according to Eisenhardt (1989), the selection of a case study methodology or research strategy, is chosen in order to replicate other existing cases or to further extend theory. In case studies, different methods can be utilized for data collection and analysis. These methods can be quantitative, qualitative or a combination of both (Hartley, 1994).

The methodology that is followed in this thesis is a case study using the quantitative methodology of self-administered questionnaire based survey. This was decided, due to the fact that "self-administered questionnaires are anonymous and therefore provide powerful results, since respondents tend to give more honest answers and feel less pressured when they are not faced with an interviewer" (Bryman & Bell, 2015). Also, the fact that the research topic is related to the IT sector, could be considered as an additional factor indicating this selection, as the right choice. Last, the questionnaire was addressed to consolut company employees, who are located in different countries, so an online survey could assist in conducting the research, including respondents from all countries consolut employees are located, thus enrichening the sample's cultural variation.

The empirical survey was based on previous research by M. Lepmets (2007), as well as M.J. Haverila and K. Fehr (2016), in order to preserve the validity of the questionnaire and subsequently the research results were analyzed in order for the research questions to be answered. Also, in order to assure the content validity, the questionnaire contains statements that are clear and mostly have one answer probability and last but not least the empirical survey is addressed to experts of the sector, eligible for the core study, who would not misinterpret the questions and the survey content (Sweis, 2019), since the sample will constitute from consolut employees, who have already worked with the internally developed hybrid project management methodology called Prisma.

The survey, as mentioned, aims to answer the research questions mentioned in section 1.3. In order to facilitate the research, the tool provided by Google, called Google Forms, was used. The questionnaire, which can be found at the appendix of the thesis (APPENDIX 1), was divided into 5 main sections, which were the following:

1. General Information
2. Projects & Business Characteristics
3. Projects Success Assessment
4. Project Management Methodology Assessment
5. Perceived Benefits of Prisma

4.1 Company Profiling

consolut is an owner-managed international IT consulting company focusing on SAP, digitalization and cloud and operating services. The company specializes in providing expert ERP and SAP services to customers all around the world. The company was established in Mannheim, Germany, in 1998, and has since expanded with offices in other countries, including countries in two continents, Europe and America, and countries as Switzerland, the United States, and Greece. In April 2023, the company consisted of a team of 164 highly qualified employees, with the majority of them technical and functional consultants in different seniority levels from junior to senior level, who work alongside consultants and junior consultants to provide top-quality services to customers.

Over the years, consolut has gained a reputation for its process-driven and process-focused approach, which is focused around the core workflows and operations of a business. By combining its deep understanding of business processes in the areas of finance and logistics with its IT and SAP expertise and the focus on latest IT and SAP technologies, the company aims to offer integrated services that are highly efficient and well-coordinated.

With more than 25 years of experience in the field, consolut obtains now over 280 active customers and has performed over 3500 projects in more than 42 countries around the world. Within the last eight years alone, the company has completed more than 361 SAP S/4 HANA projects, demonstrating its expertise in the latest technologies and methodologies in the field. The Prisma methodology developed by consolut is the methodology which, as mentioned, will be studied in this chapter.

4.2 Statistical Analysis & Results

The survey questionnaire was forwarded, as mentioned, to consolut employees. The total number of employees by the time the survey started were 164, but 26 of them belong in internal departments, including Administration, HR, Marketing, internal IT and

Sales Support, so they were not eligible for the survey. The people who ended up participating in the survey were 68. After completing the survey, the collected answers were exported in Excel Spreadsheet, through the functionality provided by Google Forms tool and imported in SPSS (Statistical Package for Social Sciences) program provided by IBM, in order to analyze the data and extract useful results.

4.2.1 Respondent Profiling

- **Gender**

According to the frequency table below, which is relevant for the gender distribution of the sample, the female respondents of this survey are 27 representing the 39,7% of the sample, the majority of the sample is male, constituting a group of 40 respondents with percentage 58,8% and there is also a 1,5% representing 1 respondent identifying as non-binary.

Table 4.1 Gender distribution frequency table

Gender:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	27	39.7	39.7	39.7
	Male	40	58.8	58.8	98.5
	Non-binary	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

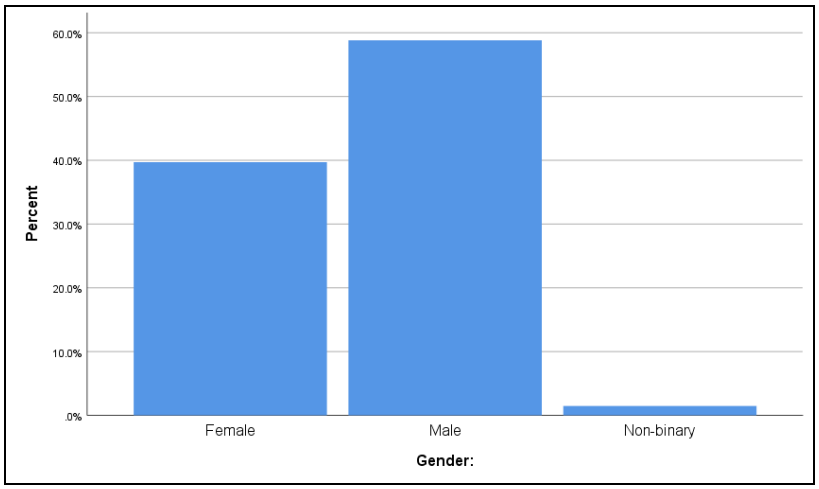

Figure 4.1 Bar chart of gender distribution of the sample

- **Age**

Regarding the age distribution of the sample population, it is observed that of the total of 68 participants in the survey, 25 of them representing the 36.8% of the respondents belong in the age group “18-30”, 32 participants representing the 47.1% belong to the age group “30-45” and last 11 participants belong to the “45+” age group, representing the 16.2% of the respondents.

Table 4.2 Age distribution frequency table

Age:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 30	25	36.8	36.8	36.8
	30 - 45	32	47.1	47.1	83.8
	45+	11	16.2	16.2	100.0
	Total	68	100.0	100.0	

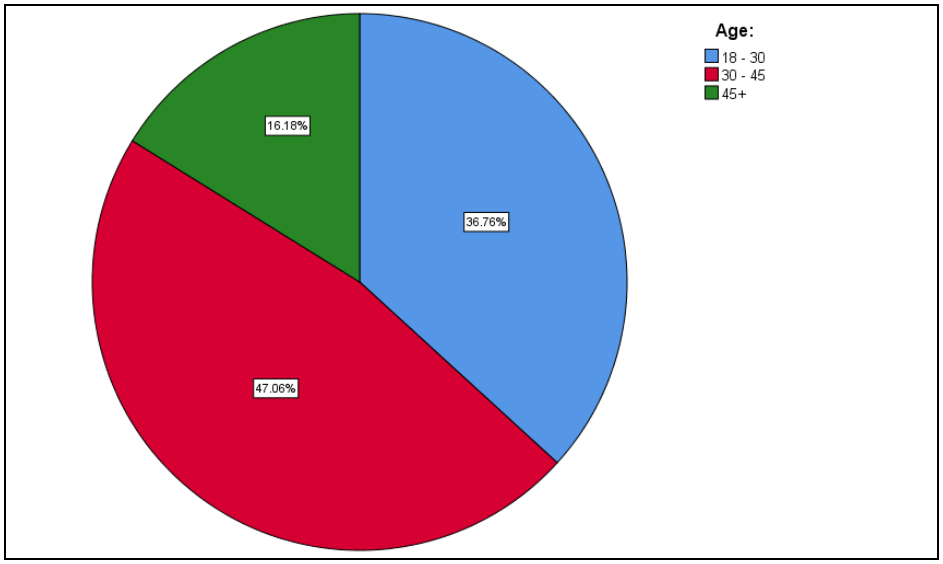

Figure 4.2 Pie chart for age distribution

- **Education Level**

It is observed that the majority of 32 of the employees participating in the survey, hold a Post Graduate degree, either Master or Ph.D., with percentage of 47,1% of the respondents, followed by those who hold an Bachelor Degree and constitute the 27,9% of the respondents. Next, 10 participants are High School graduates, with percentage 14,7% and last 7 participants have obtained a Technical qualification, representing the

10,3% of the sample. It is important to highlight the fact that, a total of 75% of the respondents are University graduates, but also the diverse in educational background amongst the employees.

Table 4.3 Educational level distribution frequency table

Education Level:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School Diploma	10	14.7	14.7	14.7
	Post Graduate Degree (Master,Phd)	32	47.1	47.1	61.8
	Technical Qualification	7	10.3	10.3	72.1
	Undergraduate Degree	19	27.9	27.9	100.0
	Total	68	100.0	100.0	

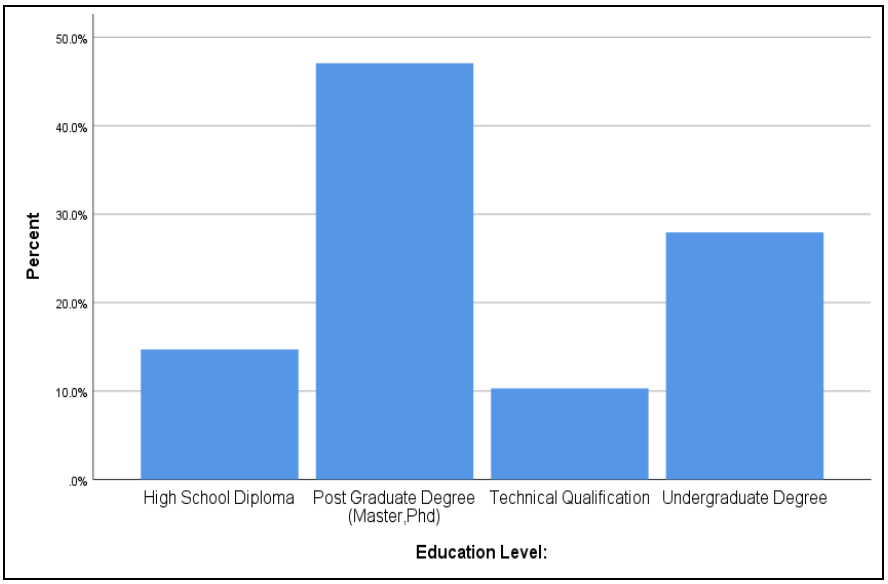

Figure 4.3 Bar chart of educational level distribution of the sample

4.2.2 Respondent Business Profiling

- **Country of employment**

The analysis of the country of employment within project teams highlights the cultural diversity of the corporate environment. Respondents employed in Germany represent the majority (48.5%) of the sample. Next, employees in Greece represent the 41.2% of the sample, in Switzerland the 5.9% of the sample, in the U.S.A. 2.9% of the sample and last respondents employed in other countries constituted 1.5% of the sample.

Table 4.4 Country of employment distribution frequency table

Country of employment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Germany	33	48.5	48.5	48.5
	Greece	28	41.2	41.2	89.7
	Other	1	1.5	1.5	91.2
	Switzerland	4	5.9	5.9	97.1
	U.S.A.	2	2.9	2.9	100.0
	Total	68	100.0	100.0	

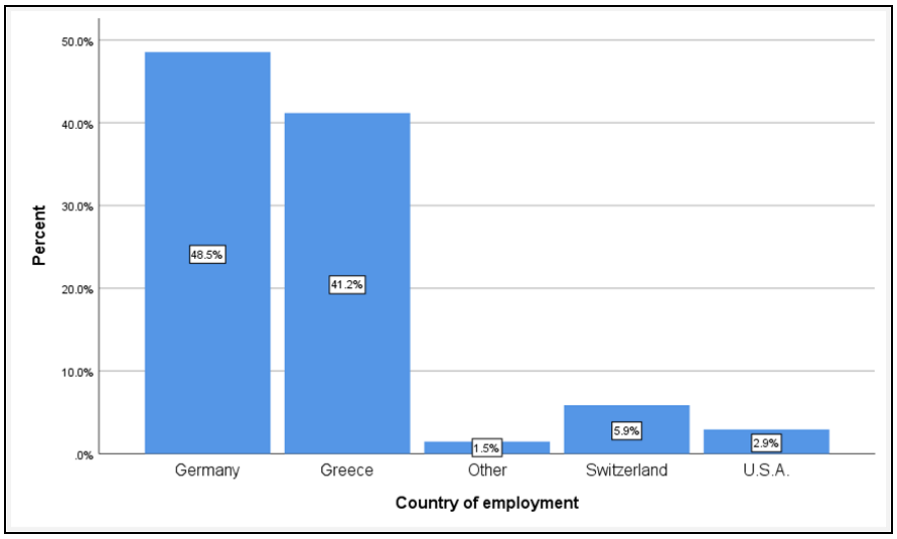

Figure 4.4 Bar chart of country of employment distribution

- **Years of business experience**

Respondents with 0-5 years and 5-15 years of business experience constitute equal percentage of the sample, 38.2% respectively. The first group includes respondents relatively new to the corporate environment, where the likelihood of limited experience in project management is higher, but they can also provide the project with innovative perspective and they tend to be more adaptable, according to the projects needs, while the second group represents respondents quite more experienced than the previous group. Last, the 16 respondents with 15+ years of business experience represent the rest 23.5% of the sample, with employees significantly more experienced than the two other groups. The analysis of business experience within project teams highlights the diverse range of expertise and the potential impact in the project life cycle and the project team environment.

Table 4.5 Years of business experience distribution frequency table

YEARS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	26	38.2	38.2	38.2
	5-15	26	38.2	38.2	76.5
	15+	16	23.5	23.5	100.0
	Total	68	100.0	100.0	

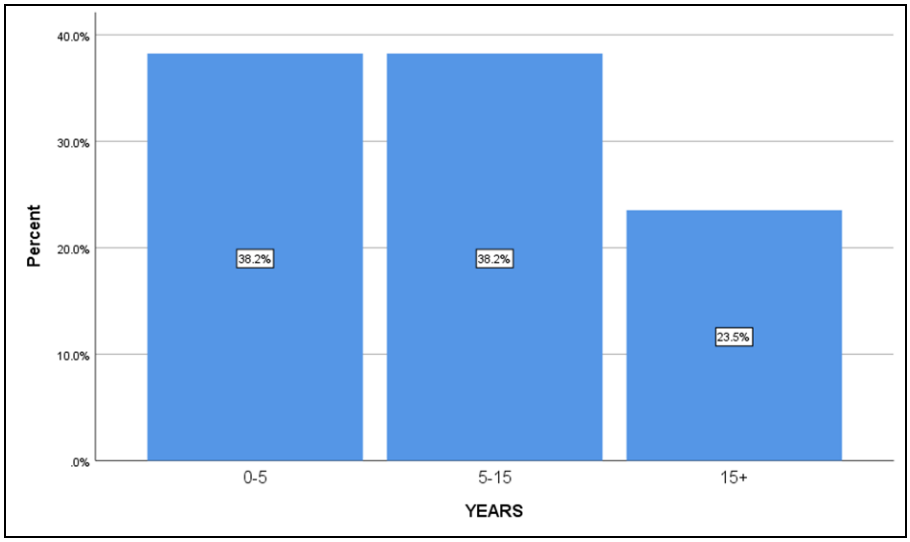

Figure 4.5 Bar chart of years of business experience distribution

- **Business Role**

Functional consultant/ process consultant role is met in 31 out of the 68 participants, with percentage 45.6%. Functional consultants/process consultants role requires the key task of communicating with the customer, thus understanding the customer's processes and business requirements. The next group is technical consultants/developers, who represent 19.1% of the respondents with 13 respondents. Project managers, comprise 5.9% of the respondents and team leaders, represent the 7.4% of the respondents.

The analysis also indicates, that some of the respondents are occupied in multiple roles simultaneously. The frequency distribution of these combined roles, as for instance functional consultant/process consultant and project manager or team leader or technical consultant/developer and team leader, indicates that in our sample functional consultants tend to have combined roles.

Table 4.6 Business role distribution frequency table

Business Role:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Functional consultant / Process Consultant	31	45.6	45.6	45.6
	Functional consultant / Process Consultant, Team Leader	3	4.4	4.4	50.0
	Functional consultant / Process Consultant, Team Leader, Project Manager	3	4.4	4.4	54.4
	Project Manager	4	5.9	5.9	60.3
	Team Leader	5	7.4	7.4	67.6
	Team Leader, Project Manager	4	5.9	5.9	73.5
	Technical consultant / Developer	13	19.1	19.1	92.6
	Technical consultant / Developer, Functional consultant / Process Consultant	2	2.9	2.9	95.6
	Technical consultant / Developer, Project Manager	1	1.5	1.5	97.1
	Technical consultant / Developer, Team Leader	1	1.5	1.5	98.5
	Technical consultant / Developer, Team Leader, Project Manager	1	1.5	1.5	100.0
	Total	68	100.0	100.0	

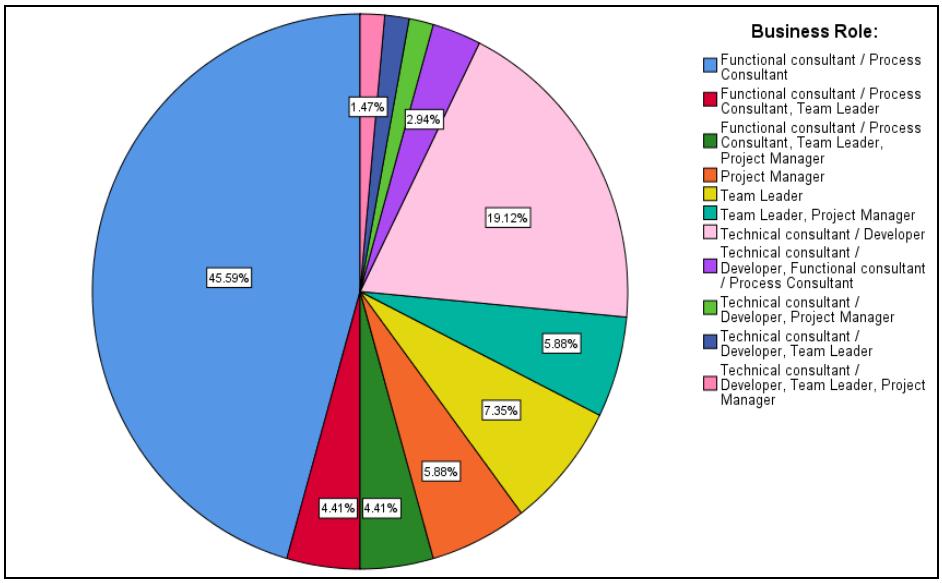

Figure 4.6 Pie chart of business role distribution

- **Phase(s) of a project during which the respondents were mainly involved**

The phase(s) of the project indicated in the survey, are:

- Initiation
- Planning/Development
- Execution/Implementation
- Finalization/Handover

The analysis of the project involvement phases highlights the wide range of project activities and the participation of project members in a variety of phases or combinations of them, when aiming to achieve project success. It is evident that many respondents participate in more that one phase of the project life cycle, and the 20 of them with percentage 29,4% participate in all the phases of the project, while 17 (25%) participate in all phases except Initiation, indicating that the project team usually remains the same during the project. The most frequently answered phase is the Execution/Implementation phase, which can be considered the core project phase.

Table 4.7 Project phases involvement distribution frequency table

Indicate the phase(s) of a project during which you are mainly involved

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Execution / Implementation	7	10.3	10.3	10.3
	Execution / Implementation, Finalization / Handover	5	7.4	7.4	17.6
	Finalization / Handover	1	1.5	1.5	19.1
	Initiation	3	4.4	4.4	23.5
	Initiation, Execution / Implementation	2	2.9	2.9	26.5
	Initiation, Planning / Development	1	1.5	1.5	27.9
	Initiation, Planning / Development, Execution / Implementation	3	4.4	4.4	32.4
	Initiation, Planning / Development, Execution / Implementation, Finalization / Handover	20	29.4	29.4	61.8
	Planning / Development, Execution / Implementation	9	13.2	13.2	75.0
	Planning / Development, Execution / Implementation, Finalization / Handover	17	25.0	25.0	100.0
	Total	68	100.0	100.0	

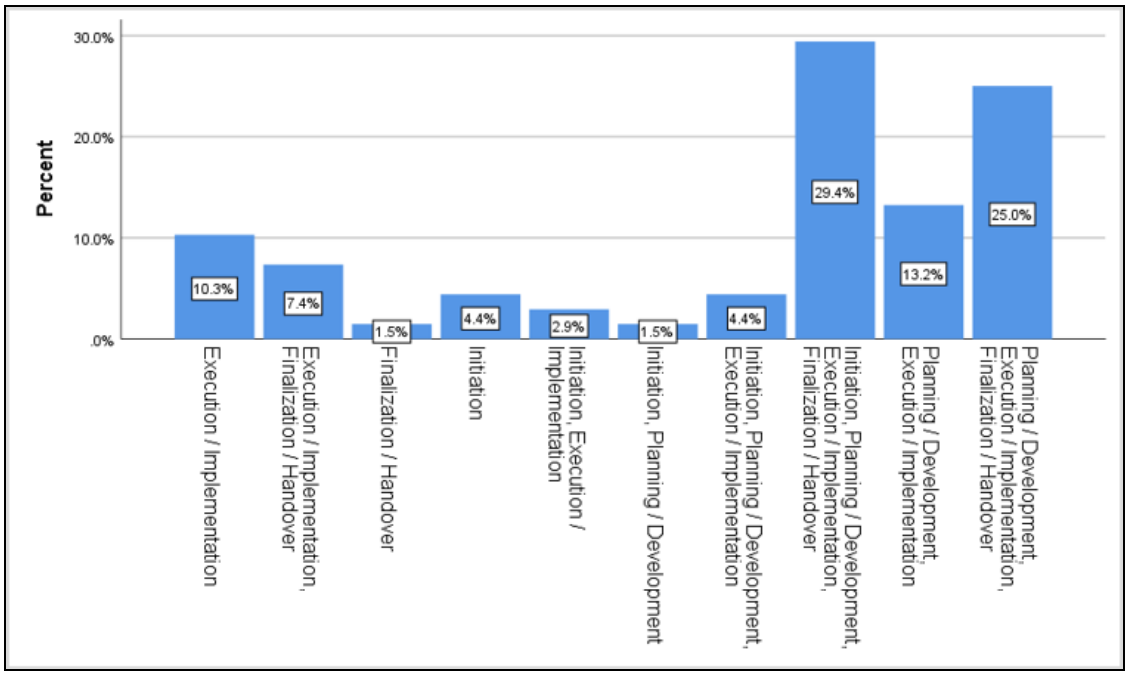

Figure 4.7 Bar chart of the project phases distribution

Considering the fact that only 11 respondents (16,2%) are involved in only one phase, it is evident that the majority of respondents is involved in multiple project phases. It is reasonable to identify the project involvement among the different project roles the respondents have, as appears in the crosstabulation table indicated below.

The key findings here, are the following:

- Both "Functional consultant/Process consultant" and "Technical consultant/developer" are involved in the "Execution/Implementation" phase, which is the core phase of the project. Many of the respondents are also involved in the "Execution/Implementation" phase, alongside with other phases.
- From the 20 respondents (29,4% of the total sample) who participate in all the phases of the project, more than 1 out of 3 have the business role "Functional consultant/Process consultant".
- The employees with business role "Technical consultant/developer" are the group which is less involved in the Initiation phase of the project. This finding is totally reasonable, considering that functional consultants communicate with the customers in the Initiation phase, in order to gather the requirements and identify the project scope.

Table 4.8 Crosstabulation of Project Phases*Business Role

Indicate the phase(s) of a project during which you are mainly involved * Business Role: Crosstabulation

Count

		Business Role:											
		Functional consultant / Process Consultant	Functional consultant / Process Consultant, Team Leader	Functional consultant / Process Consultant, Team Leader, Project Manager	Project Manager	Team Leader	Team Leader, Project Manager	Technical consultant / Developer	Technical consultant / Developer, Functional consultant / Process Consultant	Technical consultant / Developer, Project Manager	Technical consultant / Developer, Team Leader	Technical consultant / Developer, Team Leader, Project Manager	Total
Indicate the phase(s) of a project during which you are mainly involved	Execution / Implementation	3	0	0	1	0	0	3	0	0	0	0	7
	Execution / Implementation, Finalization / Handover	3	1	1	0	0	0	0	0	0	0	0	5
	Finalization / Handover	1	0	0	0	0	0	0	0	0	0	0	1
	Initiation	2	0	0	1	0	0	0	0	0	0	0	3
	Initiation, Execution / Implementation	2	0	0	0	0	0	0	0	0	0	0	2
	Initiation, Planning / Development	0	0	0	0	0	1	0	0	0	0	0	1
	Initiation, Planning / Development, Execution / Implementation	2	0	0	0	0	0	0	1	0	0	0	3
	Initiation, Planning / Development, Execution / Implementation, Finalization / Handover	7	1	1	1	4	2	2	0	1	0	1	20
	Planning / Development, Execution / Implementation	3	0	0	0	1	0	4	0	0	1	0	9
	Planning / Development, Execution / Implementation, Finalization / Handover	8	1	1	1	0	1	4	1	0	0	0	17
Total		31	3	3	4	5	4	13	2	1	1	1	68

- **Project Member Role - years of engagement at Team Member level**

Respondents with 0–5 years of engagement in project work as project team members represent the 47.1% of the sample. The ones with 5–15 and the ones with 15+ years of engagement represent 30.9% and 16.2% of the sample respectively.

Table 4.9 Years of engagement as Team Members frequency table

Project Team Member

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Experience	4	5.9	5.9	5.9
	0-5	32	47.1	47.1	52.9
	5-15	21	30.9	30.9	83.8
	15+	11	16.2	16.2	100.0
	Total	68	100.0	100.0	

- **Project Member Role - years of engagement at Project Manager level**

The majority of the respondents have no experience as project managers, with percentage 57,4%. The project members are in total the 42,6% of the respondents. In more detail, 16 participants belong in the group “0-5” years of project management experience, with percentage 23,5% of the sample, followed by the ones with significantly more experience in project management, who belong in the group “15+”years of project management experience and constitute the 10,3% percent of the sample. Last, the ones with moderate experience in project management, belonging in the group “5-15” years of project management experience, with percentage 8,8%.

Table 4.10 Years of engagement as Project Manager frequency table

Project Manager

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Experience in this level	39	57.4	57.4	57.4
	0-5	16	23.5	23.5	80.9
	5-15	6	8.8	8.8	89.7
	15+	7	10.3	10.3	100.0
	Total	68	100.0	100.0	

- **Typical duration of the primary project(s) that the respondents work on**

Respondents who indicated that their primary projects typically last up to 6 months account for 20.6% of the sample. These projects are considered relatively short-term. Then, respondents who typically participate in projects with duration 6-12 months, represent the 38,2% of the sample. Respondents who indicated project durations of 12-18 months represent the 35.3% of the sample and last respondents whose typical project duration is more than 18 months represented 5.9% of the sample.

The analysis of the typical project duration, highlights the importance of adapting project management methodologies to the specific timeframe, thus the needs of a project. Shorter projects require rapid and efficient execution, while longer projects provide opportunities for more comprehensive planning and in-depth analysis.

Table 4.11 Typical duration of projects frequency table

Typical_duration_reversed_new

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Up to 6 months	14	20.6	20.6	20.6
	6-12 months	26	38.2	38.2	58.8
	12-18 months	24	35.3	35.3	94.1
	More than 18 months	4	5.9	5.9	100.0
	Total	68	100.0	100.0	

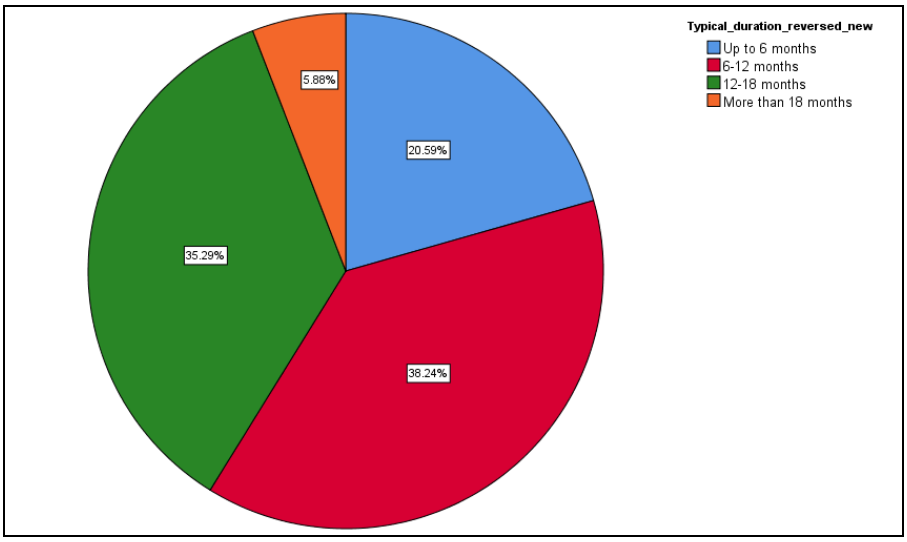

Figure 4.8 Pie chart of the project's typical duration distribution

- **Level of authority in primary project roles**

22 respondents (32,4%) indicated that the authority in their primary project roles is limited. In limited authority cases, the key decisions and the overall project directions are taken in higher levels of management. 21 respondents (30,9%) have authority withing the established project plan while the majority of respondents, constituted of 25 individuals (36,8%) are fully authorized to achieve project deliverables, within their primary project roles. The examination of authority levels within primary project roles highlights the importance of delegation, decision-making initiatives and autonomy within project teams.

Table 4.12 Level of authority in primary project roles frequency table

Level of Authority

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Limited authority	22	32.4	32.4	32.4
	Authority within established project plan	21	30.9	30.9	63.2
	Fully authorized	25	36.8	36.8	100.0
	Total	68	100.0	100.0	

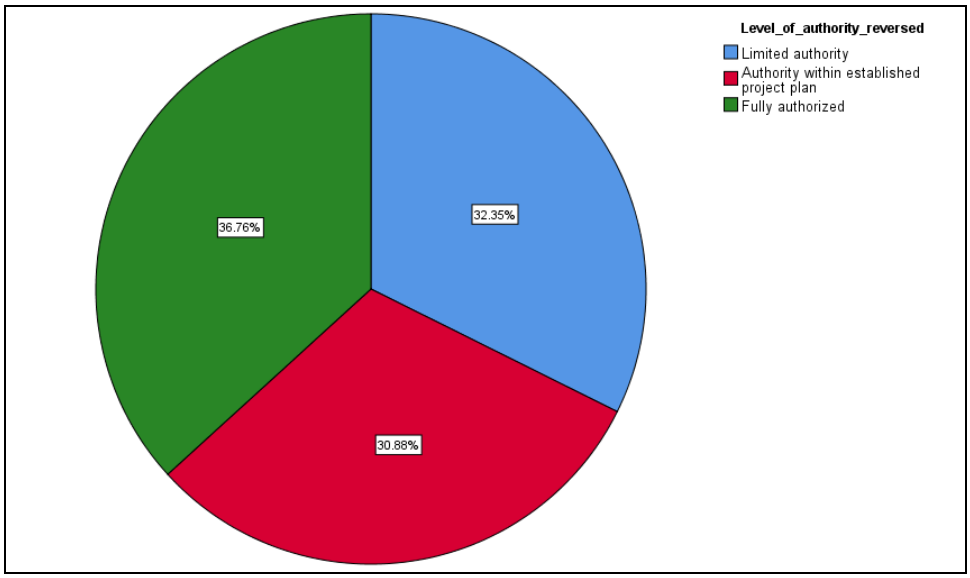

Figure 4.9 Pie chart of the level of authority in projects distribution

- **Organizational structure in the operational business area**

Respondents who indicated a balanced matrix organizational structure represent the 35.3% of the sample. In a balanced matrix, both functional and project managers hold authority. Respondents who describe the organizational structure as composite represent 22.1% of the sample. A composite organization is a blend of functional, matrix, and projectized structures. Since the company invests in developing a hybrid method, combining the benefits of both approaches, it is observed that the results with the highest frequency, are those of balanced matrix and composite organization, with a cumulative percent of 57,4%.

Continuing, respondents who reported a strong matrix organizational structure represented 19.1% of the sample. In a strong matrix, the project manager has greater authority than functional managers. Then, respondents who describe the organizational structure as functional represent the 14.7% of the sample. In a functional structure, employees are grouped into departments, based on their skills and functions. Following respondents who describe the organizational structure as weak matrix represent the 5.9% of the sample. In a weak matrix, functional managers have more authority than the project manager.

Last, respondents who describe the organizational structure as project-based constituted 2.9% of the sample. In a project-based structure, project managers have full authority.

Table 4.13 Organizational structure distribution frequency table

How would you describe the organizational structure in your operational area ?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Balanced matrix - Both the functional and project managers hold authority.	24	35.3	35.3	35.3
	Composite Organization - blend of functional, matrix and projectized organization	15	22.1	22.1	57.4
	Functional - grouped into departments where people with similar skills are kept together in forms of groups. No project	10	14.7	14.7	72.1
	Project Based - project manager full authority.	2	2.9	2.9	75.0
	Strong matrix - the project manager has greater authority than a functional manager.	13	19.1	19.1	94.1
	Weak matrix - functional manager has more authority than project manager.	4	5.9	5.9	100.0
	Total	68	100.0	100.0	

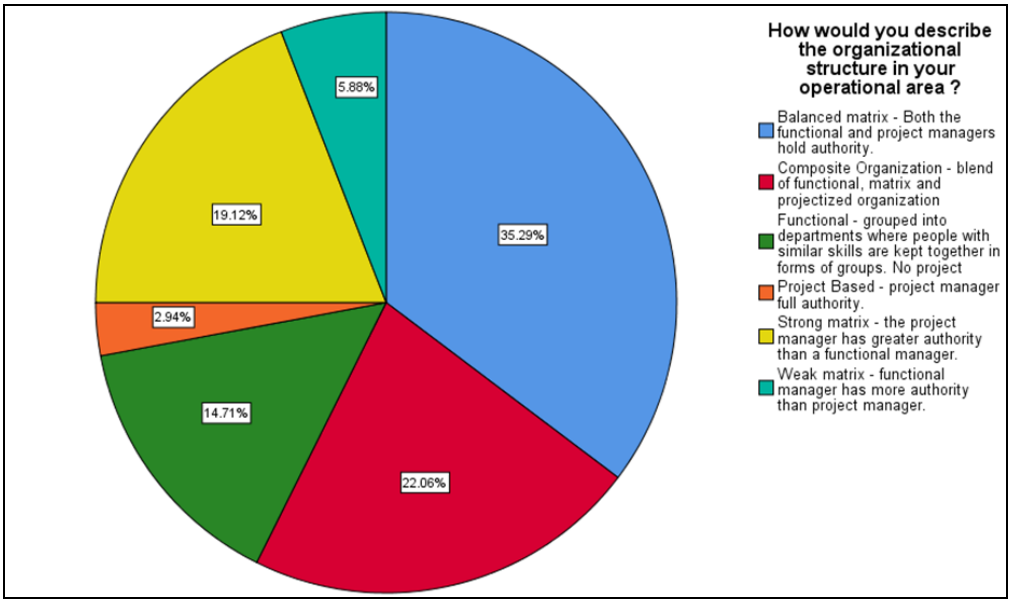

Figure 4.10 Pie chart of the organizational structure distribution

4.2.3 Research Questions Results

- **Is the business organizational structure related to the project members level of authority?**

In order to identify if there is a relation between the business organizational structure and the adopted methodology, the chi-square test of independence is used, examining the authorizations level of team members in projects in regards to the business organizational structure.

The Pearson chi-square test of independence (x2 =10,806) with the respective freedom degrees (df = 10) and p-value (p = 0,373), higher than the significance level (5%), indicate that there is no significant statistical association between the authorizations level within projects and the business organizational structure.

Likewise, Likelihood ratio value (x2= 12,596) with the respective freedom degrees (df = 10) and p-value (p = 0,247) and Linear-by-Linear Association, with p-value (p=0,975) indicate again no significant association. Fisher's Exact Test, with p-value (p=0,491), more than the significance level (5%), indicates that there are no statistically strong evidence to reject the above mentioned implications.

Table 4.14 Chi square of independence between level of authority and organizational structure

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10.806[a]	10	.373	.389		
Likelihood Ratio	12.596	10	.247	.364		
Fisher's Exact Test	9.199			.491		
Linear-by-Linear Association	.001[b]	1	.975	.981	.493	.010
N of Valid Cases	68					

a. 14 cells (77.8%) have expected count less than 5. The minimum expected count is .62.

b. The standardized statistic is .032.

Concluding, the results indicate lack of significant relation between the authorization level within the project teams and the business organizational structure,

although the interpretation of these results, might not be enough for strong allegations and further research or analysis might be required to export safe results.

- **Are factors like the business experience and business role influencing the way project members evaluate the adopted PMM?**

To answer this question, he responses were scored. This score was calculated from the responses in the five point Likert scales used in the questionnaires, aiming to evaluate the adopted project management methodology. n this context, it would be useful to examine the results, that could affect the respondents business perception and thus the methodology evaluation from two different perspectives. These are the years of business experience and the business role.

The aim is to identify, if there is a statistically significant difference in the average score of the satisfaction levels of the respondents in regards to business experience and the business role. In order to examine this, the ANOVA test was used, considering that the score distribution data, fulfil the criteria for parametric test ($p > 0,05$) (APPENDIX 2).

Level of satisfaction ~ Years of business experience

The test results suggest that there is no statistical evidence to support, that there is an actual effect of the years of business experience to the variations in the level of satisfaction, among the different respondents groups based on the business experience. The F-value (0,981), and the p-value ($p= 0,381$), which is higher than the significance level (5%), indicates that any variation is random.

Table 4.15 ANOVA test for level of satisfaction in relation to business experience

ANOVA

Score_level_of_satisfaction

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	185.349	2	92.674	.981	.381
Within Groups	6143.284	65	94.512		
Total	6328.632	67			

Level of satisfaction ~ Business role

Likewise, the results of the test, indicate that there is no statistical evidence to support that any significant difference in the level of satisfaction among the different business roles groups, has a statistically significant effect. The F-value (0,778), and the p-value (0,650), which is again higher than the significance level (5%), indicates that any possible variation is random, as in the above case.

Table 4.16 ANOVA test for level of satisfaction in relation to business role

ANOVA

Score_level_of_satisfaction

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	759.657	10	75.966	.778	.650
Within Groups	5568.976	57	97.701		
Total	6328.632	67			

In this context, it was also investigated, if the respondents show any preference for characteristics of the hybrid methodology, that derive either from TPM or agile approach. Examining the above formulation, the data were adjusted, aiming to quantify the answers that retrieve the TPM and the Agile oriented characteristics of the methodology, respectively. To answer the above question two scores were calculated.

The one is relevant for the assessment of the respondents satisfaction, regarding characteristics of the methodology which derive from TPM approaches, as for instance reliable project scheduling, emphasis on requirements gathering in the initiation phase of the project and in structured planning and documentation. The other score, is relevant for the assessment of the respondents satisfaction, regarding characteristics of the methodology which derive from agile approach, as for instance the frequent meetings on weekly basis, the extended customer involvement and open communication. In this case the non-parametric Kruskal-Wallis test was used, because the parametric test indicated that (APPENDIX 2).

Based on the test, there is no statistically strong evidence to support that the assessment of characteristics deriving from TPM or agile approaches differ significantly across the levels of the grouping variables of years of business experience or business

role. In more detail, for the TPM related characteristic, the p-values p= 0,267 and p= 0,266 respectively and in the agile related characteristics p= 0,584 and p= 0,148 respectively. All of these, are greater than the conventional significance level (5%). This fact that indicates, that any observed differences in the assessment of characteristics which derive from either TPM or agile approaches, on business experience and business role levels are random findings.

Table 4.17 KW test for TPM characteristic in relation to business experience and role

Test Statistics[a,b]

	TPM
Kruskal-Wallis H	2.644
df	2
Asymp. Sig.	.267

a. Kruskal Wallis Test

b. Grouping Variable: YEARS

Test Statistics[a,b]

	TPM
Kruskal-Wallis H	2.645
df	2
Asymp. Sig.	.266

a. Kruskal Wallis Test

b. Grouping Variable: Business Role:

Table 4.18 KW test for agile characteristic in relation to business experience and role

Test Statistics[a,b]

	Agile
Kruskal-Wallis H	1.076
df	2
Asymp. Sig.	.584

a. Kruskal Wallis Test

b. Grouping Variable: YEARS

Test Statistics[a,b]

	Agile
Kruskal-Wallis H	3.817
df	2
Asymp. Sig.	.148

a. Kruskal Wallis Test

b. Grouping Variable: Business Role:

To conclude, the years of business experience and the business role, do not affect the satisfaction of the respondents from the Prisma consolut methodology. In addition to

that, those two business characteristics, do not implicate any significant results in the preference or evaluation of TPM or agile characteristics of the hybrid methodology.

- **Is the adopted PMM handling project complexity efficiently and how this relates with project success?**

The correlation (r = - 0,266) with the relevant p-value (p = 0,028, p < 0,05) indicates that there is a statistically significant negative correlation between project complexity and project success. This means that when the project complexity is increased, the possible project success tends to be decreased.

However, it is worth mentioning that the correlation does not justify causation, which is reasonable, considering the fact that other factors, not accounted in this research can affect the project success.

Table 4.19 Correlation test between project complexity and project success

Correlations

		Project_complexity	Project_success
Project_complexity	Pearson Correlation	1	-.266*
	Sig. (2-tailed)		.028
	N	68	68
Project_success	Pearson Correlation	-.266*	1
	Sig. (2-tailed)	.028	
	N	68	68

*. Correlation is significant at the 0.05 level (2-tailed).

In the questionnaire, Likert scales were used, in order to identify the main factors contributing in project complexity according to the respondents. The results indicated the impact on project complexity, for each on of them:

Tight Budget

Out of the total 68 respondents, only 3 respondents with cumulative percent 4,4% believe that tight budget has low or very low impact on the project complexity. 20 respondents (29,4%) indicated that it has a neutral impact. A considerable high proportion of 33 individuals (48,5%) consider that tight budget is contributing in project

complexity, while 12 respondents (17,6%) consider that it has a very high influence. In total, 66,1% of the respondents indicated that tight budgetary constraints have a high or very high influence in the project complexity.

Table 4.20 Complexity factors: Tight Budgetary Constraints

Budget

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	1.5	1.5	1.5
	Low	2	2.9	2.9	4.4
	Neutral	20	29.4	29.4	33.8
	High	33	48.5	48.5	82.4
	Very High	12	17.6	17.6	100.0
	Total	68	100.0	100.0	

Tight deadline

Only 1 respondent representing the 1,5% of the sample perceives tight deadlines as a factor with very low impact in the project complexity. 14 respondents consider it as a neutral contributor, while 29 (42,6%) and 24 (35,3%) respondents respectively, consider that tight deadlines has a high and very high contribution in project complexity. The majority of the respondents acknowledge the contribution of this factor in project complexity, since the cumulative percentage of the respondents, perceiving time restriction as “high” and “very high” complexity factor, is 77,9% .

Table 4.21 Complexity Factors: Tight Deadline

Deadline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	1.5	1.5	1.5
	Neutral	14	20.6	20.6	22.1
	High	29	42.6	42.6	64.7
	Very High	24	35.3	35.3	100.0
	Total	68	100.0	100.0	

Technical complexity

Only 6 respondents, with cumulative percentage 8,8% of the sample recognize technical complexity as having a low or very low contribution in project complexity and 14 (20,6%) of the respondents perceive this factor as of neutral significance. 31 respondents consider technical complexity a factor with high impact in complexity and last 17 (25%) view technical complexity as a factor with a very high impact in complexity. Overall, nearly 1 out of 3 (70,6%) of the respondents assess this factor as of high or very high impact, pointing out that understanding the technical requirement is a really important aspect of a project.

Table 4.22 Complexity Factors: Technical Complexity

Technical complexity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	1.5	1.5	1.5
	Low	5	7.4	7.4	8.8
	Neutral	14	20.6	20.6	29.4
	High	31	45.6	45.6	75.0
	Very High	17	25.0	25.0	100.0
	Total	68	100.0	100.0	

Requirements complexity

Only 1 and 2 of the respondents find the requirement's complexity as a factor with very low or low influence in project complexity respectively, with cumulative percent 4,4%. 14 respondents (14,5%) perceive this factor as of neutral impact in project complexity and a cumulative percentage of 69,1% consider this factor as of high and very high significance in the project complexity, highlighting the importance of a clear strategy in requirements gathering and understanding.

Table 4.23 Complexity Factors: Requirements Complexity

Requirements complexity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	1.5	1.5	1.5
	Low	2	2.9	2.9	4.4
	Neutral	18	26.5	26.5	30.9
	High	30	44.1	44.1	75.0
	Very High	17	25.0	25.0	100.0
	Total	68	100.0	100.0	

Large number of project members

Large number of project members is perceived as a very low impact in complexity factor from 7,4% of the respondents and 20,6% of the respondents as low. As neutral impact in complexity is perceived from 36,8%, while 27,9 % of respondents consider the large number of project members as high impact factor in complexity and 7,4% as a very high.

Table 4.24 Complexity Factors: Extended project teams

Large number of project members

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	5	7.4	7.4	7.4
	Low	14	20.6	20.6	27.9
	Neutral	25	36.8	36.8	64.7
	High	19	27.9	27.9	92.6
	Very High	5	7.4	7.4	100.0
	Total	68	100.0	100.0	

Geographic split of team members

In the context of post-Covid-19 era, and with the remote working establishment, it is significant that nearly more than 3 out of 4 (86,8%) do not consider the geographic split between team members as a high or very high complexity factor and that more than 1 in 2 (57,3%) consider it as low or very low impact factor in project complexity.

Table 4.25 Complexity Factors: Geographic split of team members

Geographical split of team members					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	16	23.5	23.5	23.5
	Low	23	33.8	33.8	57.3
	Neutral	20	29.4	29.4	86.8
	High	9	13.2	13.2	100.0
	Total	68	100.0	100.0	

Customer's lack of change management acceptance

Only 5 of the respondents perceive a customer's lack of change management acceptance as having low or very low influence in project complexity, with cumulative percentage 7,4%. Neutral contributor is considered by 18 respondents (26,5%) and as a high and very high contributor is considered in total by 55 respondents (66,2%). The results indicate that the customers resistance in change is emerging complexity and thus should be appropriately handled.

Table 4.26 Complexity Factors: Customers lack of Change management approval

Customers lack of change management					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	1.5	1.5	1.5
	Low	4	5.9	5.9	7.4
	Neutral	18	26.5	26.5	33.8
	High	23	33.8	33.8	67.6
	Very High	22	32.4	32.4	100.0
	Total	68	100.0	100.0	

In conclusion, there is a number of factors that affect project complexity in various extents. Factors such as tight budget, tight deadlines, technical complexity, requirement complexity, and the customer's lack of acceptance of change management were generally perceived as high contributors in project complexity. On the contrary, factors like geographic splits of team members, and extended project member teams were

considered to have a low impact in project complexity, but they should still be carefully handled to ensure they do not interfere with the project success.

In this context, and since the correlation results indicate that the higher project complexity is related with a lower probability of project success, the way Prisma consolut methodology is handling those complexity factors was assessed from the respondents. The assessment of Prisma consolut response against the above stated complexity factors was evaluated through five-point Likert scales, which were then calibrated. Their statistic frequency leads in acknowledging, that the methodology is responding well to those factors.

In more detail, the methodology seems to be responding well to tight budgetary constraints, since the median value is 6, with minimum and maximum values 3 and 9, representing the smallest and largest observed values respectively. Last, the skewness value (0,501) indicates that slight skew towards higher success levels is observed.

Table 4.27 Basic descriptive measures for the total score of method success in terms of cost

			Statistic	Std. Error
Methology_success_in_terms_of_cost	Mean		5.5735	.15441
	95% Confidence Interval for Mean	Lower Bound	5.2653	
		Upper Bound	5.8817	
	5% Trimmed Mean		5.5261	
	Median		6.0000	
	Variance		1.621	
	Std. Deviation		1.27333	
	Minimum		3.00	
	Maximum		9.00	
	Range		6.00	
	Interquartile Range		1.00	
	Skewness		.501	.291
	Kurtosis		.108	.574

Tight deadline is also a factor that the methodology seems to be, in general, responding well to, since the median value is 6, with minimum and maximum values 3 and 9, representing the smallest and largest observed values respectively.

Table 4.28 Basic descriptive measures for the total score of method success in terms of time

			Statistic	Std. Error
Methology_success_in_terms_of_time	Mean		5.3382	.17853
	95% Confidence Interval for Mean	Lower Bound	4.9819	
		Upper Bound	5.6946	
	5% Trimmed Mean		5.3039	
	Median		6.0000	
	Variance		2.167	
	Std. Deviation		1.47223	
	Minimum		3.00	
	Maximum		9.00	
	Range		6.00	
	Interquartile Range		2.00	
	Skewness		.198	.291
	Kurtosis		-.565	.574

Likewise, the focus on quality as response to technical complex requirements, as well as general complexity in requirements are also factors that the methodology seems to be responding well. As observed, the median value is 6, with minimum and maximum values 3 and 9, representing the smallest and largest values respectively.

Table 4.29 Basic descriptive measures for the total score of method success in terms of quality

			Statistic	Std. Error
Method_success_in_terms_of_quality	Mean		5.8824	.17720
	95% Confidence Interval for Mean	Lower Bound	5.5287	
		Upper Bound	6.2360	
	5% Trimmed Mean		5.8529	
	Median		6.0000	
	Variance		2.135	
	Std. Deviation		1.46123	
	Minimum		3.00	
	Maximum		9.00	
	Range		6.00	
	Interquartile Range		3.00	
	Skewness		.121	.291
	Kurtosis		-.691	.574

Last, the methodology seems to have developed mechanisms that are responding well to customer's lack of change management acceptance, since the median value is 6, with minimum and maximum values 3 and 9, representing the smallest and largest

observed values respectively. The skewness value (0,545) indicate slight skew towards higher success levels.

Table 4.30 Basic descriptive measures for the total score of method success in terms of customer acceptance

			Statistic	Std. Error
Method_success_in_terms_of_acceptance_by_the_customer	Mean		5.8088	.19459
	95% Confidence Interval for Mean	Lower Bound	5.4204	
		Upper Bound	6.1972	
	5% Trimmed Mean		5.7484	
	Median		6.0000	
	Variance		2.575	
	Std. Deviation		1.60463	
	Minimum		3.00	
	Maximum		9.00	
	Range		6.00	
	Interquartile Range		2.00	
	Skewness		.545	.291
	Kurtosis		-.399	.574

It is worth mentioning that, the median and not the mean value was preferred for representing the typical value in the above cases, because the majority of the distributions were skewed, so the mean value could be influenced by extreme values.

To conclude, the results indicate that higher project complexity relates to lower probability of project success. The factors, that according to the respondents have a high influence in project complexity, are tight budgetary and timing constraints, technical complexity, requirement complexity, and the customer's lack of change management acceptance. Last, the methodology seems to respond, in general, well and tackle the complexity factors according to the respondents.

- **Are the perceived benefits of the adopted PMM contributing to successful project outcomes?**

There is statistically significant positive correlation ($r= 0,452$, $p < 0,001$) between project success and the perceived Prisma consolut benefits. This finding is important for the analysis, because it means that when the adoption of the hybrid Prisma consolut methodology leads to high levels of perceived benefits, it is associated with successful projects outcomes. It is important to point out again, that correlation does not indicate

causation, and there might be more factors that can influence the perceived Prisma benefits and the project success.

Table 4.31 Correlation test between project success and consolut Prisma benefits

Correlations

			Project_success	Prisma_Benefits
Spearman's rho	Project_success	Correlation Coefficient	1.000	.452**
		Sig. (2-tailed)	.	.000
		N	68	68
	Prisma_Benefits	Correlation Coefficient	.452**	1.000
		Sig. (2-tailed)	.000	.
		N	68	68

**. Correlation is significant at the 0.01 level (2-tailed).

In this context, it would be reasonable to briefly mention the perceived Prisma consolut benefits. Through the questionnaires in the empirical survey, with the use of Likert scale, the perceived benefits of the methodology assessment were identified according to the respondents. The results indicated that 43 respondents agree or totally agree with the statement that "Prisma consolut methodology flexible and adaptable, combating the projects complexity", with cumulative percent 63,2 %. 22 respondents (52,9%) remain neutral towards this statement, while 3 of them, with a cumulative percentage of 4,4% disagree or totally disagree with the statement.

Table 4.32 Prisma benefits: flexibility and adaptability

The adopted PMM is flexible and adaptable, combating the projects complexity.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	1	1.5	1.5	1.5
	Disagree	2	2.9	2.9	4.4
	Neutral	22	32.4	32.4	36.8
	Agree	36	52.9	52.9	89.7
	Totally Agree	7	10.3	10.3	100.0
	Total	68	100.0	100.0	

Regarding structure and planning provision of the methodology, the 45 of respondents (66,2%) agreed or totally agreed with the statement “The adopted PMM offers the nessesary structure for the project planning”. The percentage of neutral responses is 30,9% representing 21 individuals, while the cumulative percentage of disagreeing or totally disagreeing responses is 2,9% .

Table 4.33 Prisma benefits: structure for project planning

The adopted PMM offers the nessesary structure for the project planning.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	1	1.5	1.5	1.5
	Disagree	1	1.5	1.5	2.9
	Neutral	21	30.9	30.9	33.8
	Agree	34	50.0	50.0	83.8
	Totally Agree	11	16.2	16.2	100.0
	Total	68	100.0	100.0	

Regarding customer satisfaction in terms of the project deliverable, the majority of the respondents agree or totally agree with the statement that “The customers are satisfied with the project deliverable” with cumulative percentage 75% . 3 of the respondents (19,1%) have a neutral attitude towards this statement and only 4 of them (5,9%) disagree or totally disagree with the statement.

Table 4.34 Prisma benefits: customer satisfaction in relation to deliverables

The customers are satisfied with the project deliverable.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	1	1.5	1.5	1.5
	Disagree	3	4.4	4.4	5.9
	Neutral	13	19.1	19.1	25.0
	Agree	38	55.9	55.9	80.9
	Totally Agree	13	19.1	19.1	100.0
	Total	68	100.0	100.0	

Continuing, and in regards to customer satisfaction, the majority of the respondents agree or totally agree with the statement, that "The customers are satisfied with the PMM followed during the project and consider it helpful for the positive project outcome". The disagreement proportion is again low, with those disagreeing or agreeing to constitute a cumulative percent of 4,4%. It is observed that a significant proportion of the respondents (39,7%), neither agree nor disagree. This might suggest, that customers do not consider that the methodology actively contributes in the project outcome.

Table 4.35 Prisma benefits: customer satisfaction in relation to project methodology

The customers are satisfied with the PMM followed during the project and consider it helpful for the positive project outcome.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	1	1.5	1.5	1.5
	Disagree	2	2.9	2.9	4.4
	Neutral	27	39.7	39.7	44.1
	Agree	30	44.1	44.1	88.2
	Totally Agree	8	11.8	11.8	100.0
	Total	68	100.0	100.0	

In conclusion, the perceived consolut Prisma benefits according to the answers received, are the coexistence of flexibility and adoptability alongside with structure and planning in the project context, as well as the customer satisfaction. The positive relation between project success and perceived Prisma consolut benefits, indicates the possible value of adopting the Prisma methodology in achieving successful project outcomes.

The above stated analysis, is a result of the provided data and perhaps additional feedback from customers perspective would add value, succeeding to gain a deeper look in the strengths and weaknesses of the adopted methodology.

5 Conclusions & Future Research

5.1 Analysis of research objectives fulfillment

This master thesis is consisted of two parts. In the first part the SLR was conducted, based on the PRISMA protocol. The second part was a case study for the company consolut, where quantitative methods were used for the data collection. Then the data were further statistically analyzed to extract impactful information. The two parts, lead to results which answer the research questions relevant to the respective research objectives set in Chapter 1.3.

The SLR conclusions, as answers to the research questions according to the respective research objectives are mentioned below.

- **Objective 1:** Understand how project management strategy is selected based on the existing PMMs.

RQ1: The PMMs are assessed based on criteria that an organization or a company considers as significant, so as to select a suitable project management methodology for each project and focuses on the factors that the selected PMM can and will affect, while contributing to the success of a project. These criteria according to the SLR are: cost, quality, project team synthesis, project characteristics and customer satisfaction. As the literature indicates, there are sometimes frameworks developed, in order to group the criteria and the pain points and suggest the ideal methodology for each case.

When a methodology is selected, organizations should identify with accuracy their pain points, in order to justify the selected methodology and define the metrics to facilitate project performance evaluation. The implementation of an agile approach instead of a traditional one, affects positively the cost, quality, productivity and customer satisfaction according to the results of the SLR. It is important to highlight, that the agile methodology should be chosen, only if the customer is willing to be involved and the organizational structure is aligned to the agile principles. Also, this methodology can easily adopt in requirements changes from the customer, so in cases where the requirements are not clear in the initiation phase, and the circumstances of the organizational structure allows it, agile is also preferred. but in case the customer is not willing to be involved, the selection of the agile approach will cause issues in

clarification of requirements, and subsequently in productivity reduction and thus, in insufficient product quality.

Furthermore, despite the fact that the agile approach to software development seems to work efficiently in practice even in more complex situations, another indicator to avoid agile approaches, as verified from the SLR results, is the size of the project and the complexity this leads to, when a project is large scaled, considering, that the methodology is not based on detailed cost estimation in the initiation phase. Last, in Agile approach the team is autonomous and knowledgeable regarding agile elements, so in case of lack of agile trained project team or lack of autonomy and self-initiative, when some decisions are vital, the agile is not the best option.

In these cases, the Waterfall model, representing the traditional project management methodologies, is suited to support teams without particular experience in software development, or teams that are constantly reorganizing their composition. In these cases and also in projects where the customer involvement is limited and requirements need to be gathered at the initiation phase, the detailed planning of this approach leads to a clear overview of the project lifecycle. In case none of the above methods are suitable, a hybrid methodology is selected, depending on the pain points identified and the metrics considered significant in each project, in order for the adopted methodology to include all elements that are required from both approaches. In these cases, hybridization leads to combination of beneficial characteristics in existing methodologies, depending on the needs of each project or organization. As explained, TPM is characterized by a more serial structure and extensive planning while agile approach by more flexibility.

Also, in cases that the agile flexibility is desired, agile approach is not always attainable to use, due to complexity and organizational characteristics. In these cases the agile framework can then be transformed into a hybrid approach, to establish flexibility, speed and results by incorporating waterfall characteristics to ensure a well defined plan and project scope from the beginning. Except this, sources in the SLR indicated that, when agile spiral models include microphases of waterfall approach at specific points, the methodology is more trustworthy and quick (Mitropoulos et al., 2020). The stated arguments indicate, that the hybrid PMMs include processes that differ in key phases from the existing ones and they are developed to overcome obstacles, cover gaps and combine characteristics of existing methodologies in a more efficient way, leading to successful projects.

- **Objective 2:** Investigate how specific attributes, like the skills in existing teams and risk handling affect the selection of a project management methodology.

RQ2: Skills on existing teams portray a significant role in the project management selection, mainly in agile methodologies, where the project team synthesis is very important, as one of the most important attributes of the methodology (Dingsoeyr et al., 2018). The selection of the agile methodology, requires that the project members are, in majority, trained on the agile techniques Romano and Da Silva, 2015), considering that the agile approach tends to lead to higher success rate of the project when the degree of the methodology application is higher, as indicated in the SLR (Serrador and Pinto, 2015). For this reason, many organizations need to consider providing specific training programs on the practices of Agile, as for example in Scrum, which is the most popular approach and with one of the highest success rate model in Agile methodology, when there is intention to adopt this approach in their projects. This applies in all organizations and projects, although agile methods are based on knowledge sharing and learn by doing. Last, except skilled and competent project members in agile practices, it is important to highlight teams skills, based on group and not on individual level. If the necessary decision making, autonomy and effective collaboration are not excelled, then the PMM selection should be TPM oriented or hybrid, to assure that requirements planning and project lifecycle are properly defined, understood and executed.

RQ3: The main risk factors interfering with projects are the individual characteristics of the project members, as well as characteristics in teams, as skillset, various organizational attributes of the team synthesis and the degree of change management adoption (Yel et al, 2022) as well as large and complicated in terms of requirements projects. When a project is allocated to the right project management methodology, both waterfall and agile approaches seem to respond well in terms of risk (Anguelov and Angelova, 2016). In the same context, Kosztyan et al., 2020 suggested that hybrid project management methodologies lead to more efficient “amount/ratio” of successful projects, which highlights the importance of the alignment between the project characteristics and the PMM adopted. Last, as a way to track progress and drawbacks in projects, the use of KPIs is suggested, in order to take the nessesary decisions in the right timing and reduce risks (Hanief et al., 2020).

- **Objective 3:** Explore the impact of the hybrid PMM, consolut Prisma, to the success of projects performed by consolut, a company specialized in SAP consulting.

RQ4: The x2 test of independence indicated no association of the business organizational structure with the level of authority in the project roles

RQ5: The results of the statistical tests, indicate no significant association between the years of business experience or the business role and the satisfaction of the respondents from the Prisma consolut methodology. In this context, an extra test was performed in order to identify, if the seniority in terms of business experience or role lead in preference of agile or waterfall characteristics of the hybrid methodology, which again did not result in any significant association.

RQ6: The correlation test results suggests a rather significant negative association between the perceived project complexity and project success. The factors with the highest perceived contribution in project complexity, are: tight budget, tight deadlines, technical complexity, requirement complexity, and the customer's lack of acceptance of change management. The factors with less perceived contribution in projects complexity, are the geographic splits of team members, and extended project member teams. Prisma consolut methodology seems to respond well in the high complexity contributors.

RQ7: The perceived benefits from consolut Prisma are the flexibility and adoptability alongside with structure and planning in the project context and the customer satisfaction. The positive correlation between project success and perceived Prisma consolut benefits, leads to the conclusion of possible value from adopting the Prisma methodology in achieving successful project outcomes.

5.2 Conclusions

In general, the conclusions of this thesis, shed light and group the certain criteria, which affect projects, hence the PMM selection. The most important criteria, according to the results of this thesis, are: technical and requirements complexity as well as factors

like cost in relation to budget constraints, time in relation to tight deadlines, degree of change management acceptance, team synthesis, risk handling, methodological provision for planning but also flexibility, customer satisfaction and framework for monitoring the adopted methodology and the quality of projects. According to these findings, project management experts should consider these criteria, based on the uniqueness of each project, in the attempt to select the proper methodology and achieve successful project management.

The uniqueness of each project needs, depends on the nature of each project. This statement is the key to decompose the complexity and identify the ideal project management methodology. Hence, distinct custom based hybrid approaches, combining characteristics of both traditional and agile approaches, are beneficial for project management, since they allow organizations to identify the project needs and allocate the proper characteristics of each methodology to each project, in order to achieve project success, overcoming complexity.

5.3 Research Limitations

Research limitations are observed, both in terms of the SLR and the consolut case study. In the first case, since the researcher was one, it is more likely than in cases were more than one researcher is involved, to have a biased approach in terms of literature assessment. Also, in the research field relevant for agile and hybrid methodologies, in plenty of the studied sources, it was highlighted that not a plethora of sufficient studies exist, in the fields of auditing agile and hybrid projects and implementing ERP systems with hybrid or agile approaches. This, as mentioned in the respective chapter, was also identified as a research gap.

In the case study, the sample size was limited (68 respondents) and the empirical research was mainly focused in the consolut hybrid Prisma methodology, thus the results can not be generalized. A questionnaire with structured and predefined questions was used to conduct the research, which comparing to qualitative interviews eliminates the respondents from further explaining their opinion or point of view, which could potentially lead to useful information. Last, although the sample was distributed among several countries, the majority of the respondents are located in the European Union, while other continents' representation in the total sample was minimal.

5.4 Suggestions for Future Research

The limitations of this research could potentially be used as inspiration for further studies. Thus, further research in more than one enterprises implementing ERPs with hybrid or agile methodology, could be more easily generalized and add value in this field of research. Also, research with qualitative interviews from the respondents would be beneficial, and considering the fact that there is relatively lack of sufficient research in this field, it can shed light in the field of ERP implementation projects. The empirical research on ERP implementation projects could further evolve, in other countries of continents outside Europe. Last, further research in consolut case, or in any similar company, including the customer's side, would result in important feedback regarding the developed and adopted methodology as well as the user satisfaction from the project outcome.

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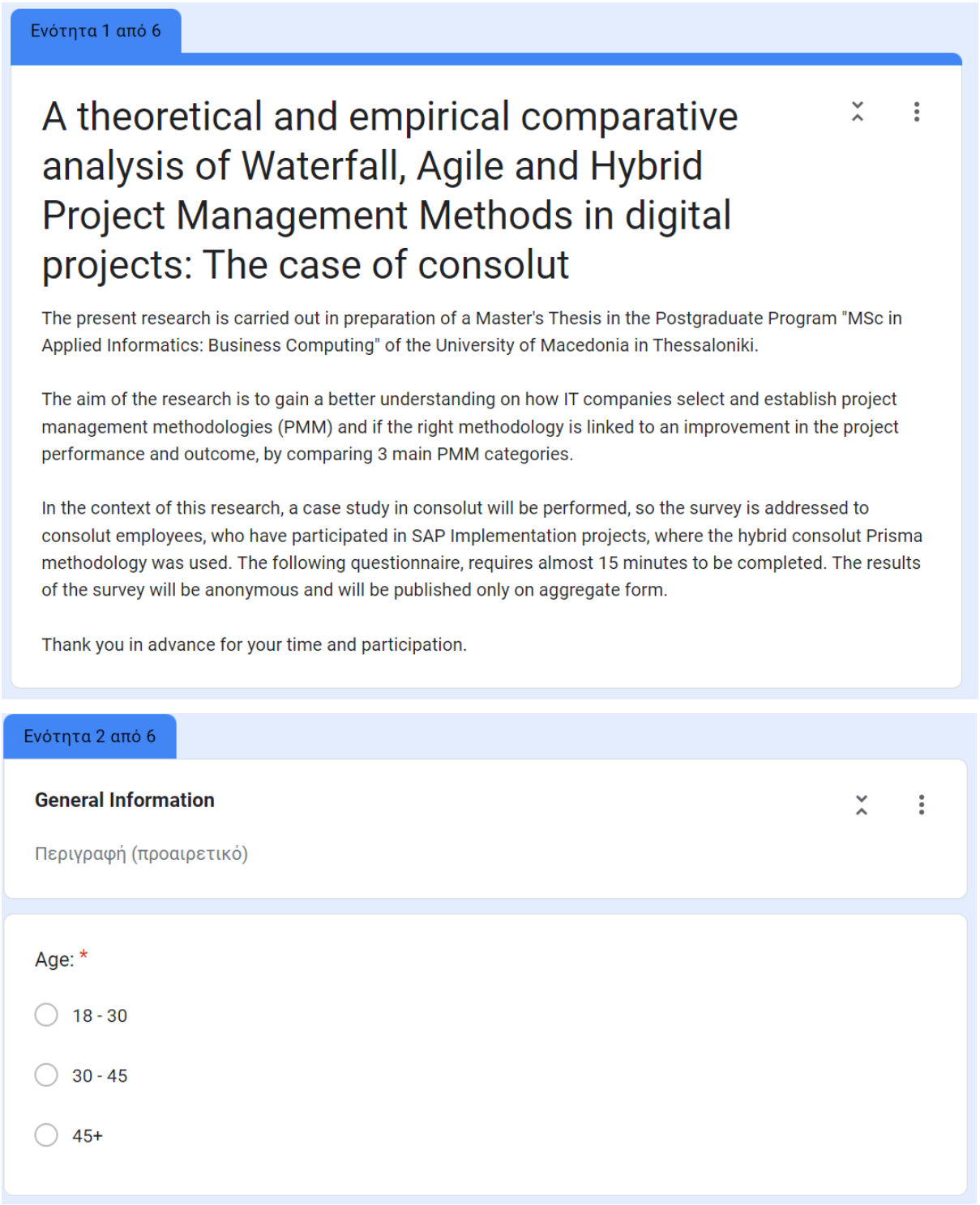
Appendix 1

- Questionnaire (Google Forms)



Ενότητα 1 από 6

A theoretical and empirical comparative analysis of Waterfall, Agile and Hybrid Project Management Methods in digital projects: The case of consolut

The present research is carried out in preparation of a Master's Thesis in the Postgraduate Program "MSc in Applied Informatics: Business Computing" of the University of Macedonia in Thessaloniki.

The aim of the research is to gain a better understanding on how IT companies select and establish project management methodologies (PMM) and if the right methodology is linked to an improvement in the project performance and outcome, by comparing 3 main PMM categories.

In the context of this research, a case study in consolut will be performed, so the survey is addressed to consolut employees, who have participated in SAP Implementation projects, where the hybrid consolut Prisma methodology was used. The following questionnaire, requires almost 15 minutes to be completed. The results of the survey will be anonymous and will be published only on aggregate form.

Thank you in advance for your time and participation.

Ενότητα 2 από 6

General Information

Περιγραφή (προαιρετικό)

Age: *

- 18 - 30
- 30 - 45
- 45+

Gender: *

- ○ Female
- ○ Male
- ○ Non-binary

Education Level: *

- ○ High School Diploma
- ○ Technical Qualification
- ○ Undergraduate Degree
- ○ Post Graduate Degree (Master,Phd)

Years of Business Experience: *

- ○ 0 - 5
- ○ 5 - 15
- ○ 15 +

Business Role: *

- ☐ Technical consultant / Developer
- ☐ Functional consultant / Process Consultant
- ☐ Team Leader
- ☐ Project Manager

Country of employment *

- Germany
- Greece
- Switzerland
- U.S.A.
- Other

Ενότητα 3 από 6

Projects & Business Characteristics

Περιγραφή (προαιρετικό)

Project Member Role - years of engagement at each level: *

	No experience in t...	0 - 5	5 - 15	15 +
Project Team Mem...				
Project Manager				

Level of authority in your primary project roles *

- Fully authorized to achieve project outcomes/deliverables
- Authority within established project plan
- Limited authority - parameters and key decisions referred to higher levels of management

Typical duration of the primary project(s) that you work on *

- ○ Up to 6 months
- ○ 6 - 12 months
- ○ 12 - 18 months
- ○ More than 18 months

Indicate the phase(s) of a project during which you are mainly involved *

- ☐ Initiation
- ☐ Planning / Development
- ☐ Execution / Implementation
- ☐ Finalization / Handover

How would you describe the organizational structure in your operational area ? *

- ○ Functional - grouped into departments where people with similar skills are kept together in forms of grou...
- ○ Weak matrix - functional manager has more authority than project manager.
- ○ Balanced matrix - Both the functional and project managers hold authority.
- ○ Strong matrix - the project manager has greater authority than a functional manager.
- ○ Project Based - project manager full authority.
- ○ Composite Organization - blend of functional, matrix and projectized organization

To what extent, according to your opinion, are the following factors contributing in project complexity: *

	Very Low	Low	Neutral	High	Very High
Tight Budget	○	○	○	○	○
Tight Deadline	○	○	○	○	○
Technical com...	○	○	○	○	○
Requirement's ...	○	○	○	○	○
Large number ...	○	○	○	○	○
Geographic spl...	○	○	○	○	○
Customer's lac...	○	○	○	○	○

Ενότητα 4 από 6

Projects Success Assessment

Περιγραφή (προαιρετικό)

To what extent do you agree with the following statements about the projects you were involved: *

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
The project wa...	○	○	○	○	○
The project wa...	○	○	○	○	○
The project wa...	○	○	○	○	○
The project ac...	○	○	○	○	○
The developed ...	○	○	○	○	○

Ενότητα 5 από 6

Project Management Methodology Assessment

Περιγραφή (προαιρετικό)

Level of satisfaction with the adopted project management methodology and it's contribution in consolut's projects success in terms of: *

	Dissatisfied	Less satisfied	Satisfied	Very satisfied	Totally satisfied
Time	○	○	○	○	○
Cost	○	○	○	○	○
Quality	○	○	○	○	○
Communicatio...	○	○	○	○	○
Communicatio...	○	○	○	○	○

Level of satisfaction with the adopted project management methodology, for attending meetings/site visits to understand the project requirements: *

- ○ Dissatisfied - such meetings are not a priority, leading to lack of understanding project in terms of require...
- ○ Less Dissatisfied - limited planning, leading to in general unprepared project teams due to issues with un...
- ○ Satisfied - sufficient provision exists but could be better.
- ○ Very Satisfied - such meetings are planned, providing with requirements gathering, project planning and p...
- ○ Totally Satisfied - frequently planned, providing with requirements gathering, accurate project planning a...

Level of satisfaction with the adopted project management methodology, in terms of reliable project scheduling and meeting milestones specified by the project schedule: *

- Dissatisfied - consistently fail in delivering according to plan facing significant delays and disruptions, du...
- Less dissatisfied - occasionally deliver according to plan, deliverables are often late leading to delays and...
- Satisfied - what is expected is delivered, but there is room for planning improvement.
- Very satisfied - consistently meet the expectations, but there is still some room for planning improvement.
- Totally Satisfied - consistently deliver according to plan and performance exceeds expectations due to ac...

Level of satisfaction with the adopted project management methodology, for providing complete documentation, as per the project schedule? *

- Dissatisfied - the documentation provided is not sufficient or not delivered on time, causing significant dr...
- Less Dissatisfied - while the documentation is in general delivered according to plan, there are still misco...
- Satisfied - documentation is in general complete and accurate, but could still be better.
- Very Satisfied - documentation is complete, accurate, and delivered on time, but could still be better.
- Totally Satisfied - documentation is always complete, accurate, and delivered on time, exceeding expecta...

Level of satisfaction with the adopted project management methodology, for committing the appropriate resources to complete the project, as scheduled *

- Dissatisfied - lacks in clarity and in clear framework, leading to failure with the allocation of sufficient res...
- Less Dissatisfied - provides with basic guidance but the project team occasionally fails in sufficient reso...
- Satisfied - clear guidance but could still be better.
- Very Satisfied - consistent resources allocation, but could still be more efficient.
- Totally Satisfied - totally effective in providing with a clear framework for resources allocation.

Level of satisfaction with the adopted project management methodology, regarding meetings' frequency on weekly basis: *

- ○ Dissatisfied - too frequent, no progress within a week, I do not need updates so soon.
- ○ Less Dissatisfied - frequent meetings do not work that well.
- ○ Satisfied - frequent meetings are nessesary but could be improved.
- ○ Very Satisfied - the frequent meetings are helpful for the team for updates and guidelines.
- ○ Totally Satisfied - the frequent meetings are totally helpful for the team for updates and guidelines.

Level of satisfaction with the adopted project management methodology, for: *

	Dissatisfied	Less Dissatisfi...	Satisfied	Very Satisfied	Totally Satisfied
communicatin...	○	○	○	○	○
working with al...	○	○	○	○	○
customer user...	○	○	○	○	○
conducting pro...	○	○	○	○	○
final deliverabl...	○	○	○	○	○
project support...	○	○	○	○	○

Ενότητα 6 από 6

Perceived Benefits of Prisma

Περιγραφή (προαιρετικό)

In general, do you agree with the following statements? *

	Totally Disagree	Disagree	Neutral	Agree	Totally Agree
The adopted P...	○	○	○	○	○
The adopted P...	○	○	○	○	○
I consider that ...	○	○	○	○	○
The customers...	○	○	○	○	○
The customers...	○	○	○	○	○
The customers...	○	○	○	○	○

Appendix 2

- Tests of Normality for “Level of Satisfaction” score

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Score of level of satisfaction	.093	68	.200*	.983	68	.491

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

- Tests of Normality for “TPM” and “Agile” scores

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TPM	.144	68	.001	.963	68	.044
Agile	.138	68	.003	.955	68	.016

a. Lilliefors Significance Correction