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HYBRID PROJECT MANAGEMENT AND PROJECT SUCCESS

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Tämän opinnäytetyön tarkoituksena on esitellä tieteellisesti ja järjestelmällisesti muotoiltu tutkimus projektinhallinnan alalla. Tutkittavana oleva ilmiö oli Agile-stage gate -hybridiprojektinhallintamenetelmien vaikutus projektin menestykseen. Lisäksi tutkittiin kolmen muuttujan vaikutuksia valitun projektinhallintamenetelmän ja projektin onnistumisen väliseen suhteeseen. Muuttujat olivat, johtamistyyli, tiimityöskentelyyn laatua sekä organisaation kulttuuri.

Tutkimusmenetelmäksi valittiin tapaustutkimus, jossa haastateltiin kahdeksan projektinhallinnan ammattilaista neljästä eri organisaatiosta. Haastattelut jaettiin kolmeen pääteemaan, tapausyrityksissä käytössä olevat projektinhallintamenetelmät, projektin menestyskriteerit, ja muuttujien roolit tapausyrityksissä.

Tutkimustulokset paljastivat, että tutkitussa organisaatioissa, projektipäälliköt halusivat käyttää projektin menestyskriteereiksi perinteisesti tunnettuja kustannus-, laatu- sekä aika-kriteereitä, mutta lisäksi arvostettiin myös asiakastytyväisyyttä sekä arvon tuottoa projektin lopputuloksena. Todettiin, että perinteisten projektinhallintamenetelmien avulla saavutetaan vain kolme viidestä menestyskriteeristä ja että menestyskriteereiden saavuttamiseksi tarvitaan räätälöity hybridiprojektinhallintamenetelmä. Lisäksi havaittiin, että projektipäälliköiden johtamistyyliellä on suora vaikutus projektinhallintamenetelmän ja projektin menestyksen väliseen suhteeseen. Tiimityön laadun ja organisaatiokulttuurin vaikutukset olivat merkittäviä projektin menestykseen, mutta sillä oli vain vähäinen vaikutus projektinhallintamenetelmän ja projektin onnistumisen väliseen suhteeseen.

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ABSTRACT

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The purpose of this thesis is to present a scientifically and systematically performed research in the field of project management. The phenomenon under investigation was the effect of Agile-stage gate hybrid project management methods on project success. In addition, three variables were introduced to investigate their moderating effects on the relationship between the project management methodology chosen and project success.

The research was performed using the case study method where eight project management professionals from four different organization were interviewed. The interviews were structured under three main themes, project management methods used in case companies, project success criteria used in case companies, and the role and perception of each of the three enablers in the case company.

The research results were systematically analysed with the theory framework. Further, a thematic analysis was performed to understand the interview data. The analysed data revealed that in the case organizations investigated, the project managers preferred to use the project success criteria of cost, quality and time, but with addition of customer satisfaction and value generation. It was found that with the use of traditional project management methods only three of the five success criteria can be achieved, and a customized hybrid project management method will be more beneficial to reach all the five project success criteria. Furthermore, it was observed that the leadership styles of project managers do have effect on the relationship between the project management method and project success. The effects of the other two enablers, teamwork quality and organizational culture, were significant on project success, but had only a minimal effect on the relationship between the project management method and the project success.

Keywords Hybrid project management, agile-stage gate, project success

TABLE OF CONTENTS

	LIST OF FIGURES AND TABLES	8
	LIST OF ACRONYMS AND ABBREVIATIONS.....	10
1	INTRODUCTION	11
	1.1 Research Gap	12
	1.2 Research Questions	14
	1.3 Theoretical Framework.....	15
	1.4 Structure of the Thesis.....	16
2	LITERATURE REVIEW.....	18
	2.1 Traditional Project Management.....	18
	2.1.1 Background of Traditional Project Management.....	18
	2.1.2 The Stage Gate system	23
	2.1.3 Section Summary of TPM	25
	2.2 Agile project management	28
	2.2.1 Background of Agile Project Management	28
	2.2.2 Challenges with APM in New Product Development Projects.....	33
	2.2.3 Section summary of APM	34
	2.3 What is Hybrid project management?.....	36
	2.3.1 Different hybrid approaches	37
	2.3.2 Agile-Stage Gate Hybrids.....	39
	2.3.3 Hybrid model example 1: Industrial Scrum framework for NPD ..	40
	2.3.4 Hybrid model example 2: Agile-Stage-gate at front end of NPD ..	42
	2.3.5 Section summary of HPM.....	43
	2.4 What is Project Success	45
	2.4.1 Literature review on project success.	45
	2.4.2 Section summary for PS.....	49
	2.5 Enablers in hybrid project management environment.	50
	2.5.1 Organizational culture	51
	2.5.2 The Competing values framework	52
	2.5.3 Leadership styles in project management	54
	2.5.4 Quality of teamwork.....	57
3	RESEARCH DESIGN AND METHODS.....	61

3.1.1	Introduction to the Case companies.....	65
3.1.2	Data collection procedure.....	70
3.1.3	Method of data analysis.....	70
4	DATA ANALYSIS.....	74
4.1	Analysis of RQ1	74
4.1.1	Analysis of PM methods used in case companies.....	74
4.1.2	Analysis of presently used PM methods in case companies.....	76
4.1.3	Analysis of project success criteria in case companies	78
4.2	Analysis of RQ2	80
4.2.1	Analysis of Leadership styles in the case companies	80
4.2.2	Analysis of Quality of teamwork in the case companies.....	84
4.2.3	Analysis of Organizational culture in the case companies.....	86
5	DISCUSSIONS AND CONCLUSION	89
5.1	Theoretical Contribution.....	89
5.1.1	Project Management Method and Its Effect on Project Success..	89
5.1.2	Effects of Enablers on the Relationship between PM Method and PS.	91
5.2	Managerial Contribution.....	94
5.3	Limitations and Recommendations for Further Research.....	96
6	REFERENCES.....	99
7	APPENDICES.....	107
	Appendix 1: The Agile Manifesto	107
	Appendix 2: The twelve principles behind Agile Manifesto.....	108
	Appendix 3: The OCAI instrument for organizational culture identification	109
	Appendix 4: The interview questions.....	110
	Appendix 5: View of interview replies analysis spreadsheet.....	112

LIST OF FIGURES AND TABLES

Figure 1: Theoretical framework	16
Figure 2: Mind-map of Literature review, part one.....	18
Figure 3: Example of early Gantt chart. (Wilson, 2003).....	19
Figure 4: Stage gate system	24
Figure 5: The Waterfall model of processes	26
Figure 6: Lean and Agile as Umbrella terms	29
Figure 7: SCRUM Methodology.....	32
Figure 8: Hybrid by project phases	38
Figure 9: Industrial Scrum Framework for NPD	41
Figure 10: Agile-Stage-gate innovation process with early stage sprints.....	42
Figure 11: Iron triangle of Project success.....	46
Figure 12: The competing values framework	53
Figure 13: Responses to interview invitations	64
Figure 14: The key project stages and the disciplines at CC1.....	66
Figure 15: Project services offered by CC2	67
Figure 16: Customized gate model for power plant projects at CC2.....	67
Figure 17: Project offerings and project phases at CC3.....	68
Figure 18: Project lifecycle stages at CC4	69
Figure 19: Model of data collection, analysis and results	71
Figure 20: Answers on core business activities in case companies.....	73
Figure 21: Answers for type of projects in case companies	73
Figure 22: Word cloud for PM methods used in case companies	75
Figure 23: Word cloud for interview answers on project success criteria.	78
Figure 24: Word cloud for OC in case companies.....	87
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Table 1. Definitions of the term “Project” from various sources	26
Table 2: Definitions of Project management from various sources	27
Table 3: The Four Agile values	30
Table 4: Definition of Agile project management from various sources.....	35

Table 5: Definitions of Hybrid project management methods.....	44
Table 6: Atkinsons Square root criteria of project success	47
Table 7: Success criteria measured in three critical groups.	48
Table 8: Summary of project success criteria based on literature review.	50
Table 9: Schools of leadership theory in 20 th century	55
Table 10: TPM v/s APM team characteristics	58
Table 11: Research steps and timelines	61
Table 12: List of interviewees for case study.....	62
Table 13: Interview questions and themes for RQ1	74
Table 14: Quotes for project methods used in case company	75
Table 15: Interview quotes for advantages and disadvantages of PM methods .	77
Table 16: Interview quotes for project success criteria in case companies	79
Table 17: Interview questions and respective themes for RQ2	80
Table 18: Interview quotes for role of project manager in case companies.....	81
Table 19: Interview quotes on project managers leadership styles and skills	83
Table 20: Interview quotes on Quality of teamwork.....	85
Table 21: Interview quotes for OC and its effects on project performance.....	88

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Full form
PM	Project Manager.
PS	Project Success
R&D	Research and development.
NPD	New product development
TPM	Traditional project management.
APM	Agile project management.
CVF	Competing values framework
HPM	Hybrid project management.
OC	Organizational culture
CC1	Case company one
CC2	Case company two
ER1	External reference one
ER2	External reference two

1 INTRODUCTION

This thesis is written from a project manager's and a researcher's point of view. The intended readers of this thesis are project management professionals, project managers, students and new product development project practitioners, who are interested in the topics of Agile project management or Agile-Stage Gate hybrid practices to manage projects. The thesis presents knowledge on traditional project management terminologies (Stage-Gate and Waterfall) and Agile project management practices.

This thesis is written as a part of Master's level studies. Thus, attention is also given towards presenting this study in a clear scientific format that facilitates the transfer of information to the reader.

The purpose of this research is to understand what the combination of agile project management techniques along with traditional project management methods will help to set success criteria to projects in case organizations. The case organizations chosen are dealing with physical engineering products and projects delivering physical solutions.

The reason this subject is interesting to be studied is because the agile project management techniques that are proven to be successful for the software development and are now becoming increasingly popular into machine engineering and machinery development industry. The understanding behind why this may be happening is to cope with the exploding innovations in past few decades to hardware industry. Be it the automotive industry, or heavy machinery or even infrastructure development, increasing integration of software into hardware systems is one of the biggest innovations of present times. There is also an increasing demand for transparency in project processes, decision making and adaptability to continuous change. This has put more challenges to managing projects in hardware industry. There are examples from major industry players who have successfully integrated Agile into their operations to varying degrees, companies like Tesla and X-Space, Volvo Cars, SAAB aeronautics, Lockheed martin aeronautics, Haier, and Apple have

been in the forefront of agile transformation during the past decade (2010 → 2020). These organizations have not only attempted a technological shift, but also a transformation of domains, and even crossing over into other domains (Denning, 2020).

The hybrid project management methodology (HPM) in context of this research simply means selective combination of two widely used project management methodologies namely, the Agile methodology and Stage-Gate methodology. A hybrid approach or methodology is interesting to be researched as such a customized method may allow the organizations to take advantages of best from both the methodologies and can enhance the project's ability to achieve better results, reach g the goals faster, or minimize project expenses (Strasser, 2020).

The research will study how the enablers influence the relationship between hybrid project management methodologies and project success. This research variables chosen are Leadership styles, Quality of Team work and Organizational cultures.

The Competing value framework theoretical model will be introduced as a theoretical framework. The competing value framework (CVF) is widely used as a framework for studying organizational cultures. The framework focuses on competing tensions and conflicts typically existing within human organizations. The competing value framework suites well for this research because it identifies two dimensions. One dimension being the competing demand between change and stability and the other dimension reflecting on the competition between internal demands of an organization to that of its external environment (Denison, 1991).

1.1 Research Gap

Previous research findings prove that the project methodologies chosen do have an impact on the project success. In addition, it is also known that the organizational environment will influence this relationship. Meaning simply that *“Project success will depend not only on the project methodology chosen, but also the environment where a project exists”* (Joslin & Müller, 2016a). The research by Joslin

and Müller (Joslin & Müller, 2016a) finds that large portion of the methodologies applied were in fact customized to suite certain project criteria. Based on this observation, it is understood that organizations do indeed see the benefit behind using project methodologies and customizing them to meet select success factors.

However, there seems to be a lack of research and literature to specifically understand why organizations are choosing to implement alternative or customized project management methodologies such as Agile, Scaled Agile or Hybrid-Agile methodologies specifically in machine design engineering projects where the traditional waterfall methodologies are already existing and established. It is interesting to understand why this transformation is happening and this we identify as a Research Gap.

Most of the literature studied for this thesis, relating to Agile methods was directed towards the software industry or relating to software product development. This is also understandable when referring to the Agile manifesto (Appendix 1) and the Agile mindset values (**Error! Reference source not found.**), where “Working software” is clearly mentioned as one of the key elements behind the Agile movement. The lack of study and literature relating to APM methods applied specifically for machinery design R&D projects has been identified as one of the research gaps that this research attempts to fill in. Therefore, this thesis intentionally looks beyond the software specific practices in APM frameworks and identifies more common literature, practices and principals that can be applicable to any product development project. One such literature is a book by the Project management institute *Agile Practice Guide* (PMI Guide, 2017). The authors intentionally address the APM methodology from a “generic” point of view and “goes beyond the use of Agile in computer software development industry, because agile has expanded into non-software development environments. Manufacturing, education, healthcare and other industries and becoming Agile to varying degrees [...]” (PMI Guide, 2017).

Organizational enablers relating to project success have been researched (Müller, Shao, Pemsel, 2016) and it has been found that leadership, mentality and infrastructure are the highest influencing factors towards project success. From the point of view of how project methodologies evolve in organizations, the research finds that changes in external factors, such as market conditions or market share do not have a direct and predictable effect on the evolution of project methodologies within the organizations. Research suggests that decisions and changes coming from organizational leaders and organization strategies to be the main drivers behind evolution in project management methodologies (Müller, et al., 2016). However, there seems to be lack of published research and literature specifically identifying how these enablers will affect the relationship between project methodology and project success in organization adapting an Agile-Stage Gate hybrid methodology (Laanti, et al., 2011). Organization heads and project managers are facing increasing demand to deliver innovation, increase customer focus and be more adaptive to change. In practice however, this is unclear for the project practitioners. The original “Agile management” derived from The Agile manifesto (Beck, et al., 2001) is a set of goals, principals, values and practices ideated in 2001 to speed-up software development (Denning, 2018). Further research is however needed to fit this as a methodology for hardware and machine development engineering organizations. Innovative progress has been comparatively slower in hardware as compared to software industry. The root-cause behind this may be *“... over regulation of systems, or slower and rigid manufacturing processes or is it the way hardware is being managed in these big old manufacturing firms”* (Denning, 2020).

1.2 Research Questions

The research gap was identified as a need to understand advantages to hardware producing organizations from implementing APM-TPM hybrid project management methods instead of relying on TPM methods. With this in focus we identify the following for investigations as Research Question 1.

RQ1: How hybrid project management methodology affects project’s success?

The research gap also identified the lack of evidence on how enablers will affect the relationship between project management methodology and project success. We identify the following for investigations as Research Question 2

RQ2: How Project manager's Leadership style, organizational culture and the quality of teamwork, affect the relationship between project management method and project success?

1.3 Theoretical Framework

The use of Agile-Stage gate hybrid project management methodologies will have a positive effect on ultimate project success; these methodologies are designed to take advantages of the best practices from both, the traditionally used stage gate method, as well as the flexible Agile methodologies. Project success is subject to project's or organization's own perception of success criteria. However, this research and other researches referred to in this thesis will show that the most preferred and widely accepted criteria for success are still cost, quality and time but with additional attention now on customer satisfaction, customer involvement and overall customer experience. This research suggests that the Agile-stage-gate hybrid approach gives the needed structure and checkpoints to keep the project on the agreed budgets, within the agreed acceptance quality criteria and on agreed time schedules, and in addition, increase the possibility of customer involvement in the project at early stages and in-turn helps in improving customer satisfaction.

The project manager's leadership styles, organizational culture and quality of team work will influence the role of enablers on the relationship between project management methodologies and project success. The successful implementation of hybrid project management methodologies needs a high level of commitment from both, the project task execution team, and the project management team. This research suggests that a leadership style based on emotional intelligence and competency traits is more preferred and will have a more engaging and motivating

effect on the overall performance of project team, and how they will accept the alternative (new) project management approach. Organizational culture plays an important role in how people react to and accept changes in project management methodology. This research suggests that a culture based on values of Clan and adhocracy has an orientation toward collaboration, values flexibility, fosters development culture and still can put emphasis on competitiveness. Project tasks are executed in teams of individuals. This research proposes that teams that have well defined roles are self-managed, focus on overall team success over individual achievements, and are relatively small in size, are able to perform better and able to align to an improved project management methodology. The theoretical framework looks as shown in Figure 1 below.

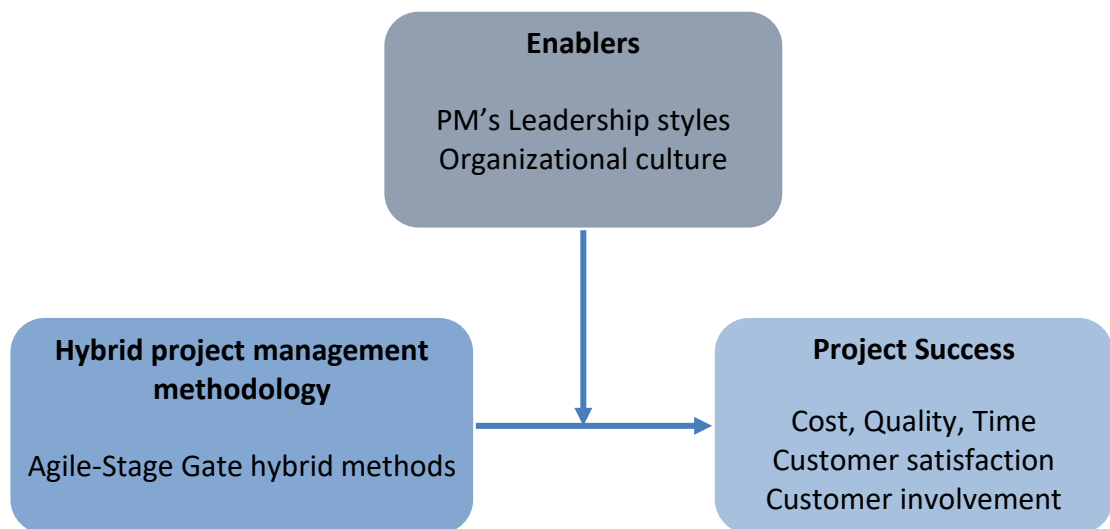


Figure 1: Theoretical framework

1.4 Structure of the Thesis

Chapter 2 of this thesis is dedicated to in-depth literature review on the topics central to this research. The purpose in reviewing the literature is to establish a firm foundation for the study into the body of knowledge. This thesis will refer to primary sources (books), such as the *Agile practice guide* (PMI Guide, 2017) and *Agile project management* (Layton & Ostermiller, 2020). Valuable information is

also obtained from respected journal articles, online business magazine articles, reports and publications on project management subjects and Agile practices. The literature review will present knowledge on traditional project management methods such as waterfall and the stage-gate methods that have well established and extensively researched knowledgebase, in scholarly articles, books, standards and guidelines. Examples of primary sources of information on TPM referred in this thesis are *Project management body of knowledge (PMBOK® Guide)* (PMI Guide, 2008), and *International Standard ISO "Guidance on project management (SFS-ISO 21500, 2021)* and *Project management: A systems approach to planning, scheduling, and controlling* (Kerzner, 2013).

The research design is presented in Chapter 3, where details on how the case study was set up and how the data was collected and systematically examined. This was a case study research where project management processes of select case companies were studied as background research. Further, through structured interviews, the researcher has collected data how projects are managed and executed in the case companies, their criteria for project success, and the role of enablers; leadership styles, quality of teamwork and organisational culture in the case companies.

In Chapter 4, the data obtained from the structured interviews is presented in a thematic format. The actual "data" is in form of interview quotes, and these quotes are analyzed and presented systematically to obtain an overall view of what was asked, what was answered and how the answer is important for this research.

Finally, Chapter 5 will connect and compare the obtained research information from interviews to the body of knowledge or the theory studied during the literature review. This chapter will conclude by presenting the contribution and conclusion of this research.

2 LITERATURE REVIEW

The literature review in this section presents knowledge on project management methods, success criteria, and the chosen enablers; Organizational culture, Leadership styles and Quality of team work. A mind map of the literature review and how the sections are inter-related is presented below in Figure 2.

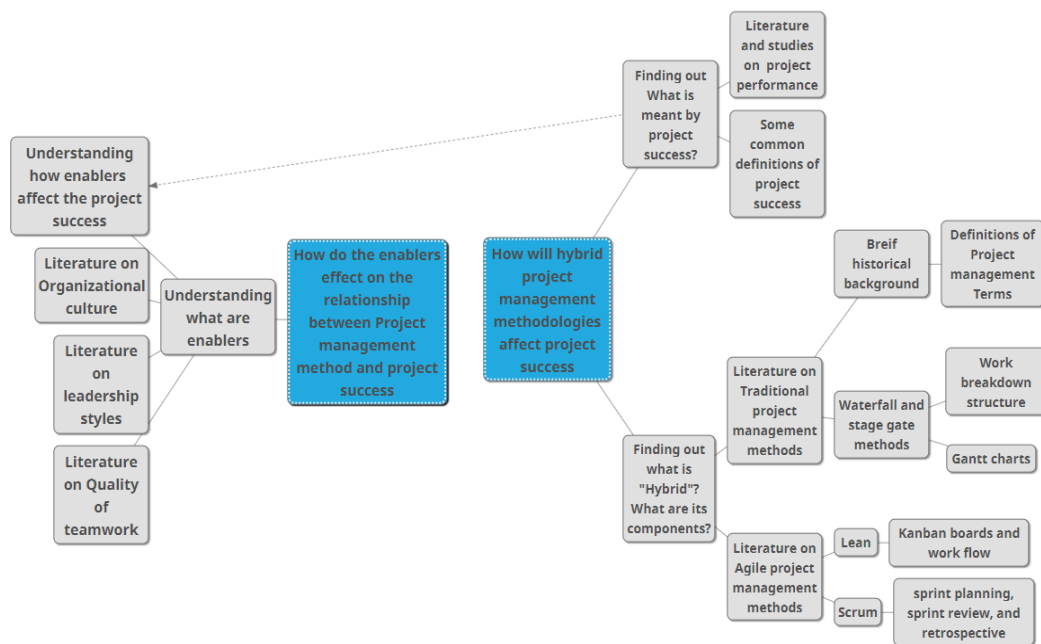


Figure 2: Mind-map of Literature review, part one

2.1 Traditional Project Management

2.1.1 Background of Traditional Project Management

For the purpose of this research, it is interesting to investigate in brief the background and history of traditional project management methods, the scientific research behind the methodologies, and how they have evolved. During World War I period (1914 — 1918), Henry Gantt had developed a task-tabulating method. By the 1920's the Gantt's charts were well established as a general tool for production planning and managing batch production. Gantt used a time-phased set against demand approach to production planning. The Gantt charts were intended

later realized that their system was insufficient to achieve a larger productivity improvement throughout the organization and that overall productivity could only be developed thru comprehensive planning (Wilson, 2003), (Seymour & Hussein, 2014).

It is believed that modern Project management evolved as a separate discipline during the 1950's. The roots of modern project management are believed to be in the *Systems management theory*. Published in 1951, Karl Ludwig von Bertalanffy, a respected Austrian biologist, published his article on "Open systems" using human anatomy nomenclature to describe sub-systems (e.g. organs and functional body parts) and total system (i.e. complete human body). The Systems theory is identified as an important first step where it was identified how specialists in each sub-system could be integrated to get a better understanding of the overall operations of the total system. In 1956, Kenneth Boulding published his thoughts on *General systems theory* where he identified the communications problems that can occur between different systems. Boulding presented that for successful integration of sub-systems and total systems, it was crucial for specialists to "*speak a common language*". Boulding identified and highlighted the need for a systematic theoretical construct and a general theoretical framework. This would mean that specialists from one sub-system could better understand specialists from other sub-systems, thus improving communications and overall understanding within the total system (Boulding, 1956) (Kerzner, 2013). Organizations started to adapt systematic and process-based practices to projects during the latter part of 1950's. Planning, organizing, commanding, coordinating and controlling became a major part of organizational management. One of the main contributors to a systematic approach to managing projects was the United States Department of Defence, NASA and another weapons technology-based agency. Mega-projects were undertaken during this period, such as the B52 Bomber, the intercontinental ballistic missiles projects, and the Polaris Submarine project. These megaprojects brought in focus the need for a systematic formulation and documentation of project management systems and techniques, and a need for a "Point of contact" or person of responsibility for a given project. The United States Navy developed and adapted

the Program Evaluation Review Technique (PERT), for analysing the tasks involved in completing these complex and very large scope projects. The PERT technique uses a weighted average of optimistic, pessimistic, and most likely estimates for individual activities. Also, the terms project management and consequently appointed for these were Project Managers became common practices. During the 1960's NASA mandated use of project managers and project management processes for all its ongoing and future the space projects (Kerzner, 2013) (Seymour & Hussein, 2014).

The Critical Path Method (CPM) was developed by James E. Kelley, Jr. and Morgan R. Walker during 1956-1959 while working with the Engineering Control Group at E.I. du Pont de Nemours, Delaware, USA. Kelley presented his article Critical-path planning and scheduling: Mathematical basis (1961) in the journal of Operations Research (9 (3) 296-320. Originally, the method they developed was referred to as Project Planning and Scheduling (PPS), but later the technique was developed into the CPM networks method (Kelley, et al., 1989) (Seymour & Hussein, 2014).

In 1970, Dr Winston Royce (1929-1995) published his article "Managing the development of large software systems", where he presented two essential steps regardless of any (software) project size or complexity to be Analysis and Coding. The article points out that for a complete working and deliverable software package, other additional steps are required, nevertheless, the Analysis and Coding still contribute the most to complete a product delivery. These additional phases suggested are as follows

- Analysis phase: System requirements→Product requirements→Total Analysis
- Execution phase: Product design→Testing→ Deployment

Additionally, five systematic steps are suggested to be followed for implementing this model. High importance was given to "Extensive and detailed documentation" and seen as crucial for successful delivery of products". (Winston, 1970)

The five steps are elaborated as follows:

1. Preliminary program design: **Define processes**, procedures, design requirements and allocate resources and execution time.
2. Detailed and understandable **documentation of requirements**, design and work progress
3. **Test and Simulate** extensively: deliver only tested, complete and working version to customer.
4. **Plan, control and monitor** the testing and simulation steps. Extensively document testing and test procedures
5. **Involve the customer** and advantage from their insights and judgements. This will increase customer commitment and confidence.

There is however no mention of the term “Waterfall” or this being a Project management methodology in Dr Royce’s original article. It is believed that the term or name “Waterfall” was attached to this proposed model later when Bell & Thayer (1976) published their article “Software requirements: Are they really a problem?” where they identify the top-down method as a superior method of software development and Dr Royce’s model as a “waterfall of development activities where documents in the early phases of the waterfall can be considered as stating a set of requirements.” (Bell & Thayer, 1976)

During the late 1980’s — 1990 period advancements were seen in computing technology and personal computers and software were now available to general public. Handling and organizing of complex data required to manage projects was now easier and dedicated software programs for project management such as Projects in Controlled Environments (PRINCE) model were becoming popular (Seymour & Hussein, 2014). In the later part of 1990s, project management methodologies had developed to a common interface within organizations. Multiple business functions and processes relating to projects were beginning to integrate. It was now common that complex and large projects were being handled in partnerships and in project networks instead of one large government agency owning the entire pro-

jects. The object of interest for researchers was shifted towards finding interconnections in multi-project environments and computerized solutions for project activities. As organization became more globalized, their operations and projects became more decentralized. Projects were being conducted over geographical and cultural borders (Artto, et al., 2011). By the early 1990's project management was an established science with set procedures and methods for application to varied industries. It was not anymore, an option for project related organizations, but almost mandatory to have certain methodology set for managing their projects. Project organizations also realised the strength of formal project management systems as they can also be used as an early warning system to identify if projects are performing poorly and if they need to be terminated earlier to reduce damage to the entire organization (Kerzner, 2013).

2.1.2 The Stage Gate system

Traditionally, the structure of organizations has been hierarchal, top-to-down managed systems. In practice, all communication and control trickled down from top management towards mid-management, operations and down to manufacturing. As organizations began to develop more project-based functions and project management systems, this vertical flow of control and information needed replacement by more horizontal control and information flow across teams. Thus, a phased process was evolved where teams needed to review work at the end of each phase and acceptance criteria were set for each phase before the project could progress to the next phase (Kerzner, 2013).

Evolved from the traditional Phase-gate process, a modern Stage-Gate Model, was proposed by Robert G. Cooper as a result of his research in new product development (NPD) practices. Cooper published his results in his article "Stage-gate systems: A new tool for managing new products" (Business horizons, 1990) where he proposed a project management methodology specifically designed for new product development projects. Cooper proposed a structured approach with "Stages" where the actual work or activities in a NPD project are performed, followed by

the “Gates” where work done is checked and decisions made regarding the progress of the project (Pagoni, 2018).

Cooper proposed that with the conceptual and operational Stage-Gate model to control product-innovations efforts effectively, companies could launch their new products to market much faster and with fewer mistakes. Stage-gate systems adopt and apply the process management methods earlier used only for production processes. A production process is sub-divided into several stages or work stations. Each work station has a set criterion for its deliverable in quantity, time and quality. The product must pass through a quality check gate ensuring that these criteria are met before the product is suitable for further progress or else it is discarded or rejected. Stage-gate systems apply similar methodologies to the product innovations processes using several screening gates between activity stages as the product goes from preliminary idea concept, business case analysis, design, testing and finally production and launch as shown in **Error! Reference source not found.** below

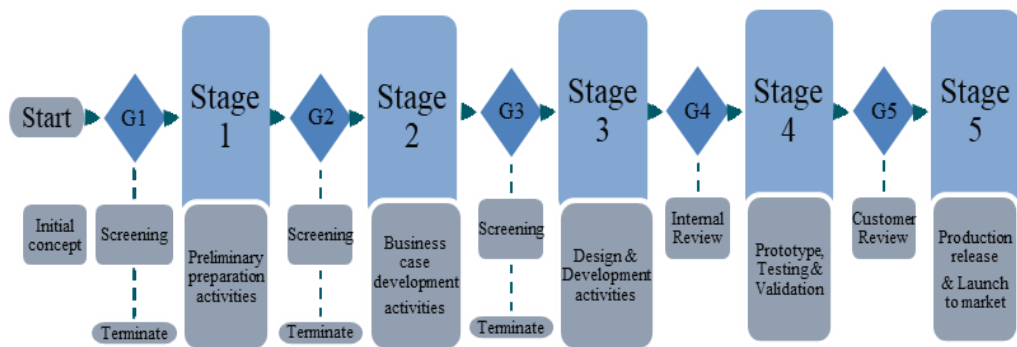


Figure 4: Stage gate system

Stages: When used for NPD projects, the project team undertakes the design and development work, obtains needed information and integrates it into the products design to push it towards the next gate. During each stage the team gathers necessary information from the earlier stages as well as requirements set by the subsequent gates. The team performs various activities in parallel during each activity stage. Members from cross functional teams may contribute to any activities

in ongoing stages in order to advance the project towards the gates. Thus, no one team or discipline owns a stage (Cooper, 2008).

Gates: The activities of subsequent stages are assessed in Gate review meetings. Gates serve as quality check points in production line. During each gate review the following checks decisions are done

- Deliverables from the previous stage are according to the project or product requirements at that gate-point. Deliverables are acceptable levels for following stages to start work with.
- Quality, quantity and level of details are considered to meet the criteria of following stages.
- Decisions as to stop and re-work, stop and terminate, or accept and proceed the project activities. The action plan to following stages may need updating based on ongoing gate review (Cooper, 2008)

The gatekeepers should be cross-functional team of senior department leaders from various functions such as R&D, marketing, productions, and sales. This ensures a proper alignment of the project activities and that proper resourcing is provided for the subsequent stages. Where the project leader or project manager leads the team as their captain, “[...] the gatekeepers’ mentor, oversee and finance the project, much like the owners, managers and coaches of a football team” (Cooper, 2008)

2.1.3 Section Summary of TPM

The distinct characteristics of Traditional project management are the five logical groups, processes or steps as represented in waterfall model as shown below in Figure 5.

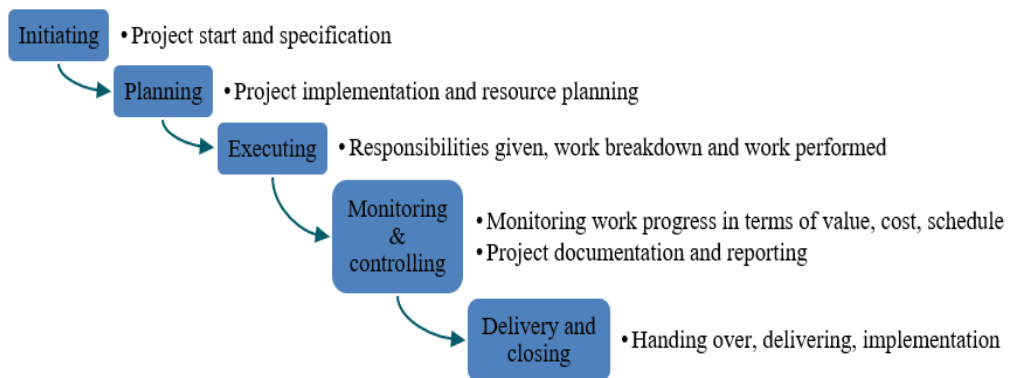


Figure 5: The Waterfall model of processes

The basic elements to definitions of projects and project management involve certain common factors. The common factors for Projects are that they have set goals and specification, have some fixed time boundaries, and need to be completed in certain budget limits. The common factors for Project management are that the methodology uses techniques and resources to achieve the above set parameters for a project (Layton & Ostermiller, 2020). **Error! Reference source not found.** shows comparing definitions for the term “Projects” from various authoritative sources.

Table 1. Definitions of the term “Project” from various sources

Definition of A Project	Source
A temporary endeavour undertaken to achieve a unique goals, product or outcome. Projects have definite Start and End.	PMI Guide, 2008
Consists of unique sets of processes and activities that are coordinated and controlled. Activities have start and end dates and are performed to achieve set project objectives.	SFS-ISO 21000:2021
A unique entity formed of interrelated activities, having a predefined goal to be achieved in specific time and within approved budget, and fulfils certain set. Specification.	Artto, et al., 2011

Series of activities and tasks that have a specific objective to be completed within certain specifications, have defined start and end dates, have funding limits, they utilize human and material resources, and are multifunctional.	Kerzner, 2013
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The Following Table 2 shows comparing definitions for traditional project management from various literature.

Table 2: Definitions of Project management from various sources

Definition of Traditional Project Management	Source
The application of knowledge, skills, tools and techniques to meet set project requirements. Project management integrates processes of initiating, planning, execution, monitoring, controlling and closing.	PMI Guide, 2008
The application of methods, tools, techniques and competences. Project management includes integration of project life cycle from start till end.	SFS-ISO 21500, 2021
The application of management practices aimed at achieving the project goal and objectives.”	Artto, et al., 2011
The planning, organizing, directing, and controlling of resources for a defined period, to achieve defined objective, and to complete set goals.	Kerzner, 2013

2.2 Agile project management

2.2.1 Background of Agile Project Management

During the late 1980 to early 1990, computers had advanced to personal computing and software was becoming increasingly less dependent on hardware constraints. This made an impact on many aspects of work and business including project management. It was obvious that the traditional methods of managing large scale production-based projects did not suite the often small and frequent nature of software projects. A more agile model encouraging software development projects using multiple but much small teams was needed (Seymour & Hussein, 2014).

In 1986, Takeuchi and Nonaka published in their article The New Product Development Game, introducing a new flexible approach for new product development projects. The suggested approach had six characteristics for a fast and flexible new product development as follows: Built-in instability, self-organised teams, overlapping development phases, multilevel and multifunctional learning, Delicate or softer control, and transfer of learning. Using the sports analogy from the game of rugby, the proposed approach would encourage constant interaction between teams and team members, team members need to work together from start to finish and engages the whole team in iterative approaches to achieve goals. This approach would increase an “Trial and error” as well as a “Learning and Teaching” behaviour

Lean umbrella: By late 1990’s—early 2000, the SCRUM method of product development had been deployed and experimented in leading software companies with significant success rate. Other development methods specifically for software development were also springing up. All the new methods, however, had the following as common characteristics, they were *incremental* (smaller and frequent releases), they were *co-operative* in nature (high involvement from stake holders and customers), they had *straightforward* approaches to project tasks (easy to follow, less documentation, teaching and learning), and most importantly they were *adaptive* in nature (accept and embrace change) (Abrahamsson, et al., 2002). During the late 1990’s and early 2000’s other popular development methods and frameworks became popular. All these concepts further share the lean thinking such as **Focus on value, Small batch sizes and elimination of waste**. Lean and Agile thus became the umbrella terms for these “Lightweight” sub-methods as shown in **Error! Reference source not found.** (Conforto & Amaral, 2016)

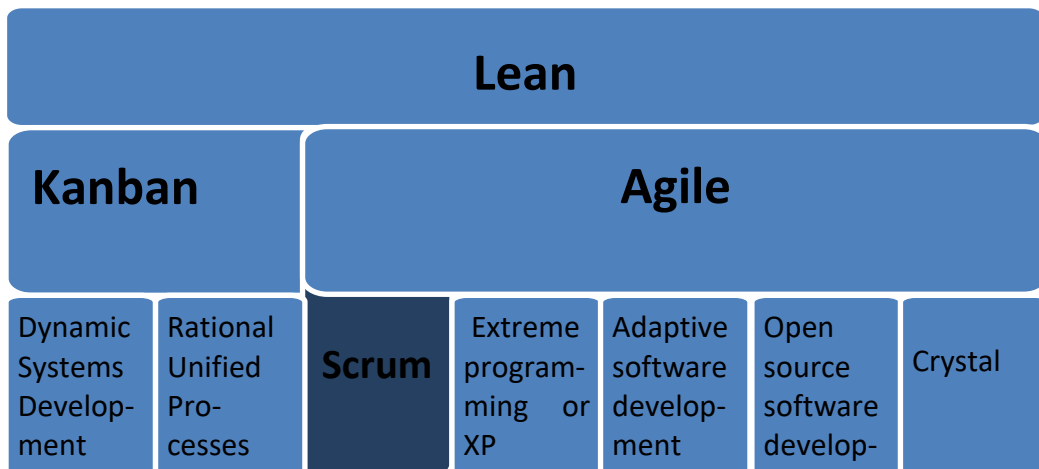


Figure 6: Lean and Agile as Umbrella terms

Agile approaches or agile methods thus cover a variety of approaches, frameworks, methods and techniques, each however observing the central Agile values and principles as shown in **Error! Reference source not found.** below.

Table 3: The Four Agile values

Four Agile values
<p><i>We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:</i></p> <p><i>Individuals and interactions</i> over processes and tools</p> <p><i>Working software</i> over comprehensive documentation</p> <p><i>Customer collaboration</i> over contract negotiation</p> <p><i>Responding to change</i> over following a plan</p> <p><i>That is, while there is value in the items on the right, we value the items on the left more.</i></p>

Lean: Lean has its roots in mass production and manufacturing process improvements. Historically, these were processes used in environments where complex, specialized and often exclusive and expensive machinery were operated by often low-skilled and inexpensive workforce. These were, for example, the foundries and forges used for the war supplies or mass-produced automobile components. Manufacturing was done in large batches of parts and evidently mass production needs “Wasteful supporting systems” to generate huge inventory in stocks, needing extra workers and ever more storage space. During the 1940’s, Toyota was a relatively small automotive manufacturer and wanted to introduce cheap and affordable cars for the Japanese market. Toyota started to build their Toyota Production System (TPS) and Toyota Way pioneered by Taiichi Ohno, around the philosophy of Long-term thinking, Waste elimination processes, Respect for people, Problem solving through learning and “continuous improvement” (Japanese term *Kaizen*). TPS is seen as the basis for “Lean production” techniques. Lean manufacturing processes focuses on five essential steps as, Customer value defining, Value

stream defining, creating and maintaining a “Flow”, creating a “Pull” from customer end, and striving for excellence (Liker, 2004).

Kanban: Sometimes referred to as the Lean-Kanban, is one of the most adapted and common approaches to any Agile system. Kanban also is a product of the Toyota Production System (TPS). One of the important ideas in the TPS was to create a “pull system” such as in a supermarket where the shelves are restocked with stock only when they are running low and only so much quantity as the capacity of the shelf. At Toyota the assembly workers used a card system (Japanese term *Kanban*) at every stage of a production line. Via Kanban-cards, they signal to the preceding step when and how much parts they need for the following stage. All stages thus maintain a “Work in progress” record and eventually a “Ready” or “Done” record. This pull-system then became a very important part of the Toyota Just In Time (JIT) system (Liker, 2004). At Toyota the Kanban works as a central system within the TPS and follows the following “[...] six rules for the effective application of Kanban: 1) Never pass on defective products; 2) Take only what is needed; 3) Produce the exact quantity required; 4) Level the production; 5) Fine-tune production; and 6) Stabilise and rationalise the process” (Farr, 2014).

SCRUM: Takeuchi and Nonaka (1986) introduced the “Rugby” analogy in their proposed six-characteristic approach but did not elaborate deeper. In 1995, the article “SCRUM Development Process” was presented by Ken Schwaber at OOPSLA Conference (Object-Oriented Programming, Systems, Languages, and Applications). Schwaber (1997) roots his proposed development process on bases of findings by Takeuchi and Nonaka (1986) and elaborates the term SCRUM. Schwaber describes Scrum as “an enhancement of the commonly used iterative/incremental object-oriented development cycle” (Schwaber, 1997). Scrum remains by far the most popular Agile framework in software development in modern times. In practice, Scrum is an iterative approach where the collective team efforts are carried out in “Sprints”. Sprints are basically work periods between one and four weeks at end of which team expects to deliver certain planned work packages. Within each sprint, the team will develop and test a functionality of a part of the end product

and gets an acceptance from the product owner. After certain number of consecutive sprints, the team will gather in a ceremony called as “Sprint Retrospective”, where the team will assess performance and outputs of previous sprints, plan for new sprints and adapt the plans according to achievements so far against set product requirements. The retrospective meeting is followed by another sprint planning session and then next batch of sprints. This iterative and adaptive cycle gives the development team the advantage to adjust and adapt to product development, make continuous improvement integral to development process, and increases interaction among stakeholders (Layton & Ostermiller, 2020). The SCRUM methodology can be described as having the following three major phases (proposed by (Schwaber, 1997))

- *Pregame*: Includes planning of sprint work load, estimating and scheduling) and high-level design plan or Product requirements.
- *Game*: Include actual multiple iterative development sprints where workable functionality is released step by step to “*Evolve*” the product. Sprint work output is reviewed and adjusted and adapted.
- *Postgame*: Final documentation, testing and release of the product Scrum methodology is designed to be flexible to change through the development cycle and enables project teams to adapt deliverables in appropriate and tested packages or “*Releases*” (Schwaber, 1997).

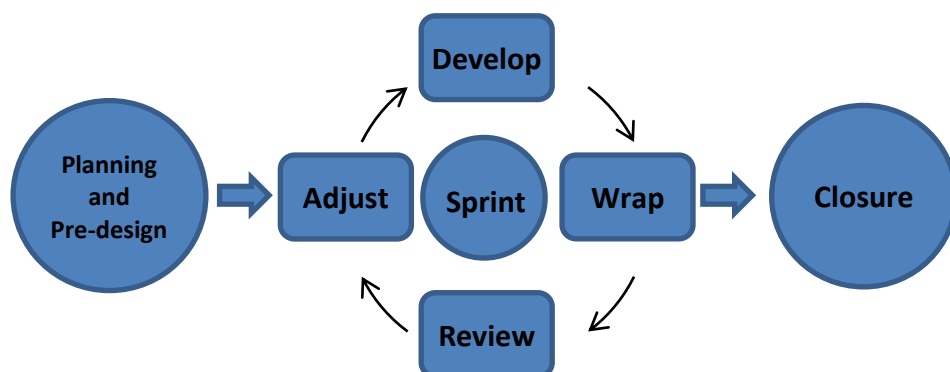


Figure 7: SCRUM Methodology

2.2.2 Challenges with APM in New Product Development Projects

APM is an adaptive approach to manage projects that combines *Flexibility* (adapt as you go) and *Control* (plan → do → check) approaches. APM in product development usually means adapting project management practices that are people oriented, enhance communication, focus on the product features, and overall increase process flexibility (Layton & Ostermiller, 2020). Agile practices however do have limitations when it comes to NPD projects. The risks of methodology mismatch and project failure is high when APM practices are imposed upon organizations or projects that have long history of non-collaborative work culture, or projects that are used to being executed in highly process-oriented manner (Cockburn & Highsmith, 2001). In traditionally managed R&D projects, complexities originate from several factors such as technology uncertainty, large number of components, systems, sub-organizations and multiple stakeholders that significantly increase need of wasteful processes and reduces flexibility. Thus, instead of a purely Agile approach a mixed approach combining APM practices with Stage-Gate models may provide an alternative (Conforto & Amaral, 2016).

In their extensive and systematic literature review article, Dikert, et al. (2016), find reports and studies suggesting that especially large-scale organizations do in fact find Agile implementation to be a difficult challenge. They find literature evidence to support that organizations face challenges especially in integrating non-development functions, they typically face resistance to change, and most of all challenges in requirements identification (Dikert, et al., 2016). Another important finding from the same study was that they found Scrum, to be the most popular agile method used across majority NPD related organizations (25 cases out of total 42). In many cases they find organizations to have “Customized agile” methods by combining several Agile and non-agile practices. Although “Scaled Agile” was not the scope of their study, the researchers noticed several reports and experiences pointing to clear interest in adapting a scaled agile framework and suggest further research in this knowledge area (Dikert, et al., 2016)

Conforto & Amaral (2016), presented APM to be more suitable methodology for small projects, small organizations, co-located teams and with smaller product portfolios. However, for larger corporations TPM should be the method of choice. Researchers suggest that however a proper combination of TPM (Stage-gate) and APM can in fact lead to a higher success rate in projects (Conforto & Amaral, 2016).

2.2.3 Section summary of APM

Agile is a term used to describe set of values and principles as stated in the Agile manifesto (Appendix 1: The Agile Manifesto

). Agile approach is an umbrella term for tools, techniques, and methods that tend to have the following properties in common

1. Development thru iterations.
2. Emphasis on simplicity, transparency and adaptivity.
3. Self-organised and cross-functional teams.
4. Progress is measured by delivering tested ad working functionalities.

Organizations using Agile approaches usually work towards fostering Lean environment that focuses on eliminating wasteful processes. Research shows that these organizations deploy some sort of iterative development cycles and target towards a final product through many smaller realises of working packages. In doing this, they ae able to have an adaptive control of processes and progress, and most importantly are able to have a people centric approach where teams are given freedom and focus on product functionality (Layton & Ostermiller, 2020). The following (Table 4) attempts to collect some common definitions on Agile project management from reliable sources.

Table 4: Definition of Agile project management from various sources

Definition of Agile Project Management	Source
APM is a way to apply the 12 Agile principles and four agile values to perform project management activities that allows to create and respond to change and deal with uncertainty.	(Agile 101, https://www.agilealliance.org/agile101/)
APM is a style of project management that focuses on early delivery of value, continuous improvement, flexibility, team efforts, and delivering well tested products that reflect customer needs.	(Layton & Ostermiller, 2020)
Agile life cycles fulfil the main principles of customer satisfaction, early and continuous delivery. They combine both iterative and incremental approaches to adapt to high degree of change and deliver project value more often.	(PMI Guide, 2017)
APM is a set of values, principles, and practices that assist project teams in coming to grips with this challenging environment. The core values of APM address both the need to build agile, adaptable products and the need to create agile, adaptable development teams.	(Highsmith, 2004)

Literature review reveals that an exact definition for APM is difficult to be found or formulated. One reason behind this is believed to be that at the core of “Agile Management” thinking are Goals, Principles, values and practices that emerged from need to speed up software development and reduce time-to-market for new software products (Denning, 2018) and not from requirement to improve project process. Goals, Principles, values and practices are relative and dependant factors.

The factors “Values” and “Principles” are highly dependent on organizational environment, and “Goal” and “Practices” are specific to project specific and change according to project context (Conforto, et al., 2014).

Agile practices reduce waste by improving direct communications between people and reducing time taken for decision making and actions implementing. In order to achieve the above Agile core teams are usually co-located (share same physical office space), and reduce documents and e-mails by directly communicating using white-board meetings. The speed and quality of decisions made is improved by directly placing expertise within the task-teams themselves. “Making user experts available as part of the team gives developers rapid feedback on the implications to the user of their design choices” (Cockburn & Highsmith, 2001).

2.3 What is Hybrid project management?

Thus far we have discussed the TPM (2.1.3) and the APM (2.2.3) methodologies and practices. Hybrid project management (HPM) methodology in context of this research simply means combining select elements of TPM and the APM methodologies in a manner that is best suitable to the project environment or to certain project. The belief here being that applying of traditional stage-gate methods for project’s sub-processes and using APM practices for the overall project management, can enhance the project’s benefits (Strasser, 2020). Effects of combining Agile project management and Stage-gate model were analysed by Conforto & Amaral (2016), in their longitudinal research to examine “Hybrid management” framework in operation in one NPD (New product development) environment case organization for a technology-driven project. The researchers identify the stage-gate-method as a more Structured set of processes and the Agile practices as a more Flexible product development process. Conforto & Amaral (2016), observed that a hybrid framework increased self-discipline and self-management behaviour, increased simplicity in planning and controlling, made flexibility aspects more visual, and promoted overall visual communication of tasks and goals. Positive effects were observed on **Information accuracy, team commitment and lead-**

ership. The researchers identify further research needs in *Critical factors* and potential *Enablers* and recommend “additional investigation considering multiple cases to identify, first, the importance of these factors, and second, which factors might affect the adoption of hybrid frameworks in different organizational and project conditions” (Conforto & Amaral, 2016).

2.3.1 Different hybrid approaches

Hartman, et al., (2017) discuss on two types of Hybrids. According to the authors Hybrid methodologies can also result from blending several Agile methods, techniques, or frameworks (Blended Agile hybrid). However, in context of this research we consider Mechanical design R&D projects where other constraints or demands require non-Agile elements may exist. In such cases “Hybrid” could be understood as simply the combination of Agile methods with other non-Agile techniques to form a customized framework (Hartman, et al., 2017). The authors discuss on the following two scenarios or approaches to Hybrid 1) Fit-for-Purpose Hybrid and 2) Hybrid as Transition to Agile.

Fit-for-purpose Hybrid: This could be an approach where for example Project A needing relatively low risk factors and low frequency of delivery can be executed by a Plan-Driven methodology (Such as SG), whereas Project B having high number of deliverables, high technology risks may use a Incremental and Iterative methodology (Such as APM) (Hartman, et al., 2017). Project teams may customise their approach to certain projects based on projects specific factors such as Project risks or Project culture or simply based on what framework can deliver a better chance of project success for that given project. When projects cannot or need not deliver immediate value or incremental deliveries, a predictive framework (TPM) may be more suitable than an incremental (Agile) approach (PMI Guide, 2017).

Hybrid as Transition phase to Agile: This is an approach where large organization with several departments or large projects with several stakeholders are dependent on a Plan-Driven method and sudden transition to full Agile may cause misalignments to project deliverables. Rather a step wise or a controlled transition

could be more advantageous to the entire organization. For such organizations that are used to mostly plan-driven environment, *“a hybrid approach can be a transition to more adaptability and delivery”* (Hartman, et al., 2017)

Agile practices differ significantly compared to TPM practices. Agile practices bring reduced dependency on documentation, increased collaboration and communication and demand increased involvement from team members involved. These practices may be difficult to adapt for those who are well adapted to working in predictive (TPM) frameworks. In such cases a gradual introduction of Agile practices may be more suitable approach. Introducing step-wise iterative techniques, encouraging and improving learning and alignment between team members or combination of various approaches may be considered as an Hybrid approach” leading to softer transition towards integrating full APM frameworks to entire organization (PMI Guide, 2017)

Hybrid by project phases: Project teams may decide to use several approaches during a project’s lifecycle. Projects may decide to adapt an incremental (Agile) approach during the initial or development process of a product followed by a predictive (Stage-Gate) approach for product delivery phase. Using this approach, the project team can identify and address the uncertainties, complexities, and the risks involved in a new products R&D projects (PMI Guide, 2017). Figure 8 illustrates an example of an approach where initial phases of the project are iterative, followed by a planned delivery schedule.

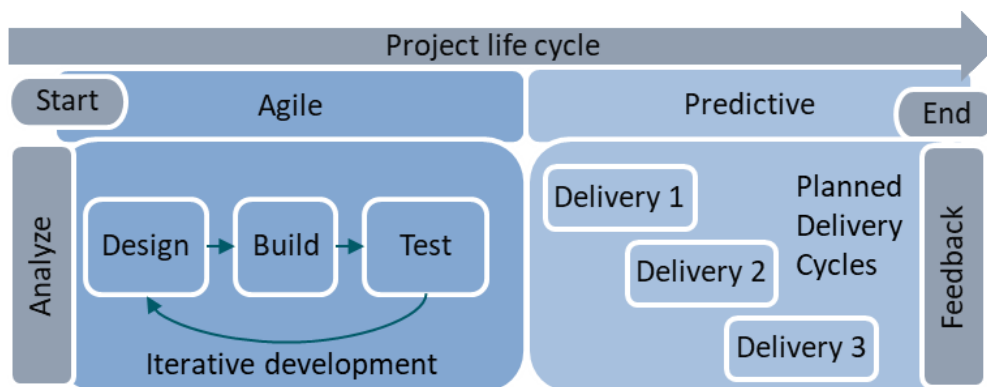


Figure 8: Hybrid by project phases

2.3.2 Agile-Stage Gate Hybrids

Technology based companies strategically focus on NPD projects and R&D activities at their core. These companies usually tend to boost innovative thinking, entrepreneurial behaviour and encourage active and high levels of communications across all levels of project stakeholders. At the same time, these organizations running NPD projects must be responsive to fast changes and uncertainties coming from both, customers as well as market conditions where the product will be launched. In such highly dynamic environments, NPD projects will advantage from the APM methods focused on **flexibility, customer centric working, boosting team members innovativeness, iterative design improvement, and lean processes**. However, at the same time, TPM Stage-gate methods will provide necessary structured activities (Stages), standardised documents, task delivery milestones, check point reviews with possibility of iterations (Gates) and frequent formal meetings with stakeholders (Conforto & Amaral, 2016).

Karlstrom & Runeson (2005), performed case studies in three large software product companies to study the effects of Agile Stage-gate hybrid models. The focus on this research was to observe effects of introducing Agile working teams in to Stage-gate project phases of software product development. The researchers find that APM methods of microplanning, daily work scheduling thru Scrum, and regular progress reporting thru scrum meetings to be important contributions to Stage-gate projects. The Stage-gate model in turn gave the project team a framework to co-ordinate activities with other development teams (during Sprints or Stages) and formal means to communicate progress to other stakeholder departments such as marketing, sales and senior management (during Gate meetings). The researchers find that integrating APM with Stage-gate process did indeed *“improve project cost control, improved product functionality and ensured project on-time delivery”* (Karlstrom & Runeson, 2005).

Cooper & Sommer (2016), studied the results of introducing the “New Tools”, meaning APM methods, to stage-gate projects dealing with “physical products”, meaning hardware or more tangible products. Cooper & Sommer (2016) provided

case study observations from the LEGO company that produces toys and other educational material. The researchers observed that specifically in the arena of NPD for physical products, the Agile-Stage-gate hybrids provided the following distinct advantages...

- Projects with HPM methods were more responsive to changing customer needs than traditional pure Stage-gate projects.
- Dealing effectively with resourcing issues as team resources were dedicated to given sprints or stages.
- Observed reduced cycle times and increased productivity than either pure APM or pure TPM method projects.

The research objectives of Cooper & Sommer (2016) were to investigate 1) Are APM and Stage-gate models symbiotic to each other and 2) do such hybrid methodologies work effectively in manufacturing industry projects. When integrating APM in to product development of hardware or manufacturable products, Agile-Scrum method is used as the project management method in “Stages” of the bigger Stage-Gate projects. In other words, in an Agile-Stage-gate hybrid the “Stages” are Agile. The Stage-gate is used on a higher level (macro level or portfolio level) to help select and screen the right projects, map the key stages of project progress, use best practices in time bound boxes, to dedicate resources and allocate roles and approving responsibilities (Gatekeepers) at each distinct phases (Stages) of project (Cooper & Sommer, 2016)

2.3.3 Hybrid model example 1: Industrial Scrum framework for NPD

This is an example of how Agile can be integrated directly in to an existing Stage-Gate model. (Sommer, et al., 2015) performed a case study with seven technology centric companies running NPD projects. Focus of their study was to observe project performance improvements and other benefits these companies achieve from combining Stage-Gate models at a strategic (program management) level with Agile-Scrum model to perform actual project execution activities. The researchers

suggested a generic hybrid model that was named *Industrial Scrum framework* as shown below in (

Figure 9). The framework has three hierarchical business levels as follows

1. Strategic project management: This is essentially the portfolio management level where the strategic management selects what or which projects to continue with
2. Value chain/project portfolio co-ordination: In this phase the actual stakeholders from the operative side of company, the resources, and the product development team get involved with the project.
3. Project execution: this is the level where the actual deliverables for the project are created. Teams use the Agile-Scrum model of working

The roles and responsibility allocations are also done in a Hybrid fashion. As in TPM there is a Project manager appointed, but the PM shares project ownership with the business manager who acts as “Voice of the customer”, as in APM. The project team or scrum is entirely responsible and self-sufficient with experts to carry out work to produce deliverables (as in APM), however as in traditional NPD processes, the steering committee makes strategic decisions regarding, budgets, changes in scope, and resource allocations (Sommer, et al., 2015)

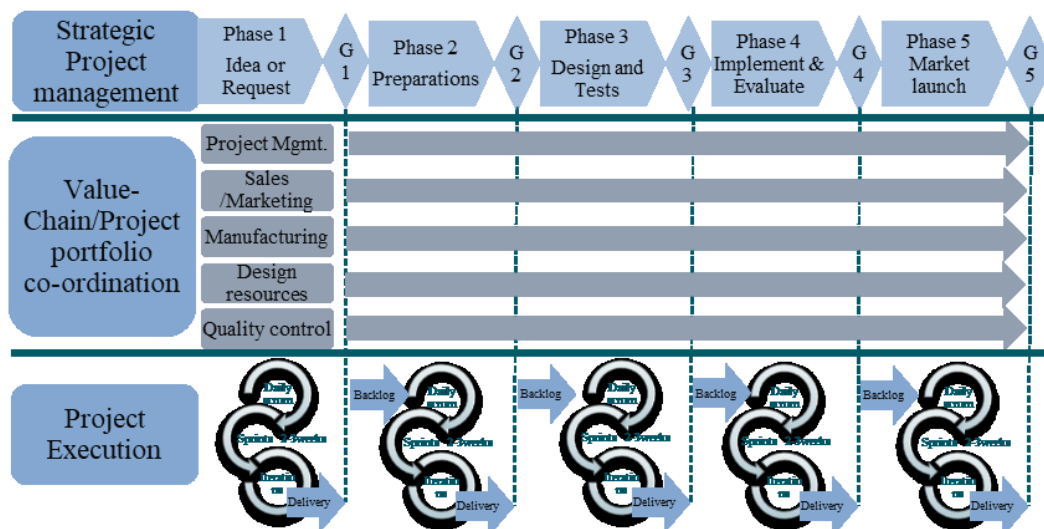


Figure 9: Industrial Scrum Framework for NPD

2.3.4 Hybrid model example 2: Agile-Stage-gate at front end of NPD

This is an example of how existing Stage-Gate model can be used successively with and Agile-Scrum process. Agile-Scrum is mostly the choice of technology-based NPD projects as it supports and boosts innovative thinking and iterative development. Similarly, Agile-Stage-gates are also well adapted to be applied to project technical stages of development and testing. In their web-article (Vedsmand, et al., 2016) present a model of how Agile-Stage-Gate can be advantageous when used in the initial stages of an NPD or what the authors call as the “**fuzzy front end**”. The speciality of these initial stages or “front end” processes is that the product is still in its idea and concept stage. The more the iterations in this stage, the more the product will be refined and meet the actual customer or market needs. The following (Figure 10) shows how the Gates 1, 2 and 3 integrate an Agile-Scrum methodology more suitable for a “Development environment”. The later G4 and G5 consecutively are traditional stage gate processes more suitable for a production environment.

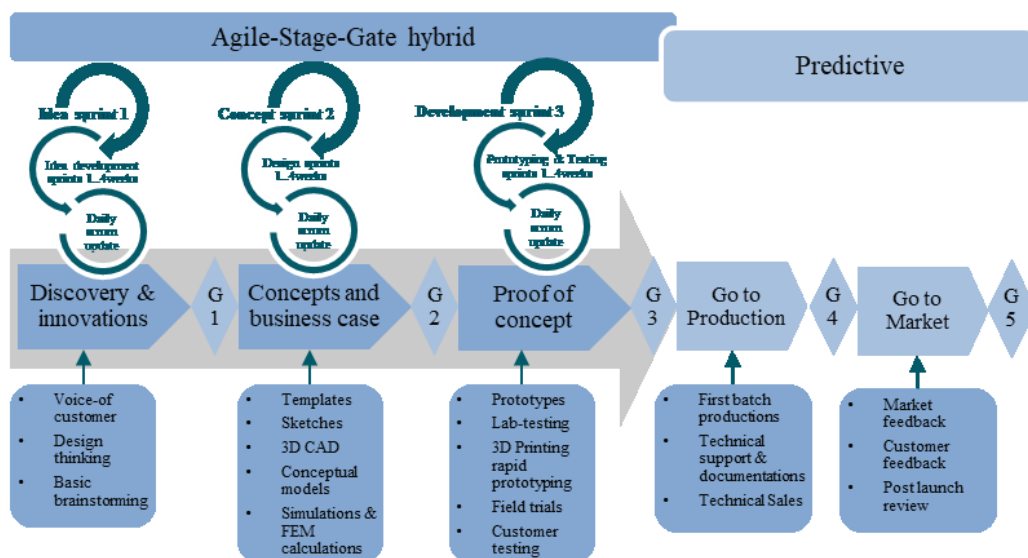


Figure 10: Agile-Stage-gate innovation process with early stage sprints

The argument in support of this model, according to the article authors, comes in the following three fronts. First, in any NPD project the biggest challenges come from the uncertainties and doubts that both the product creators or owners as well as the market and customers have. The product technology may be relatively new, or the adaptation of new technology may be unfamiliar to the developers. By placing the ideation process at the very beginning stage allows both the developers and customers to interact and focus on what is doable and what is desired. At G1 (Figure 10), the team has clearer goals to proceed with. Secondly, the model requires a high level of communication within and across the project teams and stakeholders. Valuable feedback is generated and integrated in to product improvements. This further increases the possibilities of the producing the right products with right functionalities. And finally, the Agile-Stage-gate model is not a disruptive model. Meaning that the traditional, well-accepted and proven Stage-gate process that companies have in place and have practiced for many years, is not replaced but instead enhanced. Manufacturing (or production) and launching of products can remain in place (Vedsmand, et al., 2016).

2.3.5 Section summary of HPM.

Based on literature review done during this research, one single definition of Hybrid projects or Hybrid project management method was not found. However, the one commonality to all literature referred for this thesis is just that, there is no one such Hybrid system, mechanism, process or method that can be applied “out of the box” to any given project. In other words, HPM needs to always be customized for one given project, or one given organization. The greatest advantages of any hybrid method will be achieved when elements of both Agile as well as Stage-Gate are applied in balance. In such a hybrid model the agility is brought to process by replacing TPM tools such as Gant Charts, milestones, CPM, and TPM methods such as heavy reporting, hierarchal planning and process centric thinking. Instead a rapid, product centric, customer centric and incremental concepts from APM are

applied. Tangible results are achieved in “Sprints” and plans are adapted in “Retrospectives”. However, Stages and Gates system remain as the broader project management framework. Stages bring the required flow and plan to the project. Stages provide the structure and requirements on what needs to be delivered and when it needs to be delivered, in order to keep the NPD project flowing towards set goal. Gates provide the stakeholders and top-management the necessary “Go/no-go” decision points for the project (Cooper & Sommer, 2018).

Some definitions to HPM as found in deferent literatures are listed in (Table 5) below

Table 5: Definitions of Hybrid project management methods

Definition of HPM	Source
The Agile-Stage-gate hybrid model integrates principles and methods from Agile project management into Stage Gate project management models.	Vedsmand, et al., 2016
It is not necessary for a project team to follow one certain project management method for the entire life cycle of the project. Projects can advantage from combining elements from different methodologies in different project life stages. <i>“A combination of predictive, iterative, incremental and/or Agile approaches is a hybrid approach”.</i>	PMI Guide, 2017

<p>A hybrid approach integrates the various methods (such as TPM/Waterfall and APM Scrum) or the use of diverse elements from various methods.</p> <p>“Hybrid project management refers to methods that combine planning strategies from traditional PM environment with the agile methodology’s flexible approach”</p>	<p>Strasser, 2020</p>
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2.4 What is Project Success

A common belief in project organizations has been that key to success in projects comes from ability of the project manager to prepare a solid project plan and to follow the plan to success. Literature review in subject of project success however shows that while the lack of planning may increase probability of failure, extensive planning does not guarantee project success. The following sections presents this literature reviewed relating to project success (PS)

2.4.1 Literature review on project success.

Dvir, Raz and Shenhar (2003) performed survey research to measure correlation between project planning and project success (PS). Study results showed that, **Goal setting, End user benefits** and **Contractor benefits**, contributed to what may be perceived as overall Project Success. Generally, well accepted criteria for project success are the Cost, Quality, Scope and Time criteria. (Dvir, et al., 2003).

Pollack, Helm and Adler (2018) find that “Triple constraint” or “Iron triangle” remain to be the central concepts in project management research and practice. The criteria of project being on time, delivered within or under budget, and within specified quality parameters, have remained consistently important than other criteria in modern project management practices from 1970’s well in to the 2010’s. Researchers also find that importance of, *Cost, Quality, Scope and Time*, as PS factors have contributed significantly in further study and development on these knowledge areas (Pollack, et al., 2018).

In addition to these basic or primary constraints as shown in left part of (Figure 11), there can be multiple other PS constraints on a project. These additional constraints or competing constraints or combined constraints are shown in right part of (Figure 11). The nature of project and the project environment may demand for factors such as value of project to stakeholders, project risks, customer relations, company image to be important PS criteria (Kerzner, 2013).

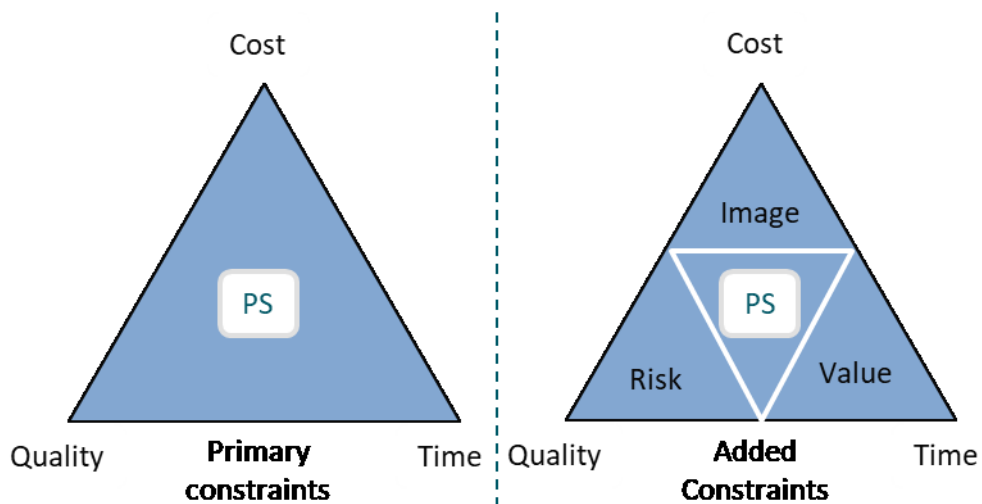


Figure 11: Iron triangle of Project success
(Atkinson, 1999) and (Kerzner, 2013)

Brief history of the triple constraints: Jugdev and Müller (2005) find that the strategic value of project management has increased significantly in the 21st century and identify trends how PS was measured in four periods as follows. Period 1(1960's-1980's): The importance of simple measurable factors such as Cost, Time, Quality and Specifications was seen as central to all projects. Project managers were in key seat to steer projects to completion and delivery. During Period 2 (from 1980's..) and Period 3 (..until early 2000's): More specific factors for success were being explored under the term *Project Critical Success Factors (CSF)*. Spotlight was on stakeholder involvement and end-user and/or customer satisfaction. The Iron triangle or Triple constraints was still seen as necessary, however other objectives such as Organizational effectiveness, Project functionality, Contractors commercial performance communications and control and resourcing were seen as necessary elements of overall project success. Period 3 (beyond 2000's): Research and study in the field of project success was gaining a holistic approach and was being developed in to an integrative concept. Factors such as Project efficiency, customer involvement, business success thru projects, and readiness to future were becoming important. Success criteria became more subjective and something that could be agreed in the beginning of project. Importance of collaborative work environment, flexibility to deal with changes and unforeseen circumstances became key for project success. Projects in present day (in 21st century)

shifted from success in delivering what was contracted, towards a wider set of objectives based on acceptance, satisfaction, active involvement of all stakeholders and adaptability to changes (Jugdev & Müller, 2005).

Alternatives to triple constraint criteria: One of the important articles in the triple constraint perspective was presented by Roger Atkinson, 1999. In this article Atkinson takes a critical view of the triple constraints to be the industry standard for measuring PS and argues that other criteria as well such as Stakeholder satisfaction needed to be considered (Atkinson, 1999). Atkinson argues that if triple constraints are the only criteria used to measure success, then the focus has been on judging only if the project was done right. However, a project done right, meaning delivered on time, performed within budget limits, and delivered to the quality standards agreed at the beginning of the project, may not necessarily bring customer satisfaction, may not provide any improvement or enhancements to the project team involved, and may not add any value to the stakeholders involved. As an alternative, Atkinson suggested three additional categories, Information systems, Organizational Benefits, and Stakeholder benefits. Atkinson called his model the “*Square root*” criteria to measure PS as presented in (Table 6) below.

Table 6: Atkinsons Square root criteria of project success

Iron triangle	Information	Organizations benefits	Stakeholder benefits
Cost Quality Time	Maintainability Reliability Validity	Improved efficiency, Improved effectiveness, Increased Profits, Strategic alignment, Organizational learning.	User satisfaction, Socio-Environmental impact, Team development and learning, Supplier benefit, Economic impact to others involved.

(Atkinson, 1999)

Artto et. Al (2011) suggest that success in projects can be studied from *efficiency* and *effectiveness* perspective. Efficiency terms will relate to success of project in reaching the Triple constraints (Cost, time, quality) with possible additional criteria such as progressing according to plan (Value achieved) or Change management.

Success measurement from project performance perspective takes a broader look at project success and instead measure the benefits from projects. “Benefits are particularly related to carrying out the expected change, the benefits experienced by the customer, the business-related benefits for the project supplier, and the realization of the expectations of other stakeholders” (Artto, et al., 2011).

Dvir, et al., (2003) studied how project success is perceived in three stakeholder groups namely, end-user (or customer), project planners and managers, and the contracting office (or project sponsor). The results of their study are presented in (

Table 7) below. The researchers conclude that project planning does indeed have positive and significant effect on the overall project success. Among the success measures listed below the researchers highlight that “...the most important dimension of project success is the end-user benefit.” because simply put “The overall success measure mainly reflects the end user point of view...” (Dvir, et al., 2003)

Table 7: Success criteria measured in three critical groups.

Groups	Success criteria seen as most important
Project planning and managing group	Defining functional requirements Defining of technical requirements Meeting delivery goals
End-user group	Improvement in performance from previous product End-user satisfaction Receiving Longer time solution to problem
Project sponsor group	Developing new knowledge and expertise Technology advancements Reputation or image boost

(Dvir, et al., 2003)

Joslin & Müller, (2016b) investigated empirically, the relationship between project governance and project success. Their research uses a model considering hard and soft factors and measures success in 25 criteria across five dimensions.

The five dimensions of project success based on Joslin & Müller, (2016b) study are as follows

1. Stake holder satisfaction,
2. Projects impact,
3. Organizational benefits,
4. Future potential,
5. Project efficiency.

Their research finds that project governance does have a small but significant effect on project success. Importantly, the study results clearly indicate the importance of stakeholder-orientation in project governance (Joslin & Müller, 2016b)

2.4.2 Section summary for PS.

Project success remains to be multidimensional and subjective to perception by the different stakeholders involved. The success criteria for each stakeholder may differ. A same project seen as successful from one stakeholders' point of view can be considered as failure by another stakeholder. It is thus imperative for project stakeholders to define the criteria for the projects they believe to be important to judge project success. Project's may have multiple success criteria set by different stakeholders (Joslin & Müller, 2016a).

In context of APM-scrum perspective Schwaber (1997), finds methodologies to be the most important factors in determining the probability of project success. Constant changes and unpredictable environments highly affect project success and therefore *"Methodologies that encourage and support flexibility have a high degree of tolerance for changes"* (Schwaber, 1997). Organizations that have embraced unpredictability and environmental complexity within their product development process are able to significantly increase the probability of success in projects.

Based on literature review, the main success drivers fall in the four main classes as shown below in (Table 8).

Table 8: Summary of project success criteria based on literature review.

Class	Project success criteria	Source
Planning	<ul style="list-style-type: none"> • Defining functional requirements, • Defining of technical requirements, • Meeting delivery goals. 	Dvir, et al., 2003
Execution	<ul style="list-style-type: none"> • The iron tringle (Cost, Quality, Time), • Flow of information: Maintainability, Reliability and Validity • Developing new knowledge and expertise, • Tolerance to changes. 	Atkinson, 1999 Dvir, et al., 2003 Schwaber, 1997
Performance	<ul style="list-style-type: none"> • Project impact • Project efficiency • Improvement in performance from previous product • Improved efficiency and Improved effectiveness. 	Joslin & Müller, 2016b Dvir, et al., 2003 Atkinson, 1999
Benefits	<ul style="list-style-type: none"> • Stakeholder satisfaction, • End-user satisfaction, • Organizational benefits • Supplier benefit • Economic impact to others involved 	Joslin & Müller, 2016b Dvir, et al., 2003 Artto, et al., 2011 Atkinson, 1999

2.5 Enablers in hybrid project management environment.

In APM and HPM literature, enablers are often described as pre-conditions or necessity of certain factors for successful integration of Agile practices, tools and methods. These enablers have direct impact, not only on the implementation of a project management framework but also affect directly the performance of the given framework (Conforto, et al., 2014). Enablers are generally presented in categories as follows...

1. Organizational enablers: such as: Organizational culture, Work environment, Performance measuring, emphasis on performance or speed and knowledge management.

2. Process enablers: such as: Process automatizations, process concurrency, development milestones, and process modularity.
3. Project team related enabler: such as: Team autonomy, team knowledge, team leadership, team experience, team size and location.
4. Project type related enablers: such as: Project complexity, project novelty, support systems and software's used, customer and stakeholder involvement (Conforto, et al., 2014).

For the purposes of this research it is interesting to study moderating effects of 1) Organizational culture, 2) leadership styles and 3) Quality of teamwork as enablers, on the relationship between HPM and PS. Further sections will present literature review focused on these three enablers.

2.5.1 Organizational culture

Organizational culture (OC) to a set of values, meanings, and key characteristics that the members of a given organization may believe in. for the employees OC may be the system by which they distinguish their organization from other organizations (Robbins, 2002). Based on literature study the following seven characteristics can be summarize what may constitutes to become OC for an organisation...

1. Innovativeness and risk-taking culture: How the employees are encouraged or discouraged to think, develop and take calculated risks.
2. Attention to detail: How employees are perceiving work precision and accuracy of task outputs.
3. Result oriented culture: Managements focus on results and outcomes, rather than techniques, frameworks and procedures.
4. People oriented culture: Management decisions have a human aspect to their decisions and consider effects of decisions on people within the organization.
5. Team oriented culture: Work activities are performed in teams and responsibilities are shared within teams rather than focusing on certain individuals.

6. Competitiveness and ambitiousness: Degree to which the individuals are willing to advance the organization and their own position.
7. Stability: Managements focus on maintaining a stable and consistent environment for- employees to feel safe within.

It is however also observed that organizations do not have homogeneous cultures. There may exist certain dominant or main-stream culture and then several sub-cultures. For example, there may exist a sub-culture within a project organization, that is quite different from its corporate OC. However, it is important that both cultures share the same core values important to the whole organization. OC's develop over several years and are relatively stable as they are rooted deeply in the values shared by the employees. However, OC's can change over time due to, for example "Market crises, Turnover in leadership, weak bonds between main and sub-cultures" (Robbins, 2002). Sub-units or departments within the organization, such as functional departments, product groups, or different teams working on the same project may also develop their own unique cultures. These sub-cultures may present difficulties in integrating sub-level processes to the organizational activities as a result of culture clashes among different subunits. (Cameron & Quinn, 2006).

2.5.2 The Competing values framework

The Competing values Framework (CVF) has been used to research issues ranging from leadership and team development in organizations and also organizational change management. CVF has also been used as a research method to analyse organizational culture. However, the CVF was originally developed to explain better the underlying factors in organizational effectiveness. The focus point of the framework is on the competing tensions and conflicts that built up in any human system. Importance is given to understanding the conflict between stability and change versus conflict between the internal organization and the external environment. The CVF model focuses on the tensions within the organizational life that builds up when trying to achieve equilibrium between change and stability (Denison, 1991). Based on a theoretical model known as the Competing Values

Framework Cameron & Quinn (2006), presented their Organizational Culture Assessment Instrument (OCAI), to be used to diagnose organizational culture. The OCAI is basically a questionnaire to be answered by individuals working with the organization. The OCAI has six items and each item has four alternatives. The individuals answering the questionnaire give points (0min to 20max) to each alternative, and thus each section may receive a total of 100 points. The six sections in OCAI are 1) Dominant Characteristics within the organization, 2) Organizational leadership, 3) Management of employees, 4) Organizational glue Strategic emphasis, and 6) Criteria of success. The scores received will help identify the type of organizational culture in that given organization. *“This framework is extremely useful in organizing and interpreting a wide variety of organizational phenomena”* (Cameron & Quinn, 2006). (See Appendix 3)

The CVF comprises of two main dimensions and four main clusters. One of the dimensions highlights factors such as Flexibility, choice, options and dynamisms; as opposed to factors such as Stability, control and order, while the second dimension brings in aspects arising from internal orientation, integration and unity, as opposed to external orientation, differentiation, and rivalry. Together these two dimensions form four quadrants or culture groups as shown below in (**Error! Reference source not found.**). Each quadrant has a distinct set of organizational effectiveness indicators.

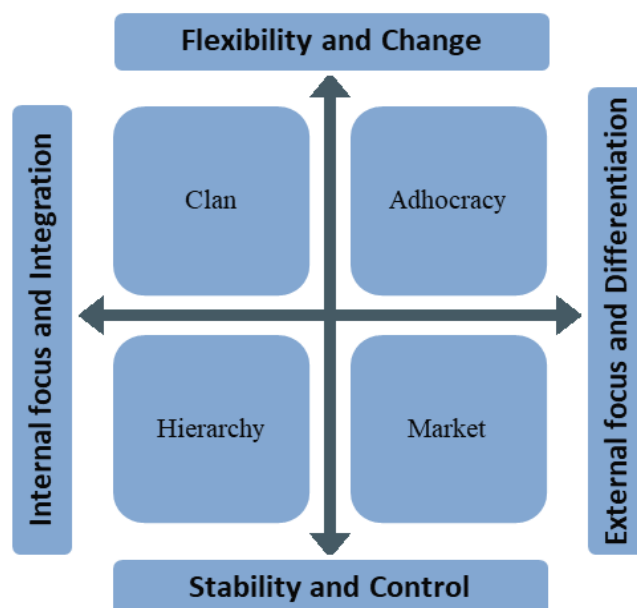


Figure 12: The competing values framework

These indicators of effectiveness represent what the people within the organization value, and what is it that is seen as good and appropriate for them. *“The four clusters of criteria, in other words, define the core values on which judgments about organizations are made”* (Cameron & Quinn, 2006)

The **Clan culture**, also referred to as group culture has an orientation toward collaboration and values flexibility. The **Adhocracy culture**, also referred to as development culture values flexibility with an emphasis on competitive positioning. The **Market culture**, also referred to as rational culture combines an emphasis on stability and control with competitive market positioning. Whereas the **Hierarchical culture** emphasizes entirely on stability and internal integration. The **Clan and group** culture favours participation and encourages the sense of belonging. This culture also positively relates to team members commitment to the team-effort, engagement and employee development. The Hierarchical culture however on the other hand appreciates a structured workplace with formal processes, policies, and standard operating procedures. The hierarchical culture focusses on work efficiency, project timeliness, and control (Yazici, 2011).

2.5.3 Leadership styles in project management

Leadership is a widely studied subject throughout the human civilisation dating back to the early Greek, and Chinese philosophers. Leadership under pretext of “General management theory” was widely studied in modern times since the 1900’s. However, the role of leadership styles as a moderator to project success, and in context to project management, is a relatively less studied area. Turner & Müller (2005) presented an extensive literature review article reciting several schools of leadership theories. Literature on leadership styles commonly discuss the various schools of leadership in the 20th century as presented in (Table 9).

Table 9: Schools of leadership theory in 20th century

Schools / Theories of leadership	Era	Highlights
The trait school	1900— 1940s	<ul style="list-style-type: none"> • Leaders are born, not made. • Conception of a leader as someone who acquires status by showing the ability to help the group in attaining its goals. • Focus on Ability, Personality, Appearance.
The behavioural or style school	1940s— 1960s	<ul style="list-style-type: none"> • Personality traits/behaviour that makes a difference in the performance or satisfaction of the followers. • Effect that “Effective” leaders can make on the team. • Concern for people/relationships, Concern for production, use of authority, involve team in decision making, Flexibility.
The contingency school / (Fiedler’s contingency model of leadership)	1960— 1970s	<ul style="list-style-type: none"> • Task oriented and participative approach • Different leadership for different situations • What makes an effective leader will depend on how well his group or organization performs the primary tasks for which the group exists. • Directive, Supportive, Participating, and Achievement oriented leaders.
Path -Goal theory (sub-theory under contingency theory)		<ul style="list-style-type: none"> • The leader’s behaviour is motivating and increases subordinate goal attainment and clarifies the paths to these goals. • Directive, Supportive, Participating, Achievement-oriented leader behaviours.

The visionary and charismatic school	1980's	<ul style="list-style-type: none"> • Transactional leadership: "Leadership" see as relationship with followers who perceive and evaluate the leader in the context of situational demands. • Rewarding followers for meeting performance targets, acting when tasks are not going as planned. • Transformational leadership: leader motivates followers to do more than what was originally expected. • Exhibits charisma, developing a vision, encourages respect and trust, provides inspiration, motivating by creating high expectations, provides intellectual stimulation with new ideas and approaches.
The emotional intelligence school	Since 1990s	<ul style="list-style-type: none"> • The leader's EI has a greater impact on team performance and its success, than the performance of the leader. • Visionary, Coaching, Affiliative, Democratic, Pacesetter (Demanding), Commanding.
The competency school	Since 1990s	<ul style="list-style-type: none"> • Identifying the competences of effective leaders • Combination of different competences can lead to different styles of leadership, suitable to different situations, circumstances, and complexities. • Intellectual competencies (IQ), Managerial skills (MQ), Emotional competences (EQ).

(Badshah, 2012); (Turner & Müller, 2005)

It is however important to note that (Turner & Müller, 2005) find that project management literature largely does not include the project managers leadership style as a factor towards project success. The argument here being that there is noticeable scientific research available (under general management theory) to show relationship between Line-managers leadership style, to employees' motivation, commitment and stress levels. However, such unambiguous results are not seen

between Project managers leadership style, to project team performances. In project management literature, the leadership style and competence of project managers seems to be given less importance on project success (Turner & Müller, 2005).

The PMBOK® guide (PMI Guide, 2008) explains the role of a project manager in an TPM environment to be quite distinct from that of a functional or line manager. The *PMI Guide*, suggests that an effective project manager much have the following three important skill sets 1) *Knowledge*: of project management techniques and processes, 2) *Performance*: to be able to focus on “Value achieved by work done in given time period”, focusing on what needs to be accomplished during the project and at what needs to be delivered at the end of the project, and 3) *Personality*: personal effectiveness, attitude, personality characteristics and ability to guide the project team to achieve the project goals (PMI Guide, 2008).

The AGILE practice guide (PMI Guide, 2017) explains the role of a project manager in an Agile environment to be somewhat undefined. Agile project teams are self-managing teams where the team members have autonomy to decide who does what and when in order to provide the necessary outputs for a given sprint. This obviously reduces the project managers need to “Manage” the team members. However, the important shift in role of project manager in Agile teams is that project managers become so called “*Servant Leaders*”. In TPM environment the Project manager is the centre and hub of the project. In contrast in APM environment the servant leaders are instead serving the team to handle project complexities, coaching, fostering learning environment, and most importantly aligning the stakeholders and communication networks. “*As servant leaders project managers encourage the distribution of responsibility to the team: to those who have knowledge to get the work done*” (PMI Guide, 2017).

2.5.4 Quality of teamwork

Team dynamics and functioning are, core to any project, regardless of what methodology is being used to manage it. What makes Agile teams different from TPM

teams is that they are more individual and interaction centric. The so called “Scrum team” that is the development team producing deliverables towards the project is largely self-managed (Layton & Ostermiller, 2020). The following (Table 10) highlights some of the main characteristic differences between APM and TPM teams.

Table 10: TPM v/s APM team characteristics

Characteristics	As observed in TPM teams	As observed in APM teams
Control	Team control is hierarchical. Work flow is managed on “Command and control” logic. Project manager assigns tasks to teams and set requirements in Stages. Task follow-up is done in Gates.	Teams are self-managed. Leadership is helping team by coaching, resourcing and removing distractions. Tasks are given in daily scrum, and follow-up in sprint increments.
Performance measurement	Individual team members are evaluated based on their tasks completed status and overall performance during the project.	Collective team performance is evaluated. Every individual in the team is responsible to achieve the set target for a given sprint.
Workload	Team members are often needed to be working on multiple tasks in a given sprint in one project. Several projects may be going on simultaneously where same individuals are performing tasks.	Development core team is focused only on one project at a time. Task team members may be involved in multiple projects, but for one given sprint the focus only on one project at a time.

Roles	Team roles are well defined. Roles come with reporting structure and well-defined project organisation.	Roles are depending on skill-sets and expertise of individual. Roles are not used, instead team work cross functionally to achieve goals. Individual reporting is done only in daily scrum stand-ups.
Team size	Team size largely depends on project structure and scope. Resourcing is done based on project budget and time. No limits on team size.	Core development teams are kept intentionally small, focused to certain skill-set. Core-team is limited from three to nine individuals and one task team leader. Although multiple teams may be involved.

(Layton & Ostermiller, 2020); (PMI Guide, 2017); (PMI Guide, 2008)

In conventional TPM teamwork, the project manager has the role of delegating tasks to team members and time them when to start and complete the tasks. Scope of collaboration between team members is limited to pre-defined roles and task responsibilities. This hierarchical command-and-control method is proven highly effective in controlling project costs, schedules and progress. In contrast APM teams apply the “people over process” principle and team has autonomy to manage themselves. Self-managed teams are seen to be most effective in Agile projects where scope changes are frequent and deliverables are not well defined at project start (Malik, et al., 2021)

Understanding the role and effects of quality of teamwork on project success is a rather niche subject and very limited research data and literature was found on this subject. In an industry wide survey research to measure the effects of project

managers leadership styles, and team work on to project's success (Yang, et al., 2011) collected data from over 200 projects undertaken in the Taiwanese construction industry. Yang, et al., (2011) showed that certain type of leadership styles enhanced relationships amongst team members and observed that team communication, collaboration and cohesiveness were significantly better for those projects where the project manager used a transactional and transformational leadership style (refer to Table 9: Leadership styles). Yang, et al., (2011) also observed that project success factors of schedule, cost and quality performance and stakeholder satisfaction (2.4.1: Project success factors) were significantly affected by the quality of teamwork (Yang, et al., 2011).

(Hoegl & Gemuenden, 2001) performed an empirical study to find how teamwork quality and success in innovative projects is interlinked. During their study the researchers refer to parallel researches and came to a common understanding of "What can be defined as a team". The researchers define a team to being "a social system of three or more people", that is placed in a common context, meaning a company or an organization, and the members of this "social system" collaborate on one or more common tasks. The researchers conceptualised teamwork quality as a "multifaceted higher order construct", and devised six concepts to understand teamwork as quality construct. These six constructs are as follows:

1. Communication.
2. Coordination.
3. Balance of Member Contributions.
4. Mutual Support.
5. Efforts from team members to team's tasks.
6. Cohesion between team members, that is "*..are team members motivated to maintain the team? And is there team spirit?*" (Hoegl & Gemuenden, 2001).

3 RESEARCH DESIGN AND METHODS

The research steps and timelines were as shown in (Table 11) below.

Table 11: Research steps and timelines

Step	Topic	Period
Step 1	Research topic selection, finalisation and case selection.	January - February 2021
Step 2	Background research, topic studying and focusing.	March - April 2021
Step 3	Studying the topics chosen and literature review	May -October 2021
Step 4	Research plan for data collection, informal discussions within case companies and interview candidate's selection	November 2021
Step 5	Data collection via interviews	December 2021
Step 6	Data analysis and thesis compilation, and connecting the literature review to research data.	January-April 2022

Background research: Prior to the interviews, the researcher performed a background research of project processes in the case companies. During the interviewees the researcher was able to further deepen understanding of the case company's project environments, how the interviewees interpreted project success and what parameters the case companies' use to interpret project's performances. Some background information was also collected on the roles of the individuals and leadership styles in general used in the case companies. With this type of combination of observation and data collection thru interviews the researcher is able take a much broader view of the theory or phenomenon being researched *"... within its natural context using multiple sources of evidence"* and *"... attempts to explore a host of factors that may be influencing a situation"* (Hancock & Algozzine, 2006)

In case study researches interviews are a most important form of data collection. While planning for the interviews, researcher followed the following five guidelines for successful data collection presented by Hancock & Algozzine (2006)...

1. "... the researcher should identify key participants in the situation whose knowledge and opinions may provide important insights regarding the research questions."
2. "... the researcher should develop an interview guide [...]will identify appropriate open ended questions that the researcher will ask each interviewee."**Error! Bookmark not defined.**
3. "Third, the researcher should consider the setting in which he or she conducts the interview...the researcher may seek a private, neutral, and distraction-free interview location to increase the comfort of the interviewee and the likelihood of attaining high-quality information"
4. "... the researcher should develop means for recording the interview data."
5. "... the researcher must adhere to legal and ethical requirements for all research involving people." (Hancock & Algozzine, 2006)

In this research the interview candidates were selected thru informal discussions with various individuals in the case companies. The criteria for interviewee selection were as follows

1. Years of experience the individual has in project management.
2. Individuals present role and involvement in actual operative projects in the case company.
3. Individual familiarisation and basic knowledge in the area of project management theories, and
4. Individuals interest to participate in an open minded and un-biased interview session.

Table 12: List of interviewees for case study

Case company	Interviewee	Years of experience in projects	Designation
CC1, Citec Oy, Vaasa	Interviewee A	12 yrs	Head of mechanical design team
	Interviewee B	5 yrs	Project manager, plant engineering
	Interviewee C	15 yrs	Senior manager, plant engineering

	Interviewee E	8 yrs	Chief design engineer, plant engineering
CC2, Wärtsilä Energy Business division	Interviewee D.	7	Product manager, plant equipment
	Interviewee H	12	Project group manager, power plant projects
CC2 Metso Outotec Oy	Interviewee F.	14 yrs	Project manager, plant upgradation and service projects
CC3 VEO Oy	Interviewee G	8 yrs	Process development and quality manager, automation and energy solution projects

Questions for the structured interviews were discussed in meetings, debated and were pre-tested with the research professor and an external research advisor. The interview questions were structured in three main themes,

1. Project management method used and link to project success.
2. Experience of Agile or Hybrid methodologies in practice.
3. Effects of enablers on project's success.

A pre-notification or permission for being interviewed was sent to twelve select individuals with option to choose between face-to-face or online interviews. The researcher received nine confirmed replies agreeing to participate in interviews. In actual however only eight interviews were successfully conducted. Tool used for pre-notification / permission forms was Google-forms.

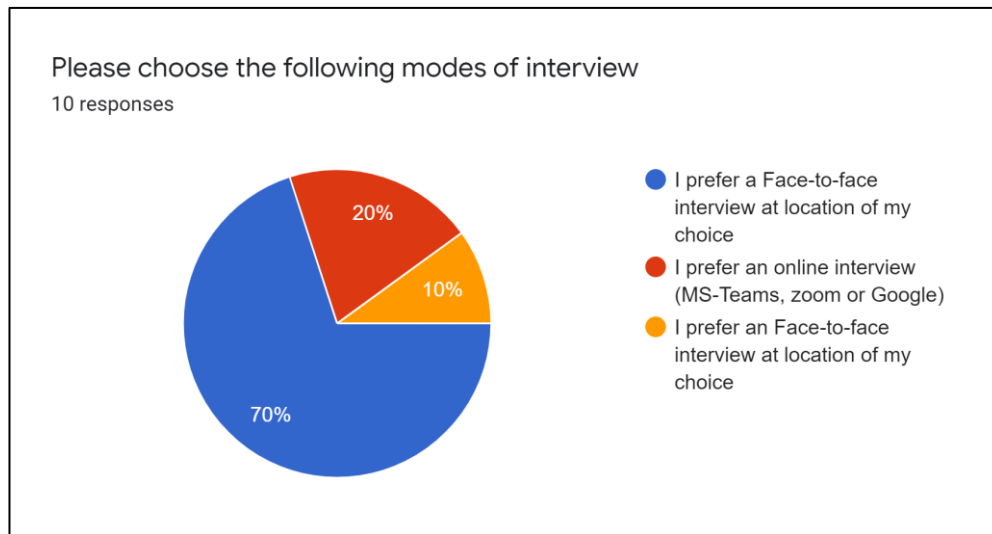


Figure 13: Responses to interview invitations

The face-to-face interviews were held in a specific meeting room in the case company one (Citec Oy) premises. This meeting room specifically selected was located away from the other office space, behind the lunch room of the office premises on a separate floor than the interviewee's actual work area. This meeting room also had a very comfortable and non-conventional seating arrangement making interviewee feel relaxed and comfortable.

For the online interviews it was decided in mutual understandings with the interviewees that the day and time for interview's will be such that interviewees can participate from their home and during their free-time. Some online interviews were held on weekends, public-holidays or at late evening hours according to the interviewee's wishes.

The face-to-face interviews were recorded using computer audio and an external microphone, with the permission of the interviewee. The external microphone was intentionally used for better audio quality purposes and also to clearly message the interviewee that their voice was being recorded. For online interviews (Zoom call), the recording was audio only and with the permission and knowledge of the participant. Two of the eight interviewees did not give permission for audio recording, so their answers were written down during the interview itself.

The interviewees were asked to fill in a consent form digitally to participate in the interviews. The consent form contained the basic information on topics of research. In addition, along with the actual interview invitations the interviewees also received beforehand the interview questions as they will be presented in the interview itself. When the interviews started, it was made clear to the interviewee that none of the questions were compulsory to be answered, and the interview can be ended at any time they wish. After each interview the transcribed replies were shared with the respective interviewee for commenting or correcting.

3.1.1 Introduction to the Case companies.

The core businesses areas of these case companies are machine building, hardware technology, mining and minerals and energy generation or power plant projects.

Case company one (CC1): Citec Oy, Vaasa, Finland. Citec Oy is an engineering consultancy company that provides design engineering, project management services and man-power for machine design and plant design process. Citec Oy, works in close contact and collaboration with their customers and has tailored their project management methods to fit the customer and project requirements. "Citec and Wärtsilä Energy Solutions have cooperated globally for a long time. As often happens in a long partnership, the way of working easily falls into a comfort zone where parties perform activities based on their so-called 'standard way of working'". (Citec Oy, 2018).

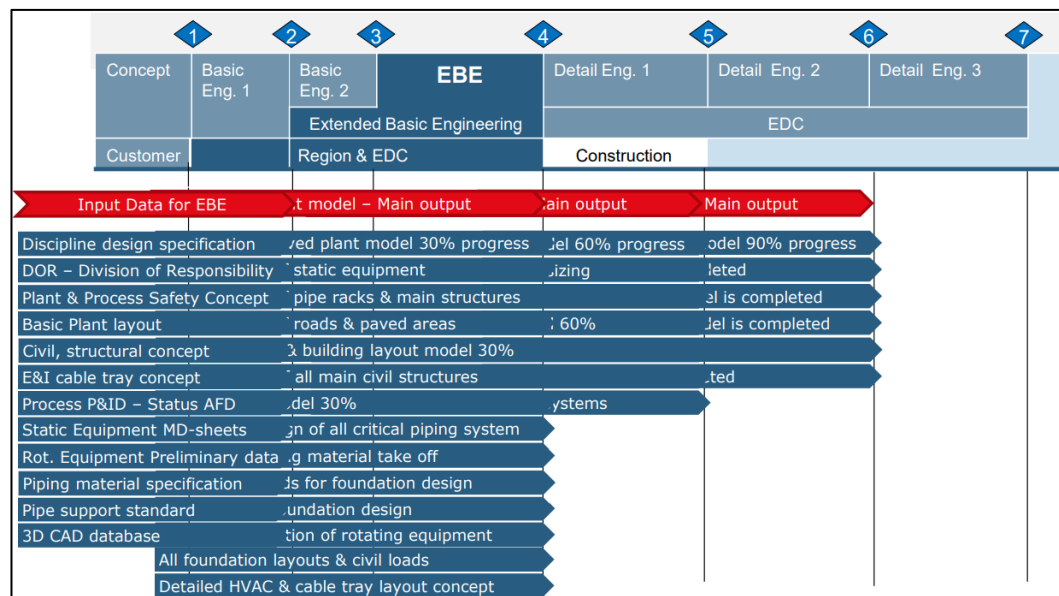


Figure 14: The key project stages and the disciplines at CC1
(Citec Oy, 2018)

CC1 utilises a customized “*Project Gate Model*” for project planning and execution as shown in (Figure 14) above. When project is started, the first step is to split projects into smaller parts or work packages. Each work package consists of pre-determined and interrelated actions that are executed in project discipline teams in a planned order. Typical medium to large scale plant design projects are performed in several discipline teams.

Case company two (CC2): Wärtsilä Oy, Energy business division. Wärtsilä manufactures engines for industrial solutions and the Energy Business division offers project services for power plant EEQ (Engineering and Equipment delivery), and EPC (Engineering Procurement and Construction) projects. Wärtsilä’s project strength comes from their inhouse expertise and a large resource pool of “...more than 250 project managers and project engineers, including 100+ PMI certified professionals, who are coupled with competent project control and planning teams. Wärtsilä deliveries are on time, ensuring that all projects proceed according to schedule.” (Wärtsilä Oy, 2021)

The project management systems followed at **CC2** are customized but based on multiple standards, including: Project Management Institute (PMI) standards, PMBOK® Guide, and ISO 21500 & ISO 10005 standards. Project services offered by Wärtsilä Energy Solutions Oy is presented in (Figure 15) below. The customized gate model used for power plant projects is presented in (Figure 16)

PROJECT SERVICE SCOPES					
PROJECT SERVICES	BASIC EEQ	EXTENDED EEQ	PROCESS EPC	EPC	EPCM
PROJECT MANAGEMENT	Delivery coordination	●	●		
	Construction management				
	EPC responsibility			●	●
ENGINEERING	Basic engineering of main systems	●	●	●	●
	Detailed plant engineering		●	●	●
PROCUREMENT	Procurement of main equipment	●	●	●	●
	Procurement of balance of plant equipment and material		●	●	●
LOGISTICS	Logistics acc. to contractual delivery items	●	●		
	Logistics to site			●	●
INSTALLATION & CONSTRUCTION	Site management advisory	●	●		
	Site logistics advisory	●	●		
	Project Scheduler/Planner service	●	●		
	Health, safety, environment (HSE) advisory	●	●		
	Technical advisory during installation	●	●		
	Construction management and site supervision			●	●
	Subcontracting			●	●
	Civil works (substructures)			●	●
COMMISSIONING	Installation works			●	●
	Commissioning advisory service	●	●		
	Commissioning			●	●
Commissioning management			●	●	

Fully customizable

● = included service
● = optional service

Figure 15: Project services offered by CC2 (Wärtsilä Oy, 2021)

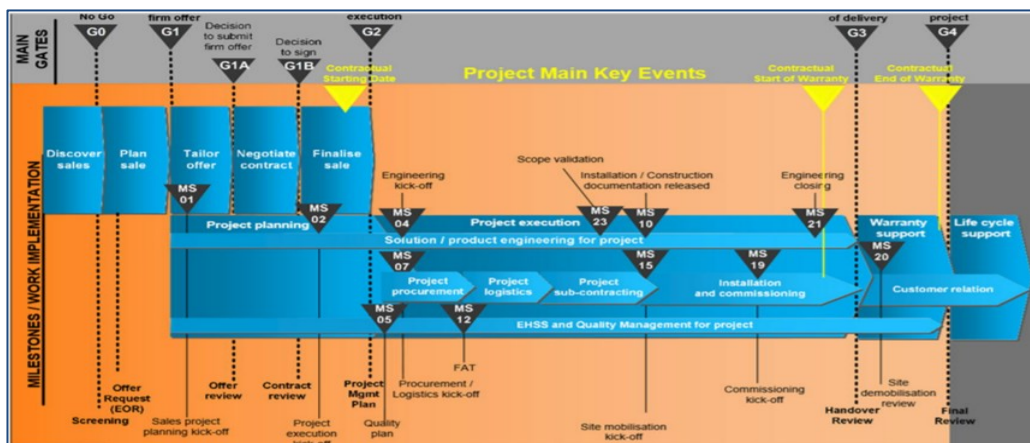


Figure 16: Customized gate model for power plant projects at CC2

The gate model used at **CC2** is customized to fit large and medium scale power plant projects. Instead of a standard five stage stage-gate model (as shown in **Error! Reference source not found.**), the **CC2** gate model has fewer gates (G0 to G4),

but instead incorporates more milestones (M01 to M20) as shown in (Figure 16) below . Gates G0 to G2 are pre-project execution phases that include sales and offering activities, and also sub-gates G1A and G1B where project contract negotiations are finalised. Milestone MS01 starts the projects planning processes, and G2 and MS4 trigger the actual project execution phases. All deliverables related engineering activities are completed by MS21 and all project deliverables are done by G3. G4 is considered as an “Extended” gate where project warranty and customer acceptance issues are handled. At end of G4, the project is considered as “Closed” and handed over to life cycle support team.

Case company three (CC3): Metso Outotec is one of the Finland’s leading companies in their market segment and offer technology solutions, project services and plant design for Mining, Aggregates, Metal refining and Recycling solutions. Core business activities at Metso Outotec are Machinery R&D, Plant modernization, upgrade, and retrofit projects, Process optimisation projects, and life cycle services including spare part and maintenance of supplied equipment. (<https://www.mogroup.com/>)

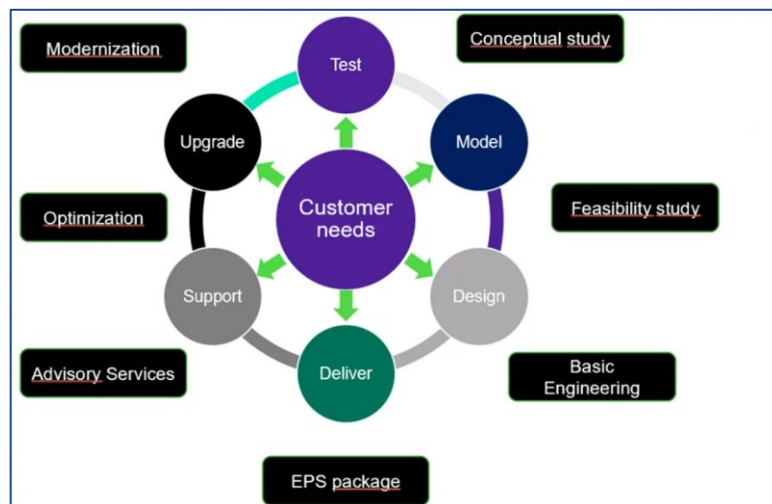


Figure 17: Project offerings and project phases at CC3 (Metso Outotec, 2021)

Case company four (CC4): Main activities at VEO Oy in located in Vaasa, Finland, are design and manufacturing of industrial automation, drives and power distribution solutions for the energy and process industries. VEO had developed and have manufacturing facilities for their own control systems products aimed at electrifications and industrial process applications. Main customers of VEO are power plants, process industries, cranes and ships as well as heavy industry customers such as paper mills and power plants. VEO has three main business units, *Power generation, Power utilisation and Power distribution*. Each business unit has their own set of physical products and own customized business and project management services. VEO has an average of 300 ongoing projects throughout the year. The scope of these projects varies from individual device deliveries to large power plant complexes. *“At VEO, a project start involves a lot of meetings with different configurations; a handover sales meeting between the sales team and the project manager, an internal meeting between the project manager and the project team, and a separate meeting with the customer.”* (VEO, 2020)

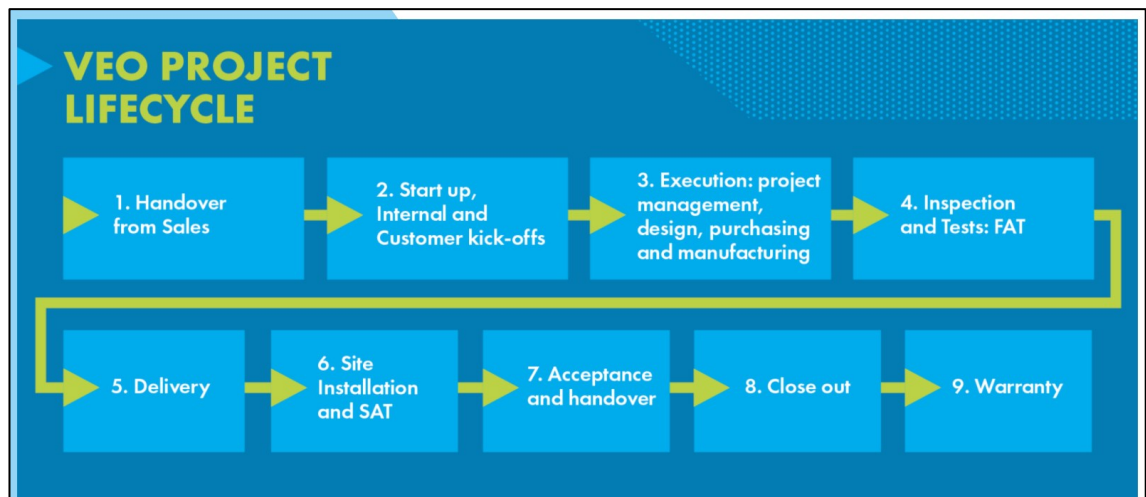


Figure 18: Project lifecycle stages at CC4 (VEO, 2020)

3.1.2 Data collection procedure.

Interview questions were formulated based on based on literature reviewed for this research. The tool used for questionnaire was Google-forms which gives the advantage of direct integration of answers filled to the on-line forms to a spreadsheet.

Audio recordings were done with permission from interviewees for six of eight interviews. Two of the interviewees did not wish to have an audio recording done, so their answers were written directly in to Google-forms with their consent and submitted at the end of the interview. All audio interviews were transcribed in detail with help of online transcribing service otter.ai. and manually re-listening and coding the text.

3.1.3 Method of data analysis.

The model of data collection, analysis and results is presented in (Figure 19). The interviews were transcribed and deductive thematic analysis was conducted. Thematic analysis means that the answers or inputs received from the interviews are examined in reflection to the research questions. This helps the researcher to build a “interpreted answer” to the questions. These “Interpreted answers” are further categorized into major themes. When all interview inputs are analysed and processed, themes emerge that can be then supported by theory, literature review and other established information (Hancock & Algozzine, 2006)

Thematic analysis involved coding the data into pre-identified themes, identifying and reviewing the audio recordings and interview notes. Post-interviews, each interviewee’s answers were examined, re-transcribed and filled in to spreadsheet to compared. The actual data from the interviews was analysed in the following four steps...

1. Coding and transcribing the interviews: Using transcription software and manually filled forms

2. Coding and classifying: Filling the answers into respective theme questions in Google-form and separate spreadsheet
3. Classification and analysis: The answers from interviewees were compared on spreadsheet.
4. Word clouds were created per question based on all the interviewees answers.

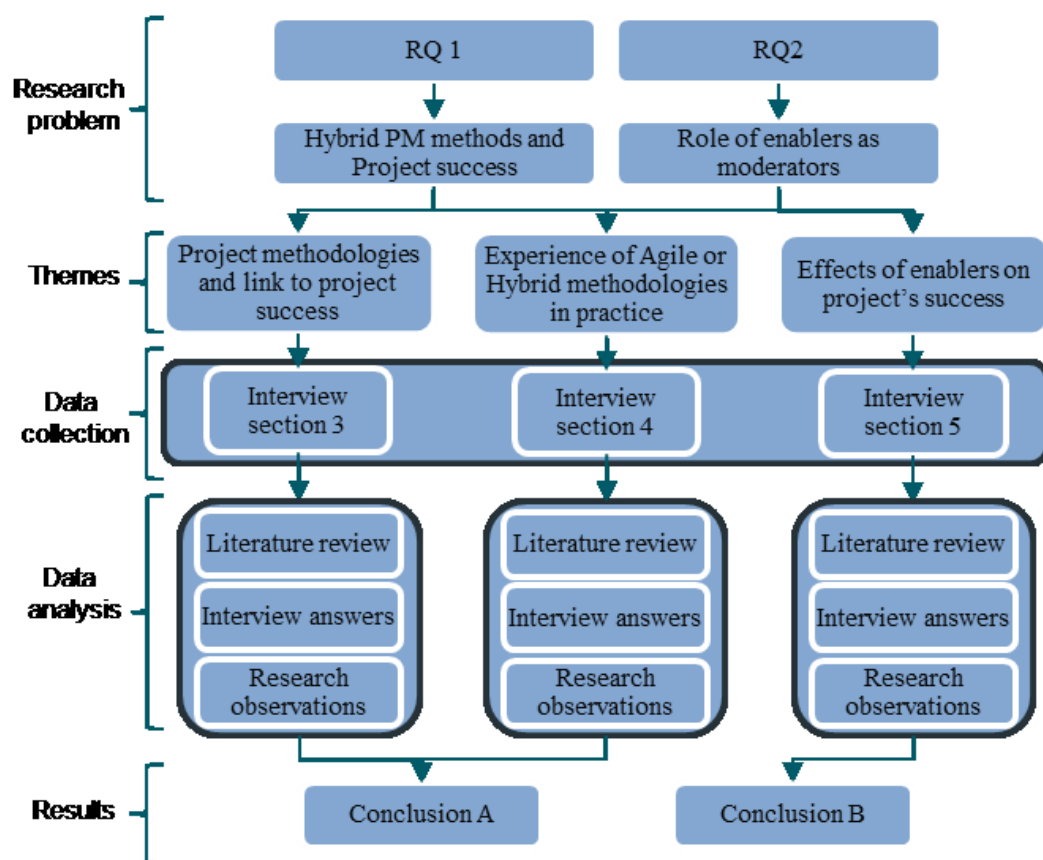


Figure 19: Model of data collection, analysis and results

Step 1: The audio recordings from the interviews were uploaded to online transcribing service for basic coding and transcribing. Otter.ai has ability to analyse and separate speakers and tags the transcriptions according to “Speaker one” or “Speaker two”. However, the software’s accuracy is only up to 90% correct for native English speakers and about 80% with some kind of accent on English. Therefore, researcher needed to listen to, understand and correct the transcriptions carefully based on audio recordings, after each interview. Transcriptions were

then saved to PDF format, and separate audio files securely stored for research validity purposes. Audio files will be delegated later on, and only transcriptions will be stored for further research. Transcription and filled-in forms with answers were sent to respective interviewees for review and commenting.

Step 2: The interviews were structured. Each theme had between two and four questions. In some cases, the answers were written down during the interview itself, but in other cases the questionnaire was used only to guide the interview discussion flow and audio recording was done. After the interview the researcher transcribed the audio and filled in the theme-answers in Google-forms or Google-spreadsheet.

Step 3: All the answers from Google-forms were collected to an attached spreadsheet. With help of the transcriptions, missing data was also filled in the spreadsheet directly. The interviews were time stamped and tagged for proper identification as shown in (Appendix 5).

Step 4: Word clouds were created for answers collectively, using a free internet-based word cloud generator to identify the commonalities. Shown below are examples in (Figure 20) and (Figure 21) with word-clouds from actual interview answers. Some level of editing was necessary for the word-cloud to be generated properly, and giving proper weightage to the proper terms being answered during the interviews.

Word cloud for the question “Can you please describe the core business activities of your company or business unit you are working in?” in (Figure 20) below

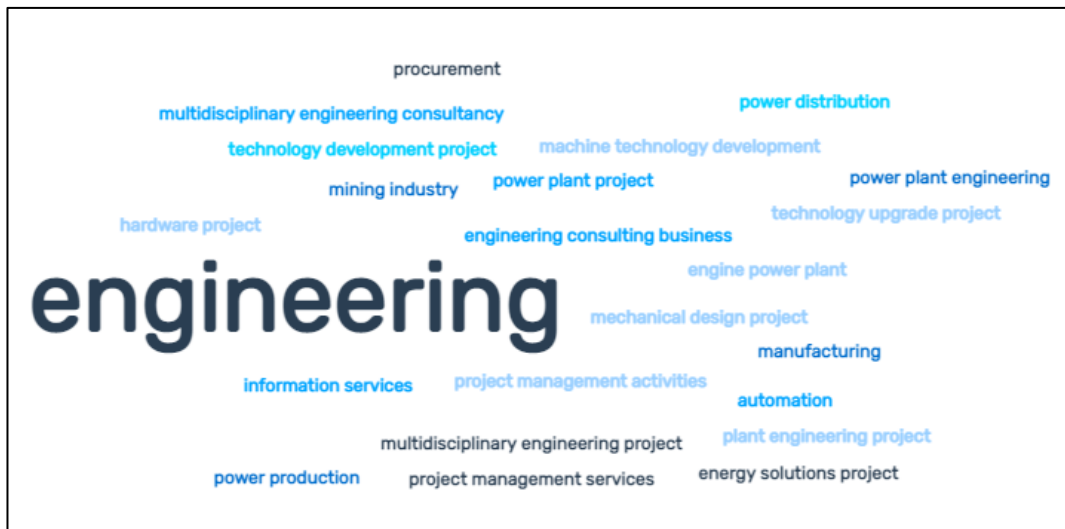


Figure 20: Answers on core business activities in case companies

Word cloud for the question “What kind of projects are carried out in your team?” in (Figure 21) below



Figure 21: Answers for type of projects in case companies

4 DATA ANALYSIS

The thematic analysis of the interview data is presented in this chapter.

4.1 Analysis of RQ1

Research question one was presented in chapter 1.2: **RQ1**: How hybrid project management methodology affects project's success?

In Section 3 of the interviews, the thematic questions as shown below (

Table 13) were formulated to investigate RQ1.

Table 13: Interview questions and themes for RQ1

Interview question	Theme classification
What type of project management method is typically used in your team or company?	Project management methods.
Did you experience any specific advantages coming from the project management method that was used?	Advantages of project management methods used.
Did you experience any specific difficulties or hurdles that were relating to the project management method used?	Disadvantages of project management methods used.
What criteria for project success were used and how were they measured?	Project success criteria.

4.1.1 Analysis of PM methods used in case companies

Almost all of the interviewees referred to certain type of Stage-gate based project management method being used in the projects that they have been involved with directly, or then for other projects undertaken in their companies. In addition, some interviewees also mentioned that the PM method they use is to certain level "Customized" to suite their projects. The interviewees almost commonly identified the task-flow and processes in their projects to be that of typical "Waterfall" method as shown in (Figure 5). The word cloud for answers from eight interviewees to question "What type of project management method is typically used in your team or company?" is shown in (Figure 22) below.

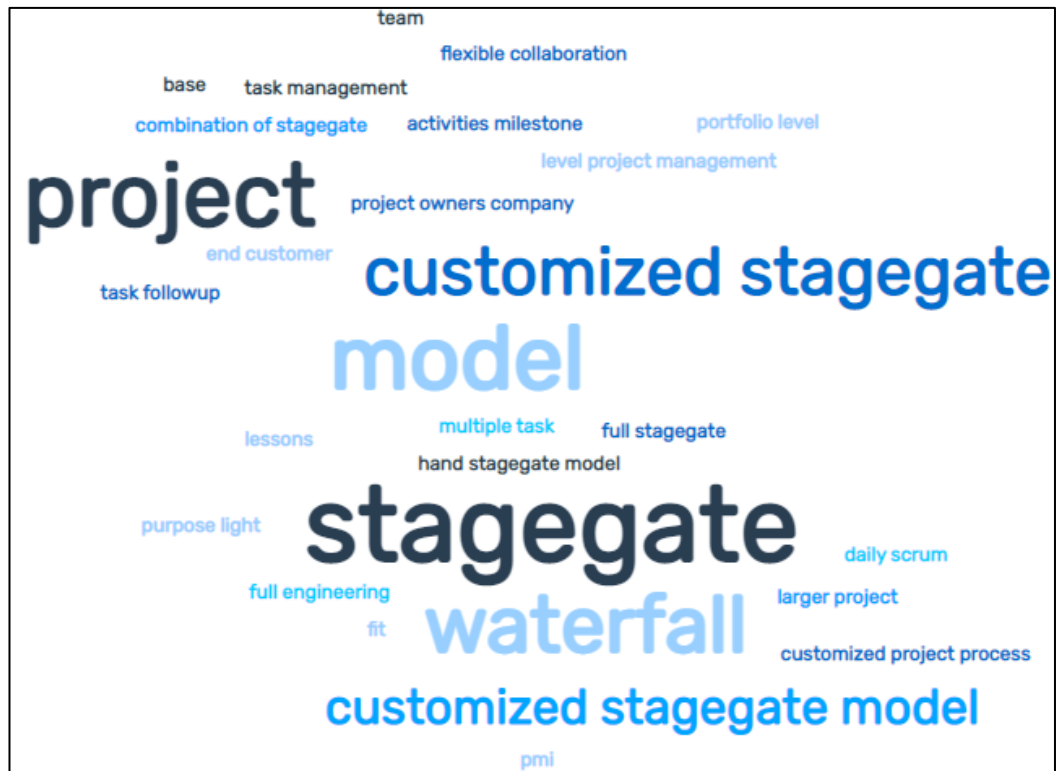


Figure 22: Word cloud for PM methods used in case companies

Interview quotes regarding project management methods used in case companies is presented below in (

Table 14)

Table 14: Quotes for project methods used in case company

Interview quotes	Interviewee
<p><i>“Fit to purpose Light Stage-gate is quite typically used. Stage-Gate is used for strategic project management level, For larger projects a Full stage-gate is used... Light SG gives us more control over "Go-NO-GO" decisions and saves time that can be used in execution”</i></p>	<p>Interviewee D</p>
<p><i>“We have combination of Stage-gate and Waterfall. Our project’s start from an approved "Sales case" followed by Project execution (this includes project categorization). We follow Gate model from G1 to G4”</i></p>	<p>Interviewee F</p>

<p><i>“We have PMI based, customized Stage-gate model as our “Base” model. Customization is focused towards more flexible collaboration with end customer. Stages include activity milestones. Streamlined reporting at portfolio level.”... “We get more time to focus on customer related works. Our method gives increased ownership to operative project team”.</i></p>	<p>Interviewee H</p>
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4.1.2 Analysis of presently used PM methods in case companies

In terms of Advantages, the interviewees answered that Stage-gate method provides them with a proven “Structure to follow”, and as long as the team was receiving the needed inputs, they could follow the process and the outputs would meet the set expectations. For repetitive tasks and similar kind of projects performed in **CC1**, Stage-gate model was producing good results. The interviewees from **CC1** found that their PM method allows them to do proper project planning, scope planning, task scheduling and also resource planning. Project managers from other case companies found that their PM method gives them a proper communication plan, well defined roles for team members, and helps in achieving proper project budgeting.

In terms of disadvantages, the interviewees answered that they found proper estimation of tasks to be very difficult to achieve in projects. They found that due to their PM method, they need to make estimations and scheduling in very early stages of projects. Due to this their project estimation’s and the task schedules were often off-mark and inaccurate. Project managers found that their PM method was too demanding in case of smaller projects with low number of tasks and that the processes were too rigid to be followed in case of non-typical projects or in case of fulfilling special customer demands during projects (See following table 15).

Table 15: Interview quotes for advantages and disadvantages of PM methods

Interview quotes	Interviewee
<p><i>"We have well defined processes, and so long as the inputs are not deviating from earlier projects, then the outputs meet the expectations of the customer. For typical solutions our processes work well, and our people know our processes."</i></p>	Interviewee C
<p><i>"Estimations is done by people who are not efficient "Do-ers" and "Doers" are not involved in planning.... Team leader or the project manager is estimating for them. ... and maybe estimating too low, because you're the leader; you've showed a bit nice numbers, of course, and maybe not knowing what the task really takes to do it"</i></p>	Interviewee A
<p><i>"For non-typical and for special requirements, we are not flexible enough to step out from our processes."</i></p>	Interviewee C
<p><i>"Full SG is bit too High level too rigorous for a normal small level R&D project. The SG gives a structure, but not many tools for actual execution."</i></p>	Interviewee D
<p><i>"We had started with good planning, Scope was agreed on, scheduling was done properly. With Waterfall we are able to do better resource planning"</i></p>	Interviewee E
<p><i>"We did project kick-off and project opening as our process...We had set project budget forecasts. Project scope understanding was done. Communication plan was done and good. Team is known, scope is known, budget allocation was communicated to team."</i></p>	Interviewee F

The second most common aspect to all the interviewees answers was that they would rather compromise on “Cost” in order to achieve or maintain certain quality. Project overheads and resource cost were specifically mentioned to be “Not so important”, or “Sacrificial” in overall success of the project. Other aspects that were seen important by the interviewees in terms of project success criteria were *customer satisfaction, performance, and time-schedules*. The quotes from the interviews can be seen in following (

Table 16).

Table 16: Interview quotes for project success criteria in case companies

Interview quotes	Interviewee
<i>“Quality is first...Quality not to be put to risk. Cost is not the highest priority. ...most of the times there is also a due date or time schedule.... quality is always something that you don't reduce from so to say”</i>	Interviewee A
<i>“For us the Quality and Performance was at the top. Good quality is key to success. Performance is based on good communication and keeping time schedules. Customer satisfaction is very important. Cost is not the main issue, but customer values good service.. real value from our performance.”</i>	Interviewee E
<i>“Customer centric approach, Customer satisfaction in terms of product up time, Quality of delivery. How satisfied consumers are with your products/services, How loyal they are to your brand, How likely customers are to recommend your company to others”.</i>	Interviewee F
<i>“Customer satisfaction, Net Present Score is important. Project budget and margin. Delivery accuracy is followed.”</i>	Interviewee H

4.2 Analysis of RQ2

The second research question presented in (chapter 1.2, Research Questions) was: **RQ2:** How Project manager’s Leadership style, organizational culture and the quality of teamwork, affect the relationship between project management method and project success?

The questions in Section 5 of the interview shown below in (Table 17) were formulated to investigate RQ2 from the point of view of the case companies.

Table 17: Interview questions and respective themes for RQ2

Interview question	Theme classification
Describe the role of a project leader or project manager in your team or company?	Leadership styles
For project leaders, what kind of leadership qualities, personality traits, or skill-sets do you see as important, and do they affect the overall performance of the project team and the project?	Leadership styles
In your experience, how important do you consider Quality of teamwork affecting towards project performance?	Quality of teamwork
Can you describe certain specific characteristics that you may consider as "My organisation's culture"? What are the specific ideals or values that set you apart from any other similar company?	Organizational culture
In your experience does company specific culture influence directly or indirectly on the team and ultimately the project's performance?	Organizational culture

4.2.1 Analysis of Leadership styles in the case companies

When asked to describe the role of a project leader or project manager, the interviewees described this role to carry most of the “Responsibilities” in projects. Interviewees answered that typically project managers in their companies were responsible to be in close contact with end customer’s and collect needed inputs and deliver them to the project team. Interviewees from **CC1** answered that the

project managers in their company take responsibility to prepare the project plans, communicate them to the team as well as customers, and were also responsible to produce and deliver project reports at agreed intervals as the project progresses. Interviewee F shared his view from **CC3** where project managers are also seen as “Project Owners” and were involved in all aspects of project planning, executions, reporting and so on all the way till project closing and later lessons-learned recording for future purposes. The interviewees from **CC2** replied that their project managers had somewhat lesser responsibilities burden, but instead carried an increased “accountability” towards the project and are required to regularly communicate the project’s progress stakeholders. In **CC4** the project managers role was seen to be more of helping, guiding and enabling the project team and keeping communication streams flowing.

According to this SFS-ISO standard, the project manager’s duties may include , providing day-to-day supervision and leadership, set scope of work and targets for the team, monitoring, forecasting and reporting overall progress against the project plan, controlling and managing project changes, ensuring stakeholder engagement and communication, and validating the deliverables and outcomes provided by the project team (SFS-ISO 21502, 2021). These role definitions are highly identical to the answers received in interviews of this research as can be seen from following table (Table 18)

Table 18: Interview quotes for role of project manager in case companies

Interview quotes	Interviewee
<i>Project manager: “Main responsible person towards customer, who is taking care of project planning, follow up and reporting.”</i>	Interviewee C

<i>“Project manager is leading and guiding the team. PM is responsible to arrange team meetings, responsible for communicating to the stakeholders. Main point of contact for different stakeholders.”</i>	Interviewee E
<i>“Project manager has the full responsibility of the project. PM is basically Project owner. PM starting from project planning, execution, delivery, lessons learned, project closing. PM does work allocation.”</i>	Interviewee F
<i>“PM's responsibility was Well, their responsibility was to you know, define the tasks avoid getting too much on the plate at the same time, divide the sub tasks for certain people. Make sure that everyone is informed, make sure everyone knows the deadlines lines.”</i>	Interviewee G

The next follow-up question was regarding the leadership styles of project managers in case companies (see

Table 17). The interviewees were asked to comment on leadership qualities, personality traits, or skill-sets of project managers that they saw as important towards project's performances. Most of the interviewees commented that while the project manager needs to have strong technical knowledge of companies' products and technology, it was equally important to have "People skills" or soft skills when working with teams. Interviewees commented that project managers must be able to motivate and encourage team members to have a problem-solving attitude and come up with solutions in order to keep up with project targets. These perceptions of project managers leadership styles and skills are highly identical to the answers received in interviews of this research as can be seen from interview quotes in following (Table 19).

Table 19: Interview quotes on project managers leadership styles and skills

Interview quotes	Interviewee
<p><i>Project manager: “Team player, needs to have basic knowledge of technology. The project leader of course needs to be good with people I see. And like a team of course, you need to have the technical background as well to be able to execute the project. ... able to understand and follow the company’s project management guidelines or directives., What and how the team is working. basics of some project management tools. Does have a direct effect on the project performance.”</i></p>	Interviewee A
<p><i>“Project Leader should be more organised with good technical and people skills. For technology companies it is quite important to have technical knowledge for being able to set targets and ensuring product quality. Lack of people skills and micromanagement has negative affect on creativity and pro-activity of people.”</i></p>	Interviewee D
<p><i>“Yes, leadership style does affect project performance. Company Manager, Line managers and strategic managers leadership styles trickles down to PM-level. Leaders should motivate people to come up with solutions.”</i></p>	Interviewee F
<p><i>“Our project scope is getting larger. PM's leadership and human skills are becoming more important. PM needs to give time and attention to team. PM should be able to mentor, lead and coach the team members. Forceful management is sees as damaging team performance and indirectly affects projects performance. I see there is direct impact on project performance.”</i></p>	Interviewee H

4.2.2 Analysis of Quality of teamwork in the case companies

The interviewees were asked to comment on how they see quality of team work effecting the performances of their project's. While some of the interviewees saw that proper project planning and project execution processes were more important for overall project success, they also agreed that good team spirits do help in keep up the project performance. Good team spirits came in turn from team members willing to work together understanding each other's strengths and learn to build trustful relationships among the team. On interviewee in particular (Interviewee G, **CC4**) had observed that in one of their longer running projects, they were facing performance issues due to internal conflicts in decision making. The **CC4** project team started to deliberately arrange team building session, getting to gather in free time, and taking efforts to know and understand team mates. Gradually, team members trust and understanding of each other increased and this not only affected positively in the project itself, but also on the overall work performance of those involved in the project. One of the interviewees (Interviewee F, **CC3**) mentioned that it is important in their projects that the team is "solutions" oriented and build expertise in that particular type of projects or technology, thus ensuring customer satisfaction and retention. In **CC3**, they have observed that good team work leads to proactiveness in teams and enhances "learning", and this in turn affects team's ability to come up with good solutions. Overall all of the interviewees commented that while quality of team work was not the key to project success, it was very important for good project performance as can be seen from interview quotes in following (Table 20).

Table 20: Interview quotes on Quality of teamwork.

Interview quotes	Interviewee
<p><i>“Good synergy in team is important. I think if you have a project team, smaller or bigger, they need to work together, and need to have good synergy between them. People have different competences and capabilities so to have a good mix of different competencies in a team will lift up their performance. Team it's like a machinery with a lot of gear wheels. It won't work if once one falls apart.”</i></p>	Interviewee A
<p><i>“If project does not have specific goals, a good team may still fail. Quality of team work is still more important than any project management practice...” (reply in context to project success)</i></p>	Interviewee D
<p><i>“Quality of team work is more important to perform a good project. Good team dynamics, and team efforts, how much team can put in efforts. Some teams are really good at putting efforts and some are not so good at putting good performance. This has major impact on project success and performance.”</i></p>	Interviewee E
<p><i>“Yes, I believe that Quality of team work does affect project performance. Proactive teams will come up with good solutions and become experts in their area.”</i></p>	Interviewee F

<p><i>“...what we saw in the beginning of the project was that when people didn't know each other so well, we had lots of conflicts about like, decision making. But when people knew each other, and they trusted each other, ... we saw that everyone knew each other's strengths. And when we made decisions we already knew that from whom do we ask what”</i></p>	<p>Interviewee G</p>
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4.2.3 Analysis of Organizational culture in the case companies

To understand how Organizational culture may acts as an enabler, interviewees were asked to describe certain specific characteristics of their own organization' culture and their thoughts on direct or indirect influence of OC on to the project's performance (see

Table 17 for questions). Interviewees from **CC1** commonly identified their OC to be multicultural, not just by nationalities, but also because they have many sub-departments within the company that have developed their own way of coping with and cooperating with the customer. Interviewees from **CC1** also commonly identified that that have a people centric and “Team oriented” what is common and essential to the type of business the company is doing. **CC1** is engineering consultancy company where teams of experts work on many customer projects simultaneously in many departments (see pg. 65, **CC1** for further explanation) Interviewee D from **CC2** identified that they there is some level of “risk taking culture” in their organization and has also noticed this to being somewhat un-necessary and “reckless”. Interviewee from **CC4** identified that they do indeed take efforts to build sub-cultures within teams and that their “Team sub-culture” is often quite different than the organization mega culture. Responding to the follow-up question, interviewees commonly agreed that both the OC as well as the team or sub-cultures did have an effect on how their projects perform. Interviewees commented that they have observed not only projects performance suffering but also sometimes quality (of work performed) was affected in certain cases. During the

research interviews, Interviewee E commented that in **CC1**, projects or project tasks are performed in sub-teams and the culture within these teams was ultimately having a larger impact on the project's performance and the OC had minor to no effect on individual projects. Interviewee F from **CC3** commented that they have developed and "open" culture where personnel's training and development is encouraged and this in turn affected positively on quality of work performed as well as employee engagement. Interviewee H mentioned that in **CC2** they believe in having and fostering an "people oriented" culture as this was believed to be more advantageous in "long run" for the entire organisation. The word cloud for interview answers on quality of team work is shown below in (Figure 24)



Figure 24: Word cloud for OC in case companies

The CVF discussed earlier (see section 2.5.2,pg.52) presented the four common organizational cultures, Clan, Adhocracy, Hierarchy, and Market culture (see **Error! Reference source not found.**, pg:**Error! Bookmark not defined.**). Based on the interview answers above it is apparent that the interviewees referred to the *Clan* or

group culture when they say “People oriented culture”. This also explains why the interviewees appreciated “Individual growth” and “Openness”. Refer to interview quotes from this section in (Table 21) below.

Table 21: Interview quotes for OC and its effects on project performance

Interview quotes	Interviewee
<i>“Start-up-culture and Entrepreneurial skills. Innovative-ness and risk-taking culture. I would say results oriented culture is bad, because people do not innovate then, because they're afraid to fail.”</i>	Interviewee B
<i>“In my company we do have some "risk taking culture" [...]On short term Company Culture may not affect the project performance, but in Long term it will have effect. Bad culture will have negative effect in long term.”</i>	Interviewee D
<i>“We have more of a Team oriented culture. Teams are doing their job in their area of expertise.. Company culture may not directly affect on individual projects”</i>	Interviewee E
<i>“Yes, we see that there is link between OC and project performance. My organisation is open for further training of persons. We have higher ethics and strict code of conducts.”</i>	Interviewee F
<i>“Team microculture will have more effect on performance than Organizational culture. Organizational culture is too far from "Frontline" of project work. Teams will have "Own micro culture.... But when another project comes, and the pieces are different, you see that, hey, it doesn't work the same way as you go with this other team.</i>	Interviewee G
<i>“People oriented culture is central to us. I do believe that team culture will affect project's performance. If we do not have people oriented culture it will be damaging in the long run.”</i>	Interviewee H

5 DISCUSSIONS AND CONCLUSION

5.1 Theoretical Contribution

5.1.1 Project Management Method and Its Effect on Project Success

RQ1: How hybrid project management methodology affects project's success?

Data from case interviews: In the analysis (section 4.1) we find that the case companies are using some level of customization in their project management methods. For example, relating to the type of project management method was used, Interviewee G from **CC4** replied *"it depends about the project ..if it's like a, like a hydro power plant project" the project management methods used "don't work the same way as they do, for example, with Drive projects"*. This means that case companies are using different methodologies based on project definition or project deliverables. Further in the same interview, Interviewee G added that *"we need to deploy Customized project processes based on "Lessons learned". Different teams use different methods."*

Knowledge from Literature review: Any hybrid methodology must be one that is customized to suite the purpose or the type of project. Strasser, (2020) presents that "hybrid" project management methodology can be understood as one that combines planning and structured execution strategies (from TPM) with adaptable and flexible approaches (from APM). For projects, this means that there is a focus on choosing methods that clearly define the plans and project goals, while allowing some level of iterative processes and adaptive approach to project objectives. Combining traditional methods of Stage-gate planning, with elements of the agile methodology (such as scrum) lets organizations take advantage of the best of both worlds to suite individual project needs (Strasser, 2020)

Data from case interviews: When following a standardized (non-customized) Stage-Gate method, the project managers from the case companies observed the disadvantages of the methods being either too large, or too rigid or then too rigorous to suit their project needs. For example, Interviewee D from **CC2** observed

that “*Stage-Gate is bit too High level and too rigorous for a normal small level R&D project*” and Interviewee C from **CC1** observed that “*For non-typical and for special requirements, we are not flexible enough to step out from our processes.*”

In terms of advantages, the project managers observed that the structure and planning processes in the Stage-Gate model was giving them advantage in the actual project execution phase. For example, Interviewee H from **CC2** observed that with proper planning done in planning phases, they are able to “*get more time to focus on customer related works. Our method gives increased ownership to operative project team. Decisions are made in team and that speed up the project progress.*”

Knowledge from Literature review: These findings are identical to (Salvato & Laplume,(2020) study where the researchers observed that the stage-gate based model “*guided and controlled activities to ensure a repeatable and reliable outcome*”. They also emphasised noticeable importance of gate reviews in their processes and that the Stage-Gate based model helped them set “*clear milestones and detailed review checklists*” and these were essential in work planning and preparing an essential communication plan. Cooper & Sommer,(2018) found that in many of the case companies the traditional gating systems were becoming unsuitable for modern project requirements. In traditional stage gate projects, the Gating system was found to be “*too linear and rigid*” and not allowing flexibility to adapt effectively to market or customer demands fluctuations

Data from case interviews: Based on the data from the interviews and the analysis in earlier section (4.1.3) relating to the effect of project management methodology on project success, most of the project managers interviewed referred to the triple constraints as shown in (Figure 11) being the preferred criteria for project success in their organization. In addition to the *Cost, Quality and Time* criteria, the project managers from case companies interviewed, also referred to *Customer satisfaction, value generation and customer involvement* to being important success criteria for their organization. For example, Interviewee F from **CC3** referred to “*Customer centric approach, Customer satisfaction in terms of product up time,*

Quality of delivery. How satisfied consumers are with your products/services, How loyal they are to your brand, How likely customers are to recommend your company to others.” when replying to project success criteria for their organisation.

Knowledge from Literature review: Joslin’s and Müller’s research (2016b) found that the success dimension *“future potential”* to be strongly correlated with project governance orientation. The researchers explain the *“future potential”* criteria to be relating to enabling, motivating, and improving organization’s capability to undertake future projects. If the dimension *“future potential”* can be understood also as *“customer satisfaction”* then the findings of this research can be supported by Joslin & Müller’s study. In another study Joslin and Müller (2016a) found that *project success* did not have a standard, organisation wide definition. However, when asked on how performance was evaluated in projects, the majority interviewees in Joslin’s and Muller’s study referred to *time, cost, scope and sometimes customer satisfaction* to be important criteria.

The results of this research interviews are highly identical to findings from Joslin and Müller, where a strong relationship was established between project methodology and project success.

5.1.2 Effects of Enablers on the Relationship between PM Method and PS.

RQ2: How Project manager’s Leadership style, organizational culture and the quality of teamwork, affect the relationship between project management method and project success?

1. Relationship between project management method, leadership styles and project success.

Data from case interviews: The analysis of interview data from this research in section 0 shows that leadership styles of the project managers does have some influence on project outcome. For example, Interviewee H from **CC2** stated that *“PM's leadership and human skills are becoming more important. PM needs to give time and attention to team.”* and Interviewee E from **CC1** stated that *“PM should*

be kind to people, encourage the team members, PM Should have higher emotional intelligence to understand the daily teamwork”.

Knowledge from Literature review: Shenhar, et al.(2001) have presented that project managers to be “*new strategic leaders*”, who have increased responsibility for project successes. While Turner and Müller, 2005 have indicated that in specific instances, project manager’s appropriate leadership style, technical competence and emotional intelligence has delivered better results. In their study Turner and Müller found that project managers have a leadership role in creating an effective working environment for the project team, which in turn can influence the perception of project success in different situations.

2. Relationship between project management method, teamwork quality and project success

Data from case interviews: The analysis of interview data in section 4.2.2 shows that the project managers in case companies saw a direct impact from quality of team work to project performance. For example, Interviewee E from **CC1** mentioned that “*Quality of team work is more important to perform a good project. Good team dynamics, and team efforts...has major impact on project success and performance.*”

Knowledge from Literature review: Hoegl and Gemuenden (2001) defined teamwork quality as a measure of collaboration in teams and found the following six facets that contribute to success in teamwork; communication, coordination, balance of member contributions, mutual support, team and individual effort, and cohesion. The researchers found that the “*quality of collaboration in a team*” determines the overall satisfaction or of team members with their own work performance. Good quality team work fostered “*learning*” attitude amongst the team individuals and this in turn “*accommodates the desire for personal and professional growth*” (Hoegl & Gemuenden, 2001). In studies relating to quality of team work specifically in new product development environment, Dayan and Benedetto (2009) found that high quality team work could be only be achieved in innovative

product development teams “*when functional diversity increases from a low to a moderate level*”. If team members have adequate knowledge and skills to be able to complete the project tasks and know team members abilities (“*team knows what or from whom information can be obtained*”), they are able to perform well, team work quality is good and possibility of project success increases.

The results for this research are quite similar to the findings by Hoegl and Gemunden as well as Dayan and Benedetto.

3. Relationship between project management method, organizational culture and project success

Data from case interviews: During the interviews for this research it was found that organizational culture as well as the sub-cultures that exists within the project teams did have an effect on project performance. For example, Interviewee E from **CC1** mentioned that “*Company culture may not directly effect on individual projects. Projects are performed in separate teams. So, team culture may be affecting more to projects performance than the company's culture.*” whereas Interviewee G from **CC4** mentioned the following when asked on effects of organizational culture on project success: “*Team microculture will have more effect on performance than Organisational culture. Organisational culture is too far from "Frontline" of project work. Teams will have "Own micro culture". Yes, I would say that team culture influences more.*”

Knowledge from Literature review: The competing values framework (CVF, see 2.5.2) is useful theoretical framework to understand the dynamics of organizational culture and project success. In Yazici’s study (2011), when the company senior leaders were surveyed, the most common or preferred organizational culture was found to be the market culture which appreciates goal achievement and market share are seen as important. However, the project managers and other project professionals surveyed in the same study replied to prefer the Clan or group culture, which favours collectivism, shared values, and participation. Organizations preferred a change towards a friendly and cohesive Clan or group culture where

leaders are mostly mentors. Results also indicated that market and hierarchical cultures were less desired by the respondents. The study further stated that “*The Clan culture was found to be related to project performance—that is, timely completion of the project, the extent to which the budget requirements and expectations are met, and project team satisfaction*” (Yazici, 2011).

5.2 Managerial Contribution

RQ1: How hybrid project management methodology affects project’s success?

Based on analysis of this research data (section 4.1) the following observations were made

- A) Project managers are finding that with use of hybrid or customized project management methods they are able to accommodate for flexibility and changing demands, while keeping a controlled structure and well-planned execution of their projects.
- B) The most preferred criteria of project success are still the iron triangle criteria of Cost, quality and time, with additional criteria of customer satisfaction and value generation. The iron triangle criteria are more achievable with a traditional project management method whereas the Customer satisfaction and value generation criteria will need a more APM based methodology.

Based on the above observations, this research was able to find a strong link between hybrid project management methodologies and project success. Projects managers need to use the TPM methodologies to ensure the basic parameters of success of Cost, Quality and Time, however they will also need another methodology based on Agile principles to achieve the Customer satisfaction and value generation criteria of project success.

RQ2: How Project manager’s Leadership style, organizational culture and the quality of teamwork, affect the relationship between project management method and project success?

There was a strong response from interviewees towards leadership styles having a direct effect on project success. A leadership style that was rigid, forceful and end result oriented was seen as damaging to project performance. A more people centric, coaching and motivating style of leadership was preferred. This type of Emotional Intelligence inclined leadership style (see Table 9) will prefer a more APM based or a more APM-TPM hybrid type of project management method that allows for more focus on human interactions, focus on customer involvement and less focus on processes. Thus, it is the observation of this research that leadership styles of project managers do indeed influence the relationship between project management method and project success.

In respect to quality of team work as an enabler, this research finds strong evidence that quality of team work does have a direct impact on the project team's performance and further on to the project success. However, this research study, as well as other scientific research referred to during this study, does not give a clear evidence of quality of team work having a direct effect on the relationship between project management method and project success. The underlying reasons may be seen as following

- A) In TPM methods or also in Stage-Gate-Agile hybrid project management methods, the focus is still on project processes and deliverables. The project team does not have any direct control on the choice of project management methods.
- B) While quality of team work is proven to have direct impact on the project performance, there is weak evidence to show that it will affect the project outcome or success factor. Project success is found to be perceived differently by different stakeholders, and quality of team work may or may not be a part of project success definition for any given project.

In relationship between organizational culture and project performance, there is evidence found to that organizational culture has a small effect of overall performance of projects. However, within project teams there are sub-cultures that de-

velop over time. These sub-cultures have a more direct effect on the project performances and may also have an effect on overall project success. However, this research was not able to prove the linkage between how organization cultures play a role in selection of project management methodology. This research is inconclusive on proving that organizational cultures have an effect on relationships between project management methodology and project success, and suggests a further in-depth research to explore this relationship.

In summation, the three enablers Leadership styles, Quality of team work, and Organizational culture were observed to effect on the relationship between the project management method and project success in the following ways

- A) As the preference of leadership styles moves from authoritarian towards a more transactional or transformational style, the project management methods preferred by these leaders will move from process based (TPM) to a more interaction based (APM) methodology.
- B) Quality of teamwork will affect the project performance and indirectly the project success. Thus, any project management method cannot directly guarantee project success without having some influence from the quality of team work.
- C) Organizational culture has only a moderate effect on the choice of project management method. However, OC will have a significant effect on team performance, leadership styles and indirectly effect project performance.

5.3 Limitations and Recommendations for Further Research

During this research, data was collected via eight structured interviews, and project managers from four different case companies were interviewed. The observations of this research are therefore confined to the case companies and the unique study environment in this case study. The majority of the interviewees were working in the role of a project manager in the case companies. Therefore, the observations are made from only a narrow view, that is the project manager's

perspective from the given case companies. Therefore, while the results are authentic and scientifically proven, they may not be applicable or repeatable in other case companies or research settings.

This research was only able to present that Agile-Stage gate hybrid project management methods will have an effect on the project success. However, further study is needed to understand what other kinds of hybrid methodologies are suitable for a given industrial sector or for certain types of projects. It would be advantageous to the scientific body of knowledge in this subject to empirically research further on different types of hybrid methodologies and their suitability to different project environments.

The three enablers chosen in this research showed to have only a moderate effect on the relationship between the project management method and project success. It would be advantageous to further investigate other such enablers. The observations presented in this research may be further verified with a larger group of participants and using a quantitative research method. In addition, it would be interesting to quantitatively investigate what enablers are seen as most affecting the relationship between project management methods and project success.

Further research and study is also recommended on the topic of teamwork and quality of team work. This research work did not present in-depth analysis on the subject of quality of teamwork. During literature review of this research, it was observed that there is a lack of scientific published articles and studies that deal with the following issues:

- Understanding further, how teamwork affects project success.
- Understanding in depth the role of teamwork in projects using hybrid project management methods.
- Understanding in a broader reference the difference between quality of teamwork in Agile teams v/s traditional project management teams.

This study was performed using qualitative research strategies and focused on a narrow segment of two case companies and eight project managers. With qualitative research strategies a subject can be studied in greater depth but a narrower viewpoint. Therefore, while the data received from this study was valuable to the knowledge of this subject and was found to be in-line of the literature studied in the research, it nevertheless provides only a narrow view on the subject matter. It is recommended to further analyse the subject using qualitative research strategies. Qualitative research allows a subject to be viewed in a much broader perspective and consider views from a much larger test group.

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7 APPENDICES

Appendix 1: The Agile Manifesto¹

<p>Manifesto for Agile Software Development We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:</p> <p>Individuals and interactions over processes and tools Working software over comprehensive documentation Customer collaboration over contract negotiation Responding to change over following a plan</p> <p>That is, while there is value in the items on the right, we value the items on the left more.</p>		
Kent Beck Mike Beedle Arie van Bennekum Alistair Cockburn Ward Cunningham Martin Fowler	James Grenning Jim Highsmith Andrew Hunt Ron Jeffries Jon Kern Brian Marick	Robert C. Martin Steve Mellor Ken Schwaber Jeff Sutherland Dave Thomas

¹ The Agile Manifesto © 2001, this declaration is copied in its entirety through notice from the authors, Beck, K. et al., 2001. Manifesto for agile software development. [Online] Available at: <https://agilemanifesto.org/> [Accessed January 2021].

Appendix 2: The twelve principles behind Agile Manifesto²

We follow these principles:

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 a preference 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 behaviour accordingly.

² The Agile Manifesto © 2001, Beck, K. et al., 2001. Manifesto for agile software development. [Online] Available at: <https://agilemanifesto.org/> [Accessed January 2021].

Appendix 3: The OCAI instrument for organizational culture identification

1. Dominant Characteristics		Now	Preferred
A	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.		
B	The organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.		
C	The organization is very results-oriented. A major concern is with getting the job done. People are very competitive and achievement-oriented.		
D	The organization is a very controlled and structured place. Formal procedures generally govern what people do.		
Total		100	100

2. Organizational Leadership		Now	Preferred
A	The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.		
B	The leadership in the organization is generally considered to exemplify entrepreneurship, innovation, or risk taking.		
C	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.		
D	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.		
Total		100	100

3. Management of Employees		Now	Preferred
A	The management style in the organization is characterized by teamwork, consensus, and participation.		
B	The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.		
C	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.		
D	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.		
Total		100	100

4. Organization Glue		Now	Preferred
A	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.		
B	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.		
C	The glue that holds the organization together is the emphasis on achievement and goal accomplishment.		
D	The glue that holds the organization together is formal rules and policies. Maintaining a smooth-running organization is important.		
Total		100	100

5. Strategic Emphases		Now	Preferred
A	The organization emphasizes human development. High trust, openness, and participation persist.		
B	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.		
C	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.		
D	The organization emphasizes permanence and stability. Efficiency, control, and smooth operations are important.		
Total		100	100

6. Criteria of Success		Now	Preferred
A	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.		
B	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.		
C	The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.		
D	The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling, and low-cost production are critical.		
Total		100	100

The Organizational Culture Assessment Instrument—Current Profile as presented by (Cameron & Quinn, 2006)

Appendix 4: The interview questions

Sections	Interview Questions
S1 Q1	Please enter a nickname to Label the interview answers
S2 Q2	Can you please describe the core business activities of your company and the activities of the business unit you are currently representing?
S2 Q3	What is your present designation and how would you describe your current job function?
S2 Q4	What kind of projects are carried out in your team?
S3 Q1	What type of project management method is typically used in your team or company?
S3 Q2	What type of project management tools, activities or ceremonies are regularly followed in your team?
S3 Q3	Can you comment on what project management method was used for this project? And what kind of project organisation or team was established for this project?
S3 Q4	In this project, did you experience any specific advantages coming from the project management method that was used?
S3 Q5	In this project, did you experience any specific difficulties or hurdles that were relating to the project management method used?
S3 Q6	In this project, what criteria for project success were used and how were they measured? Alternatively, you may also share typical project success criteria used by your company?
S3 Q7	If you may be involved in a similar project in future, and you are given the option to use a customised project management method, What practices or measures would you like to replace or incorporate in your "Customised method"?
S4 Q1	Do you know if Agile methods and practices are been used or tested in your company?
S4 Q2	Do you know of any customised Agile methods, Hybrid methods or Scale Agile practices that have been used or tested in your company? Can you describe what "Hybrid project management" means in practice for you?
S4 Q3	If you are presently using Agile or Hybrid practices for projects in your company, can you please share what is your way of 1) Getting customer involvement during project execution 2) Accommodating for continuous changes and updates and 3) Developing a common understanding of "Minimum viable product"
S5 Q1	Can you describe the role of a typical project leader, project manager or the one who leads projects in your team or company?

S5 Q2	For project leaders, what kind of leadership qualities, personality traits, or skill-sets do you see as important, and do they affect the overall performance of the project team and the project?
S5 Q3	In your experience, how important do you consider Quality of teamwork affecting towards project performance?
S5 Q4	Can you describe certain specific characteristics that you may consider as "My organisation's culture"? What are the specific ideals or values that set you apart from any other similar company?
S5 Q5	In your experience does company specific culture influence directly or indirectly on the team and ultimately the project's performance?
S6 Q1	My sincere thanks for your involvement. How did you find the questions? Do you see this research topic to be relevant and current to the present situation for managing projects in Machine design R&D sector?

