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Project Management Model for In-house Projects

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Abstract

Title: Project Management Model for In-House Projects

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Background/Problem Description: The purpose of project management is to keep track, organize and assure that the specific goal of a project will be accomplished before the project ends. Without a project management model, it is hard for an organization to monitor and fulfill the purpose of project management. Therefore, ESSIQ AB believes it would be beneficial to have a project management model when running their in-house projects. This belief laid the ground for this master thesis project. Having a project management model within an organization can also give a competitive advantage, and allow the organization to be more efficient, which is needed on today's market.

Purpose & Research Questions: The purpose of this master thesis project was to develop a project management model for small in-house projects at ESSIQ AB. Another purpose of this master thesis project was to collect information from best practices, the forefront in science and international guidelines, and to expand the knowledge within the field of project management. Based on the purpose, the following research questions were established:

RQ1: How can a generic project management model be designed to efficiently manage small projects?

RQ2: Can agile project management help organizations to manage project more flexibly?

RQ3: What are the best practices within the field of project management, at other companies?

Delimitations: A couple of delimitations have been set for the master thesis project. The framework to be developed will be a generic model but with a focus on Mechanics and Design/UX projects. The framework will be developed for small projects, normally consisting of five project members. However, the framework will be applicable for project sizes up to 15 members.

Methodology: A couple of research strategies and methods were used for this master thesis project. When gathering the theoretical framework for this master thesis project, a literature collection was carried out during an exploratory research strategy. Further on, a descriptive strategy was used when semi-structured interviews were held at ESSIQ AB, which was the master thesis's large case company. To collect best practices, seven other companies were used as smaller case companies. The interviews at the smaller case companies were open in their nature. During the model development phase, when combining and using the knowledge gathered through literature and empirical studies, the problem solving research strategy was applied.

Results and Conclusion: The contribution from this master thesis project is the project management model created for in-house projects at ESSIQ AB. The project management model is a combination of traditionally standards and approaches, such as the Project Management Institute, and forefront science within agile management. Moreover, the model is a working method for project management and can cover complete project from their initiation until they are closed.

Keywords: Project management, project management model, in-house projects, product development, agile project management, agile projects

Abbreviations

CMM - Capability Maturity Model
CSF - Critical Success Factor
FIRO - Fundamental Interpersonal Relationship Orientation
ICB - Individual Competence Baseline
IPMA - International Project Management Association
ISO - International Organization for Standardization
LTH - Lunds Tekniska Högskola
MT - Master Thesis
NPD - New Product Development
OCB - Organisational Competence Baseline
PDSA - Plan Do Study Act
PEB - Project Excellence Baseline
PEM - Project Excellence Model
PMBOK - Project Management Body of Knowledge
PMI - Project Management Institute
PMMM - Project Management Maturity Model
PMP – Project Management Professional
RM - Risk Management
RMS - Risk Management System
UX - User Experience
WBS - Work Breakdown Structure

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1 Introduction

The first chapter introduces the reader to the main topic of this Master Thesis (MT) project, project management. A problem description describing common problems within projects is further on presented, followed by a short introduction to the case company, ESSIQ AB. Further on, the purpose of the research is described, as well as the research questions are presented, which the MT project aims to answer. Thereon, delimitations, objectives and stakeholders for the MT project are introduced. Finally, the structure of the report is explained to provide the reader with an overview.

1.1 Context

The interest in project management, and the search for better ways to manage projects, has increased in parallel with the rapid change of technology, the accelerated competition, and the increased economic pressure (Patanakul and Shenhar, 2012). The interest has led to an increased need of advanced project management models. As a support to this need, several different aids, tools, processes, and methods have been developed during the past decades (Meredith & Mantel, 2012). According to a survey compiled by McKinsey, looking at top prioritized developments in the long haul within firms, almost 60 percent of senior executives said that improving and developing a project management discipline was within top three of prioritized developments (Gryger et al., 2010).

Project management has always been practiced informally such as in Egypt with the building of the pyramids, in China with the Great Wall of China, and in Peru with Machu Picchu. However, it was not until the mid 20th century it began to emerge as a profession. Since then, many project management models, standards, and tools have been developed. These can look different depending on the product or service, the overall structure, as well as the novelty of the product. The Project Management Body of Knowledge (PMBOK®) developed by the Project Management Institute (PMI) is one of the most widely used global standards today (Larson and Gray, 2014).

A project is a temporary work, which is limited in both time and resources. There is typically a time frame set before initiating a project. A project is often initiated to solve a complex problem in an organization, or to a customer, and the temporary team that is to solve the problem can consist of both internal and external parties. To reach the goal of a project, specifically designed operations must be carried out to accomplish and support the project team (Larson and Gray, 2014).

On a competitive market, a key for success is to deliver project results on time and not exceed the determined budget. Project management is a discipline to fulfil these success factors, and is used to create a value chain throughout the project. In other words, being efficient within projects, and only execute activities that add value to the project, is truly important to stay competitive on the market. Another success factor for project management is engagement. The more engaged the executive team and the project manager is, the more likely is it for the project to become successful (PMI White Paper, 2010).

1.2 Problem Description

The purpose of project management is to keep track, organize and assure that the specific goal of a project will be accomplished before the project ends. If a project lacks management, difficulties and non-value adding activities might occur. It is also reported that projects that lack project management have longer development times, higher costs, lower quality and reliability, and lower profit margins. From this situation, is it hard to have a competitive advantage and be efficient which is needed on today's market. Therefore, it is a key success factor to have a well established project management discipline when handling projects (Meredith & Mantel, 2012).

1.3 Company Background

ESSIQ AB, further referred to as ESSIQ, is a consultancy firm founded in 2005 in Gothenburg. The company has four competence areas within Product Development; Design and User Experience (UX), Mechanics, Project Management, and Software and Electronics. Throughout the years, the company has gained profound experience of working with external projects managed by their customers. To ensure further growth and development, ESSIQ has started to operate in-house projects. Currently, ESSIQ primarily operate in-house projects within Mechanics, and Design and UX. Consequently, these are the areas where a framework for in-house projects is mainly needed.

1.4 Research Purpose and Questions

The purpose of this MT project is to develop a project management model that can be used for small projects in flexible environments. Another purpose of the MT project is to collect information from best practices, the forefront in science and international guidelines, and to expand the knowledge within the field of project management.

RQ1: How can a generic project management model be designed to efficiently manage small projects?

RQ2: Can agile project management help organizations to manage project more flexibly?

RQ3: What are the best practices within the field of project management, at other companies?

1.5 Delimitations

A couple of delimitations have been set for the MT project. The framework to be developed will be a generic model for Mechanics and Design/UX projects. The framework will be developed for small projects, normally consisting of five project members. However, the framework will be applicable for project sizes up to 15 members.

1.6 Objectives of Master Thesis

The main objective of this MT project is to develop a project management framework for in-house projects. The framework will have its basis on findings from international standards, published papers, and organizational publications. Focus will be on developing a generic model that can easily be modified to accommodate projects within the two areas where in-house projects are primarily performed at ESSIQ; Mechanics and Design/UX. In addition, the framework will consider best practices from both ESSIQ and other corporations. The framework will be tested and validated, and accustomed to existing model requirements at ESSIQ.

1.7 Stakeholders

The stakeholders for this MT project are ESSIQ employees involved in present or future in-house projects. The aim with the developed framework is to give support to project managers at ESSIQ in how to manage in-house projects. The MT project report also acts as educational material for engineering students at LTH and other faculties.

1.8 Report Structure

To give the reader an overview of the report, a brief description of the chapters follows below.

Chapter 1: Introduction

The report begins with an introduction to the subject and a description of common problems within the field. From this, the research questions are derived, delimitations are set, and the objectives are stated. In addition, a brief introduction to ESSIQ is included.

Chapter 2: Methodology

In the second chapter, the chosen research strategies and methods are stated and explained. The techniques to be used for data collection are presented and described, as well as methods for quality assurance are included. In addition, the reader is given a short overview of the MT project working procedure.

Chapter 3: Theoretical Framework

The third chapter presents the theoretical framework that has been used as a base for the model development.

Chapter 4: Empirical Research

This chapter includes information gathered from empirical research. First, the current state regarding project management practices at ESSIQ are presented. Secondly, the information collected through benchmarking is presented.

Chapter 5: Conclusions

The fifth chapter is initiated with a section describing the model development process. Then, the developed model is thoroughly presented. Further on, a section regarding implementation and use of the model is included. The chapter ends with a section describing possible further project management development areas at ESSIQ.

Chapter 6: Discussion

The last chapter includes a reflection and discussion regarding the chosen methodology, and the credibility of the MT project. Moreover, benefits of the MT project are presented and its contributions to the science of project management are discussed.

2 Methodology

In this chapter, the research strategies and methods used in this MT project are introduced. Moreover, the techniques used for data collection are presented, as well as a discussion about how the quality of this MT project is assured. The chapter ends with an overview of the procedure of the MT project.

2.1 Research Strategy

There are many ways of doing good research. An important first step before initiating research, is to determine which research strategy to apply. The research strategy should give an overview of the plan of actions required to reach the research goals. The choice of strategy is dependent on the research project. Consequently, there is no single strategy that could be recommended as the best regardless of research project (Denscombe, 2010). Moreover, several different research strategies can be applied in one single research project. This is common in a project consisting of a number of substudies (Höst et al., 2006). In this MT project, an exploratory, descriptive, and problem solving research strategy will be applied. Below follows a brief description of the three chosen strategies.

When initiating a project about a topic within one has limited knowledge, it is suggested to use an exploratory research strategy. By applying an exploratory research strategy, one aims to gain enough knowledge to enable basic analyses (Lekvall and Wahlbin, 2001). As mentioned, several research strategies can be applied in a project. The exploratory research strategy is often one of several strategies, and typically performed in the beginning of a project. One can also refer to the strategy as a pre-study, or a pilot study, after which a more extensive study will follow. Characteristic for the exploratory strategy is that one gains knowledge through literature studies, previous studies, and industry experts (Lekvall and Wahlbin, 2001). In this MT project, the authors are applying an exploratory strategy when initiating the project to gain as much knowledge about the topic as possible.

To apply a descriptive research strategy, a well specified and formulated research question is required. The descriptive strategy involves collecting data and knowledge about this specific question. The aim with the strategy is not to explain why things are as they are, but rather just describe them (Lekvall and Wahlbin, 2001). In this MT project, the descriptive strategy will primarily be applied during the empirical study phase.

During the development phase of this MT project, a problem solving research strategy will be used. The aim with a problem solving research strategy is to find a solution to one or many problems that have been identified (Höst et al., 2006).

2.2 Research method

For applied science research, the four most used research methods are; survey, case study, experiment and action research. The methods can be used in different ways depending on whether the research strategy has a flexible or fixed approach. For a flexible approach, the method's context can be changed throughout the project and thereby easily adapt to changes in the project. However, for a fixed approach, changes cannot be made throughout the project. The methods case study and action research are mainly flexible in their nature (Höst et al., 2006). For this MT project, the methods case study and action research will be used and are further explained below.

2.2.1 Case study

For a research with the aim to gather a deep understanding of an object or a phenomenon, it is suitable to use the case study method. This method is commonly used for contemporary phenomena and can for example be used to understand how an organization is structured. A case study is used to study one specific case, and the design of the method is flexible. The data that is collected from a case study is thus usually qualitative, and common techniques for collecting data to a case study are interviews, observations and archive analysis (Höst et al., 2006). In this MT project, one main case study of ESSIQ will be conducted, along with smaller case studies at benchmarking companies.

2.2.2 Action research

The action research method has, as the case study method, a flexible approach and is mostly used for qualitative data. The method is also known as a problem solving method. A project that aims to improve, and meanwhile study an area, is suitable with the method action research. The method consists of four different phases and the starting point for this method is to observe and study a phenomenon or situation to identify the problem that needs to be solved. The next step in the action research method is to find and suggest a solution to the identified problem, and to execute the solution. Further on, the third phase is to study the executed solution and control whether it has led to an improvement. The last and fourth step in the action research method is to learn if the solution was successful, and decide whether it should be a permanent implementation or not (Höst et al., 2006).

2.3 Techniques for Data Collection

To execute and follow the research strategy and chosen methods, a couple of techniques are needed. The techniques are used to collect data and information which is required to carry out the project (Höst et al., 2006). In this MT project, the techniques described below will be used.

2.3.1 Literature collection

Literature collection is a keystone in scientific methodology. It is important for the basis of a project, and a well performed collection of literature increases the probability of adding new value to the research area. The process of collecting litterature is iterative, which means that there is no straight line of activities but they can be mixed. The process of literature collection is also important in the beginning of the MT project, to get a deeper understanding of the chosen research area (Höst et al., 2006). In this MT project, the authors used the process of finding one interesting and reliable article, and then searched in the list of references of that article to get access to additional sources. Another key part of the literature collection is the importance of reliable sources. All sources have different reliability and therefore source criticism is very important. One way to validate a source is to check if it has been gone through a scientific peer reviewing. Another way is to check how many quotes a source has (Höst et al., 2006). In this MT project, many theoretical sources are from standards and institutes within project management, such as PMI and IPMA, that are widely known and used all over the world.

2.3.2 Interviews

A common data collection method within case studies is interviews. Interviews can be open, semi-structured, or structured. The purpose of conducting an open interview is to enable exploration of the subject at hand, whereas semi-structured and structured interviews have the purpose of enabling description of a subject (Höst et al., 2006). For this MT project, open and semi-structured interviews have been conducted. When conducting an open interview, the interviewer has prepared an interview guide with a few open questions. The questions can be formulated differently, and asked in different orders from interview to interview. The open interview is qualitative in its nature. In a semi-structured interview, the interviewer prepares both open questions, and fixed questions with answer options bound to them (Höst et al., 2006). All interviews conducted during this MT project was recorded to ensure that no information was left out when interview notes were written.

The semi-structured interview method was applied when interviewing employees at ESSIQ. The interview type was chosen because of its descriptive nature. To get a thorough description of ESSIQ was considered essential to ensure as good deliverables as possible. After the interview guide had been developed, it was sent to the supervisor at LTH for review. A few adjustments were made and after approval, the interview guide was sent by email to the interviewees one week before the interview was to be conducted to allow for preparation. The majority of the interviews were conducted in person. However, a few of them were conducted through Skype. The questionnaire used for the interviews can be found in Appendix A.

To validate the first draft of the model, feedback sessions were conducted with ESSIQ employees and management. The model was presented and explained by the authors, and the interviewees were encouraged to give their comments based on their previous experience.

When collecting information through benchmarking, open interviews were used. As previously stated, open interviews are exploratory in their nature, which was considered suitable for benchmarking purposes. An interview guide with open questions was prepared to have a foundation for the interviews. The questions varied slightly between the interviews. The majority of the interviews were conducted in person. However, a few of them were conducted through Skype. The questionnaire used for the interview can be found in Appendix B.

2.3.3 Archive Analysis

Archive analysis is a technique for collecting data and is often used within case studies. The method consists of reviewing old documentation that has been made in other purposes, and that is not related to the ongoing project. An example is to review old annual reports and identify how an organization has made progress within an area of interest. For qualitative data, which will be the nature of the data in the MT project, the analysis is often iterative. This means that all theory is not written before that analysis is carried out. Parts of the theory might be added in the meanwhile of writing the analysis (Höst et al., 2006).

2.4 Quality Assurance

Quality assurance, and the ability to demonstrate it, is an essential part of the research process. One should not assume that people will be naive and consider the findings accurate. To achieve credibility of the research, one must demonstrate that the findings are based on acknowledged practices and good research. There are four bases for judging credibility; validity, reliability, generalizability, and objectivity (Denscombe, 2010). According to Höst et al., (2006), one will achieve a greater spectrum of a topic if one uses multiple methods, examines different kinds of data, and has several people studying the object . This is referred to as triangulation which, according to Denscombe (2010), is a method for validation. According to Shenton (2004), the achievement of credibility is one of the most important quality aspects in research. Credibility can be achieved by following certain provisions, a few of which can be found in Table 1.

Table 1. Provisions for credibility (Processed by the authors from Shenton, 2004)

Provision	Explanation
The development of early familiarity with the culture of participating organizations	Before the first moment of dialogue takes place, one should get familiar with the organization in question. This enables one to establish a relationship of trust, and one is more likely to gain adequate understanding.
Tactics to help ensure honesty in informants	Each participating person should be given the opportunity to refuse to participate. This ensures that only those who are genuinely interested in participating are involved. It should be made clear that the information is only for the researcher, and will not be shared with managers. This enables the participant to freely talk about previous experiences.
Frequent debriefing sessions	The researcher should have frequent debriefing session with superiors, such as project director. The sessions can be used to discuss alternative approaches, and one might detect flaws in the proposed course of action.
Triangulation	One form of triangulation is to use a wide range of informants. Individual experiences and viewpoints can consequently be verified against others, and one can construct a rich picture of the field.

Before the first formal interviews were conducted at ESSIQ, the authors ensured to get familiar with the organization and could hence develop a mutual relationship of trust. All interviews at ESSIQ and the benchmarking companies are initiated by informing the participant that the information shared during the interview is only to be shared between the authors, and for future reference the interviewee will be held anonymous. In addition, all interviewees participated voluntarily and out of interest. Frequent feedback sessions are held together with both the project supervisor at LTH, as well as the supervisors at ESSIQ. A feedback session is held approximately every other week. Triangulation is applied in this MT project since several methods are used, such as the case study and action research, and different kinds of data are collected by the two authors. In addition, triangulation is further used since a wide range and a relatively large number of informants are participating in the empirical study. All these activities implies great credibility to this MT project.

For validation, the project management framework is reviewed and discussed together with ESSIQ to ensure that the authors have interpreted the information correctly, as well as to get input. The majority of the participating benchmarking companies are well-established with profound experience in the field of project management which ensures further credibility to the MT project. In addition, the theoretical framework, which is based on a wide range of credible literature and standards, ensures yet another form of quality assurance. Another form of validation that is applied is that the authors will, when the model development has begun, follow and work in accordance with the model during the remaining time of the MT project.

2.5 Procedure

The MT project will be conducted in eight phases, each phase briefly described below. An overview of the phases and their duration is shown in Figure 1 below. The writing process of the MT report is an iterative process and is hence ongoing throughout the course of the project. Therefore, it is not included in Figure 1.

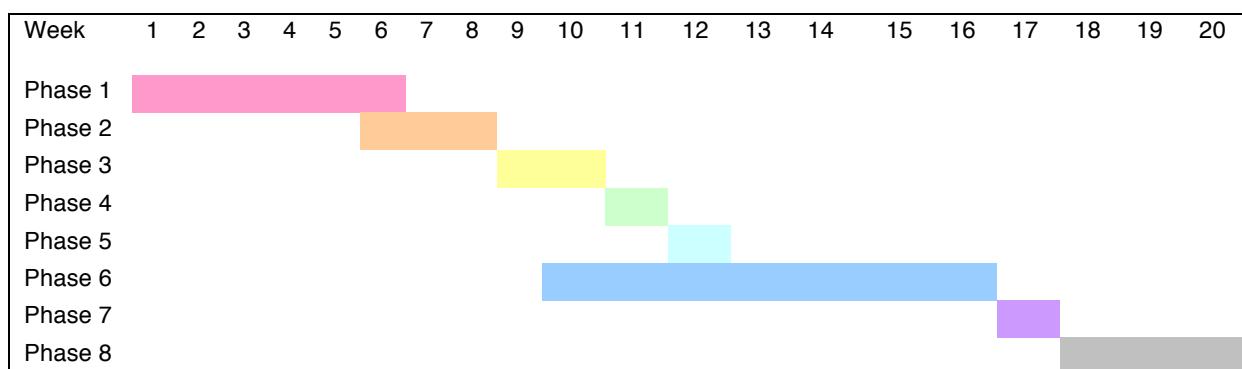


Figure 1. Gantt-chart with the MT project procedure (Authors)

1. The first phase is focused on gathering theoretical knowledge needed to fully understand the principles behind project management. The exploratory strategy is applied in this phase and data is collected through extensive literature studies. See detailed description in Literature collection.
2. The second phase consists of consolidation of existing models and working methods used at ESSIQ. Information is gathered through conducting interviews and meetings with company supervisors. In addition, interviews are conducted with ESSIQ employees. The focus in this phase is also on understanding the company and their expectations of the MT project. The descriptive strategy is applied and the case study method is used.
3. The third phase is focused on gathering information from reference companies. This is done through benchmarking, and the aim is to visit both other consultancy firms as well as larger industrial companies, to investigate how they work with project management. As in the previous phase, the descriptive strategy is applied, and each reference is handled as a small case study.

4. During the fourth phase, a rough first draft of the model is created, based on the information gathered from benchmarking and the theoretical framework. During this phase, the problem solving strategy is applied.
5. During the fifth phase, a feedback session is conducted with employees at ESSIQ to discuss the framework developed in phase four. The feedback is summarized, and later analyzed and applied in the framework during phase six.
6. The sixth phase regards the development of the project management framework suited for in-house projects at ESSIQ. This work is heavily based on the findings from the previous phases. During this phase, the problem solving strategy is applied and the action research method is used.
7. The seventh phase is focused on validation of the project management framework developed in the previous phase. This is done through feedback sessions with ESSIQ project managers.
8. The last phase includes finalizing the MT report. Moreover, a presentation of the MT project and the findings is presented at both Lund Faculty of Engineering (LTH) and at ESSIQ. This phase also includes the writing of the popular science summary.

3 Theoretical Framework

In this chapter, theories, standards and frameworks that will constitute the basis for the theoretical foundation are introduced. The literature collection has been chosen as described in Chapter 2. Firstly, project management in general and closely related topics will be described. Secondly, the field of agile project management will be introduced and described. Agile project management is included to examine whether the use of it can enhance the flexibility in management of projects. Lastly, a number of project management standards are presented. The standards that will be considered in this MT project are PMI, IPMA and ISO 21500. The authors have the ambition to achieve a wide range of knowledge that could be applicable worldwide and hence, the choice of standards includes one american, one british, and one international standard.

3.1 Project Management

Project management has been practiced informally for centuries, and managing projects is one of the oldest and most respected accomplishments in the history of mankind (Morris, 1994). It was not until the mid 20th century that formal project management emerged, as a response to the need to develop and implement a management philosophy to facilitate management of large military and support systems. These military projects were highly complex, and hence required some formal managerial system. Project management emerged as a process for managing ad hoc activities, and projects were early characterized by having a distinct life cycle (Cleland, 1999). According to Morris (1994), the development and evolution of project management has been closely related to the following: “the development of systems engineering in the US aerospace and defense industry, the development of modern management theory and the evolution of the computer”.

In today's competitive business atmosphere, it is crucial to manage projects with high efficiency and high quality. Project management is therefore key to have a sustainable economic growth and provides organizations with tools and mindsets that can be beneficial to succeed with projects (Larson and Gray, 2014). The most commonly used standards and methodologies for project management are (PMI, ISO, IPMA), and will be further discussed later in this chapter (Nicolas & Steyne, 2017).

3.1.1 Project Management Maturity

For organizations that highly rely on projects to achieve corporate goals, it is critical to deliver successful projects. Since the mid 1990's, a variety of project management maturity models (PMMM) have been developed (Pennypacker & Grant, 2003). Many of these are based on the Capability Maturity Model (CMM), developed by the Software Engineering Institute. The CMM was developed to improve the production of software, but has shown to be applicable beyond software engineering, and many of the PMMMs are as mentioned derivatives from the CMM (Bergman & Klefsjö, 2010; Wysocki, 2004). According to Pennypacker and Grant (2003), PMMMs “are designed to provide the framework that an organization needs to purposefully and progressively develop its capabilities to deliver projects successfully project after project”. PMMMs can help organizations to increase the

likelihood of achieving high-quality results, as well as it can reduce the likelihood of risks impacting projects negatively (Demir & Kocabas, 2010). Assessing an organization's project management maturity can provide evidence of certain project management competence for business partners. Another motivation to use PMMM could be for benchmarking purposes (Albrecht & Spang, 2014). The consultancy firm PM Solutions has developed the PMMM illustrated in Figure 2. The model acts as a tool used to measure a company's project management maturity. Each level is briefly described below (PM Solutions, 2012).

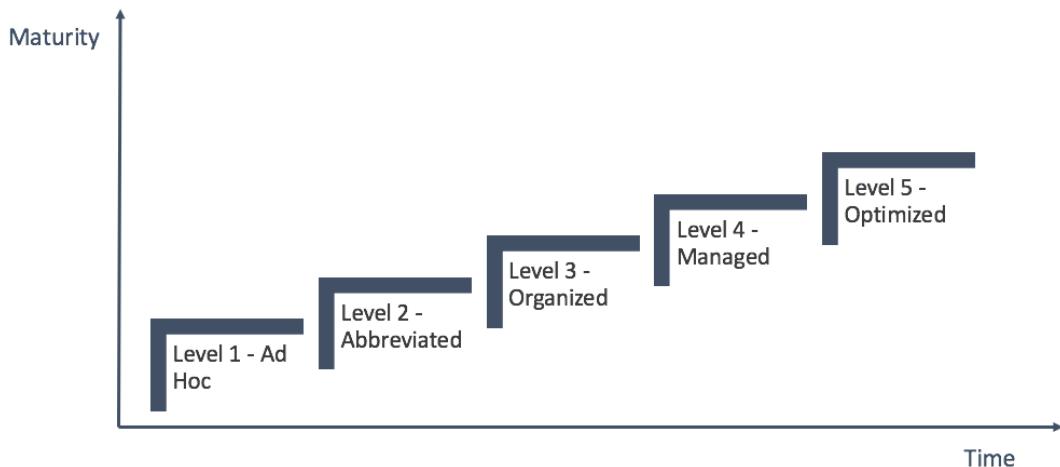


Figure 2. Project Management Maturity Model (Processed by the authors from PM Solutions, 2012)

Level 1 - Initial Process

In this level, there are no standard processes in place, and both project managers and team members act in an ad hoc manner. Projects are managed informally, and often each project manager manages in their own specific way. There may be good knowledge on how to manage projects, but there is no process on how to share this knowledge and best practices. In addition, the best practices in one project might not be applicable in another project where teams practice project management in their own way. Moreover, there is no sign of any movement towards organizational standards and processes (Wysocki, 2004).

Level 2 - Structured Process and Standards

In the second level, there are defined and documented project management processes in place. However, there is no requirement that these are used or followed. Status report processes are ad hoc and not consistent across projects (Wysocki, 2004).

Level 3 - Organizational Standards and Institutionalized Process

There are defined and documented standards and processes just like in level 2, but in this level it is required that these are used. However, it is understood that one size does not fit all, and adjustments and adaptations are allowed (Wysocki, 2004).

Level 4 - Managed Process

In the fourth level, project management systems are integrated with other corporate systems. Metrics are in place which allows for comparison between projects, and there is a process in place to capture lessons learned and best practices. The lessons learned are made available for other projects (Wysocki, 2004).

Level 5 - Optimizing Process

In the highest level, focus is on improvement of project management processes. Project performance is measured and collected to allow for identification of improvement areas. Performance is analyzed and evaluated continuously. Best practices and lessons learned are also used to identify improvement areas (Wysocki, 2004).

3.1.2 Phases of Project Management

Whether you are managing small or large projects, developing a new car, building a house or moving, you will go through the same steps within a project. These steps are known as planning, build-up, implementation and closeout. In different literature they have somewhat different names, but are in their nature similar. The steps also contain activities that in the big picture are similar to most projects. The steps are presented in Table 2 together with belonging activities in each phase (Harvard Business Review Staff, 2016).

Table 2. The four phases of project management and its belonging activities (Processed by the authors from Harvard Business Review Staff, 2016).

Activities within the phases of project management	1. Planning: How to map out a project	2. Build-up: How to get your project going	3. Implementation: How to execute the project	4. Closeout: How to handle end matters
	Determine the real problem to solve	Assemble your team	Monitor and control process and budget	Evaluate project performance
	Identify stakeholders	Plan assignments	Report process	Close the project
	Define project objectives	Create the schedule	Hold weekly team meetings	Debrief with the team
	Determine scope, resources and major tasks	Hold a kick-off meeting	Manage problems	
	Prepare for trade-offs	Develop a budget		

Before starting a project, it is critical to initiate the project correctly. It is common to start a project too early and skip a part of the initiation phase and the phase of project selection (Meredith & Mantel, 2012). These two phases are described in detail in the following sections.

It is also common to use gates in between phases of a project management model. Phase-gates are, according to Meredith and Mantel (2012), defined as “preplanned points during the project where progress is assessed and the project cannot resume until the re-authorization has been made”. Gates are also a way to assure quality in a project management model. To pass a gate, certain predefined criterias must have been accomplish. Having such requirement enables a sort of control of how project should be run which increases the quality of projects (Nilsson, 2018).

3.1.3 Project Selection

The process of selecting projects is an important area within project management (Meredith & Mantel, 2012). Project selection is argued to be one of the most critical and important problems in the context of decision making, and engineering management has given great attention to it (Wang et al., 2008). Before selecting a project, managers should evaluate their potential value based on a predefined set of criteria. If properly selected, a project can show on a company’s ability to achieve important goals with an efficient allocation of scarce resources. Projects should meet the strategic objectives of an organization, which makes the operating environment highly complex (Benedetto et al., 2016). The environment becomes increasingly complex in the absence of a proper project selection model, and research on selection methods and tools has been given much attention and thorough research by many scholars (Benedetto et al., 2016; Wang et al., 2008). An effective project selection model is argued to help ensure optimized resource utilization, as well as it can ensure that selected projects act as great contributions to company objectives and goals. Important to note is that the selection criteria should be accustomed to the individual company (Cheng and Li, 2005).

The first criteria that should be met when selecting a project is that the project is aligned with the company’s strategy (Benedetto et al., 2016). Following, the questions or criterias that need to be researched are: if the project is doable; if it is wanted; and if the project can be acquired. If the answer is no to any of the following questions, the project should not be taken on; Whether a project can be completed; Whether a project should be strived for; Whether a project can be acquired (Wang et al., 2008). In Figure 3 below, the three questions, named A, B and C, are shown together with four factors.

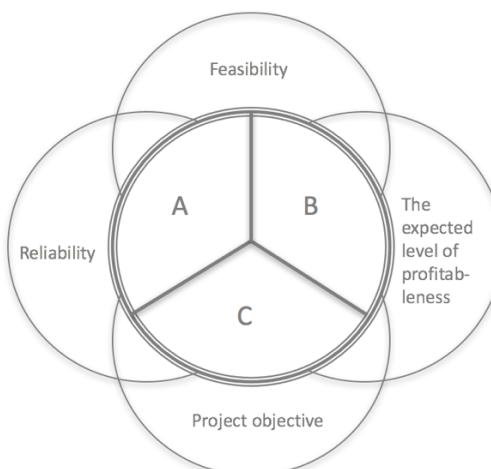


Figure 3. Model for project selection (Processed by the authors from Wang et al., 2008).

Project selection is a multi-criteria decision-making process and is used to find projects that create most value to the organization. Firstly, the feasibility requirements needs to be fulfilled. The project bidder should ensure that the organization has enough experience for technical requirements, quality requirements, and know that they most likely will be able to deliver on time. If the bidder fails to estimate weather the feasibility requirements will be met, and the project fails, the organization will jeopardize the organization's reputation and may receive fewer project possibilities in the future. Therefore, it is truly important that the bidder fully understands the feasibility requirements for the project before initiating it (Wang et al., 2008).

Another important factor is to closely evaluate the reliability of the project. The reliability evaluation can be based on documents belonging to the project, risk analysis, and the credit condition of the project owner. Moreover, another important factor that has to be satisfied is the level of profit. The fourth factor, seen in Figure 3, is project objective. The project should be in line with the organizational development area's strategy. In Table 3, the three questions mentioned earlier, which should be answered with yes to bring on the project, are presented together with ten criterias (Wang et al., 2008).

If a project does not deliver direct profit, the real option project selection model can be used. It is a model based on an idea that an investment or project will lead to opportunities that otherwise would not be possible. Therefore, these kinds of projects does not have to be profitable or beneficial in itself, but will lead to something beneficial or profitable in the future. A couple of examples of projects with this nature are projects where the organization gain new knowledge, learn about new technology, receive access to new potential customers, or improves the competitive strength of the organization (Meredith & Mantel, 2012).

Table 3. The three evaluation factors together with ten evaluation criterias for project selection (Process by the authors from Wang et al., 2008).

Evaluation factors	Evaluation criterias
Whether a project can be completed	If the enterprise can hardly meet the requirements of qualification, capital turnover, manpower, equipment, construction period, quality, etc., and cannot adjust itself by means of leasing, financing, cooperation, etc., the enterprise should abandon bidding. If not, it could participate in bidding.
Whether a project should be strived for	If the enterprise's current working focus is on brand creation in a certain region, it can participate in bidding only if the expected project profit reaches the meager profit level.
	If the enterprise has the problem of task shortage and the urgent need of obtaining the project at the present stage, it can participate in bidding.
	In the predicted design stage, if the enterprise has sufficient task and cannot get satisfactory profit from the expected project, it should give up.
	In the predicted design stage, if the enterprise has sufficient task and some other more attractive projects, it can give up.
Whether a project can be acquired	If there exists serious local protectionism and the enterprise's rights can not be protected, it should give up.
	If there exists serious trade protectionism and the enterprise's rights cannot be protected, it should give up.
	If there are a large number of known or predictable competitors whose strengths are much stronger, it should give up.
	If the enterprise and the owner have cooperated before and have a good relationship, it can participate in bidding.
	If there are evidences to suggest the existence of nonstandard phenomena in the process of bidding, and the enterprise has no special relationship with the owner, it should give up.

3.1.4 Project Initiation

The project initiation phase is the most critical phase for evaluating a project based on business value. If an organization can evaluate projects effectively in the initiation phase, they will most likely have a large competitive advantage (Rojas-Meluk, 2006). Moreover, it is critical that the project is aligned with the company's strategy, which can be ensured by chartering the project (Brown, 2005). Chartering a project can be done by developing a project charter, which usually contains the following elements; project purpose, objectives, requirements, risks, milestones and stakeholders (Meredith & Mantel, 2012). PMI defines the project charter as; "a document issued by the project initiator or sponsor that formally authorizes the existence of a project, and provides the project manager with the authority to apply organizational resources to project activities" (Brown, 2005). In Figure 4, an example of a project charter document is presented.

Project Charter		
Project Name	Date	Area of Focus
Business Case		Scope
	In Scope	Out of Scope
Measureable Target/Goal	Key Deliverables	
Team Members		Timeline
	Actions/Milestones	Target Date/Status
Assumptions/Constraints		Financials
	Business Impact	Investment
	Risk Planning	

Figure 4. An example of a project charter document (Processed by the authors from Project Management Skills, 2018).

Along with the project charter, other activities usually occur in the initiation phase of a project. An article from Harvard Business Review presents the following activities to be executed in the first phase of a project: Determine the real problem to solve; Identify the stakeholders; Define project objectives; Determine scope, resources and major tasks; and Prepare for trade-offs (Harvard Business Review Staff, 2016).

3.1.5 Project Planning

Project planning is an important phase in project management and should not be underestimated. The concept of project planning is defined as “developing the plan in the required level of detail with accompanying milestones and the use of available tools for preparing and monitoring the plan” (Cleland, 1999). Over the years, the approach to project management has changed and new philosophies such as agile project management have become popular to use. With different approaches of project management, the phases are also carried out differently. For traditional project management the paradigm is; Plan first, execute second. Within agile project management the paradigm is; Adapt to change as you iterate (Baird & Riggins, 2012).

No matter which approach a project has, the project planning process is critical. It is common that the planning part gets too little attention, which often is the reason why projects become chaotic (Feeney & Sult, 2011). According to Baird and Riggins (2012), the best methodology for planning is to settle in the middle group between traditional and agile project management, and it was acknowledged that most software projects use a combination of waterfall structure and agile methods. For traditional project management planning, based on PMI, the most important parts of the planning process are: Project activity and risk planning; Budgeting; Scheduling; and Resource allocation (Meredith & Mantel, 2012).

Creating the project charter is the starting point before planning a project. It explains the nature and scope of the project and the expectations on the project from management (Harvard Business Review Staff, 2016). The following elements are suggested to be included in a project charter: Purpose; Objectives; Overview; Schedules; Resources; Personnel; Risk management plans; and Evaluation methods (Meredith & Mantel, 2012). The elements are presented together with an explanation in Table 4.

Table 4. Elements belonging to a project charter (Meredith & Mantel, 2012).

Elements in a project charter:	Explanation:
Purpose	A brief description of the project, dedicated for top management and for those who are not familiar to the project. The goals should be included as well as the connection to the organization's objectives.
Objectives	Goals and objectives of the project described in detail.
Overview	Technology and management approaches are presented in the overview. Available technology for the project and how procedures are to be handled.
Schedules	Present schedules for the project combined with all milestones, gates and phases that the project are to go through.
Resources	The section should handle budget, contractual items and cost controlling, and control procedures.
Personnel	Requirements of human resources to the project.
Risk Management Plans	A clear risk management plan should be outlined for the project.
Evaluation Methods	All projects should be evaluated towards a standard after completion, or by a project management inspector.

When the project charter has been established, the planning process can move further onto starting the project plan. The project charter is one of the most important input for this section. The project plan includes all activities needed to complete the project, all resources required, and when and where resources are needed. Both activities and resources need to be planned in detail, and a commonly used method to carry out the project plan is the work breakdown structure (WBS) (Meredith & Mantel, 2012). A WBS is defined as; “the total decomposition of all the works/stages included in a project from start to finish” (Olaru & Zecheru, 2016). It is a hierarchical planning process and breaks down main activities into smaller ones. When the WBS has been constructed, a more detailed schedule for all activities can be discussed, together with budgeting every activity (Meredith & Mantel, 2012).

A different approach to planning a project is by milestones. It differs from the traditional approach by focusing on identifying milestones in the project instead of activity planning in the beginning of a project, as traditional project planning suggests. A milestone is defined as natural subproject ending points where payment might occur, evaluations may be made, or progress may be reassessed (Meredith & Mantel, 2012). Thereby milestone planning focuses on milestones in a project and not specific activities. It is a result-oriented and goal-directed approach (Andersen, 2006).

3.1.6 Communication

Communication, which is defined as the exchange of information between individuals, has been identified as a critical aspect for project success. In a project, communication is the number one force used by the project manager to ensure that the team is working together on project problems and opportunities (Cleland, 1999). Despite this, communication is often taken for granted, and classical values such as time, cost, and quality are given more attention (Johannessen & Olsen, 2011). Studies seeking to find the most frequent problems and challenges in a project, show that communication is at the top of the list, and that the classical values appeared much further down (Johannessen & Olsen, 2011; Cleland, 1999). However, when the communication process works efficiently, it is perceived as the most important factor in achieving good results. Having an efficient communication process becomes increasingly important when a project is subject to high rates of changes (Johannessen & Olsen, 2011). This is often the case for a product development project (Ulrich & Eppinger, 2011). Given all the evidence of the great importance of communication in projects, Johannessen and Olsen (2011) argues that communication should be given the same attention as the classical values.

The most common reason that communication is not working, or so called communication traps, are lack of context, lack of questions and dialogue, and lack of connection (Ashkenas, 2011). Project teams can reduce these traps by having a well structured plan for coordination and communication. The use of a communication software is a popular method to improve communication within teams (Elton & Roe, 1998). The most critical communication link is usually known as the one between the project team and the stakeholders. There needs to be structured communication between the parties to reduce misunderstandings, which otherwise might mislead the project (Rajkumar, 2010). According to Rajkumar (2010), the points presented in Table 5 are the most critical to be included in a project communication plan.

Table 5. Critical points to be included in a project communication plan (Processed by the authors from Rajkumar, 2010).

Critical communication points:
The stakeholder communications requirements in order to communicate the appropriate information as demanded by the stakeholders.
Information on what is to be communicated. The plan includes the expected format, content, and detail-thinks project reports versus quick email updates.
Details on how needed information flow through the project to the correct individuals. The communication structure documents where the information will originate, to whom the information will be sent, and in what modality the information is acceptable.
Appropriate method for communication include emails, memos, reports and even press releases.
Schedules of when the various types of communication should occur. Some communications, such as status meeting, should happen on a regular schedule, while other communications may be prompted by conditions within the project.
Escalation processes and timeframes for moving issues upwards in the organization when they cannot be solved at lower levels.
Methods to retrieve information as needed.
Instructions on how the communications management plan can be updated as the project progresses.
A project glossary.

It is also suggested that the communication plan includes information and guidelines for project status meetings, online meetings, project team meetings, and emails. It is critical to set these guidelines as early in the project as possible to establish a communications plan for stakeholders and the project team. It is also a way to early set the expectations for how communication is to exceed during the project. The first step when establishing the communications plan for a project should be to identify communication requirements. One framework that can be used for this, is the 5Ws and 1H framework as seen in Figure 5 below. By answering the questions, one have come a long way in developing the communications plan (Rajkumar, 2010).

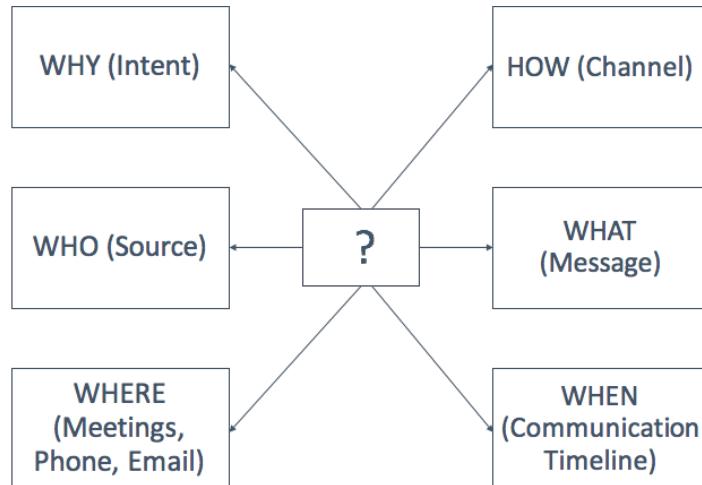


Figure 5. The 5W's and 1H Framework (Processed by the authors from Rajkumar, 2010)

Within the project team, different coordination mechanisms are needed to coordinate team members between activities in product development. The need of coordination mechanisms is a key requirement to develop a product as a team. Coordination is especially needed when new information is added to the project, or when unexpected events occur. Coordination can be difficult when there is not enough communication within the project team. Therefore, the following mechanisms can be used by teams to facilitate information exchange and to coordinate activities within projects (Ulrich & Eppinger, 2011).

Informal communication includes spontaneous and informal conversations between project members. An example of this kind of coordination mechanism is when a colleague stops by another colleague's desk just for small talks. This mechanism is very efficient for breaking down organizational or individual barriers, and works toward a cross-functional organization. It is also known that if team members are located more than a couple of meters away from each other, this mechanism is a lot more unlikely to occur than if the members are sitting close (Ulrich & Eppinger, 2011).

Meetings are another coordination mechanism which is a formal way of communicating. The frequency of meetings usually varies from once a week to having formal meetings every day. If a team is located in the same office, the need of meetings is often not as big as if the team is not located at the same place. A good way to keep meetings short and efficient is to have them standing up (Ulrich & Eppinger, 2011).

Schedule display is a coordination mechanism used to keep track of the project's schedule. For smaller projects, this task usually belongs to the project manager. To keep track of the schedule and to display it, preferably by a Gantt or PERT chart, is one of the most important information systems for the project execution (Ulrich & Eppinger, 2011).

Weekly updates is a task for the project manager. It can be distributed by email, notes or other channels. The weekly updates contains events, accomplishments and decisions made during the past week. If it is distributed by a written document, it is usually not longer than one or two pages (Ulrich & Eppinger, 2011).

Process documents is a coordination mechanism used for every method in the project and contains different documentation. The mechanism is used to have a structured and documented decision basis and to monitor progress (Ulrich & Eppinger, 2011).

A powerful project management tool or software can help teams beat their deadline demons. It also empowers the team and the project manager in terms of efficiency. A good project management software helps projects to structure and organize in an easy way, and in short time. This allow teams and project managers to spend more time on the actual project and less time on organizing. Other tasks needed for organizing a project that project management softwares can help with are for example delegating tasks, creating trackable to-do lists, and accessing progress reports (Fearn & DeMuro, 2018).

3.1.7 Project Risk Management

All projects are subject to risks, and risk management has become a major concern for executives and professionals working in projects today (Rabechini Junior & Monteiro de Carvalho, 2013). Risk can be defined as “uncertainty that has an impact on project objectives”. Risk is commonly described in the terms of likelihood that it would occur, as well as the impact it would have if it occurred (Moran, 2014). An illustration of the risk matrix is shown in Figure 6 below. The matrix can be used as a tool to categorize and prioritize the identified risks (Norrmann & Jansson, 2004).

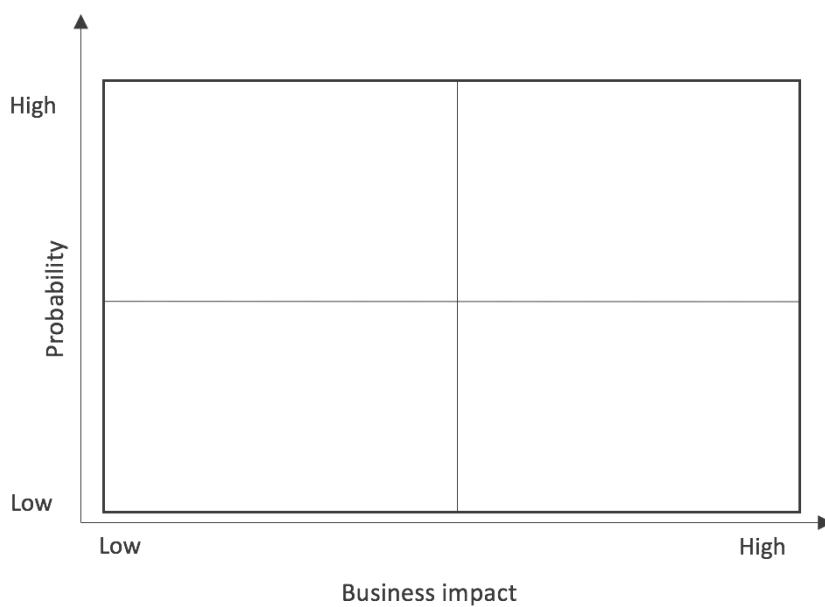


Figure 6. Risk Matrix (Processed by authors from Norrmann and Jansson, 2004)

Ibbs and Kwak (2000) argued that little effort has been put into the subject of risk management. However, today, a number of risk management frameworks have been established. The frameworks differ slightly, but for most of them one could break them down into the following stages: Initiation and Planning; Risk Identification; Risk Assessment; Risk Treatment; Risk Monitoring; and Risk Review (Moran, 2014). PMI have developed their own risk management processes, and an overview of the processes can be found in Table 6. The project risk management framework has the objective to “increase the probability and/or impact of positive risks, and to decrease the probability and/or impact of negative risks”. This will increase the chances of project success. Positive risks are those that could be considered as opportunities, and negative risks are those considered a threat (PMBOK® Guide, 2017).

Table 6. PMI's Risk Management Processes (Processed by the authors from PMBOK® Guide, 2017)

Risk Management Process	Explanation
Plan Risk Management	The process of defining how to conduct risk management activities for a project.
Identify Risks	The process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics.
Perform Qualitative Risk Analysis	The process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics.
Perform Quantitative Risk Analysis	The process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives.
Plan Risk Responses	The process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks.
Implement Risk Responses	The process of implementing agreed-upon risk response plans.
Monitor Risks	The process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project.

Critical Success Factors for Risk Management

The importance of risk management has, as previously mentioned, been highly recognized and understood by project managers. Despite this, research show that only about 25% of the organizations that have implemented a risk management system (RMS) have been successful (Yaraghi & Langhe, 2011). In addition, evidence is growing that risk management is often ineffective (Akram & Pilbeam, 2015). In response to this, research has been conducted to identify critical success factors (CSF) for risk management. CSFs could be defined as “a few things that must go right for the business to flourish” or “those few key areas of activity in which favourable results are absolutely necessary for a manager to reach his/her goals” (Yaraghi & Langhe, 2011). In a study by Yaraghi and Langhe (2011), the authors identified CSFs for RMSs. The CSFs were grouped into three different categories: (1) Factors important before implementation of an RMS; (2) Factors important during implementation of an RMS; and (3) Factors important after implementation of an RMS. In all three categories, strategy was identified as the most important CSF. Organizational culture and structure, and support of top management were also among the most important CSFs (Yaraghi & Langhe, 2011). The definitions of the CSFs are shown in Table 7 below.

Table 7. CSFs and their definition (Processed by the authors from Yaraghi & Langhe, 2011)

Critical Success Factor	Definition
Strategy	Well-defined and clearly understood vision, mission, and long-term strategy toward risk management in the organization
Organizational Culture	Staff morale and commitment. Adaption to change and respect to external management consultants
Organizational Structure	Organization's design, allocation of authorities, and responsibilities
Top Management	Level of top management support of RMS practices

Akram and Pilbeam (2015) studied CSFs for effective risk management (RM) in new product development (NPD). The authors identified six main CSFs, which are presented in Table 8.

Table 8. CSFs for NPD and their definition (Processed by the authors from Akram & Pilbeam, 2015)

Critical Success Factor	Definition
Systematic and Formalized RM Process	-Well defined and clear processes for identifying, assessing, and treating risks -Consistency of rules, tools, and procedures across NPD projects -Provides a structure for RM
Flexible and Tailored RM Process	-Processes need to be flexible due to the nature of NPD projects
Holistic and Cross Functional RM	-RM team should consist of people from different functions, both internal and external -RM processes should be integrated and coordinated with the whole supply chain
Timely, Iterative and Ongoing RM	-RM is ideally performed at several times during the NPD project -RM is important during the initiating phase -RM processes should be carried out iteratively, especially if the product are subject to many changes
Transparent and Comprehensive RM	-Include all team members and stakeholders in the RM process, this will build trust and credibility -Consider the whole product life cycle in RM processes
Strong RM Culture	-Will ensure effectiveness and efficacy of RM processes -Teams have an open and honest communication, and shares their knowledge about risks -Top management support will result in a strong RM culture

3.1.8 Resource Management

An important field of project management is the management of resources (PMBOK® Guide, 2017). This involves management of all kinds of resources, such as; financial, human, organizational, physical, technological, and social (Mathur et al., 2013). Resource management is one out of ten knowledge areas proposed by PMI, and has a strong focus on human resources. It is emphasized that the project manager should invest considerable effort in “acquiring, managing, motivating, and empowering the project team”. In addition, it is a responsibility of the project manager to ensure that the formation of the team constitutes an effective group (PMBOK® Guide, 2017). The FIRO (Fundamental Interpersonal Relationship Orientation) theory, developed by William Schutz in 1958, shows that all groups go through five phases in its development toward efficiency and unity (My Sourcing Leader, 2014). If a group that has reached the final phase loses one member, the group will fall back to phase three. On the contrary, if a new member is added to the team, the group will fall back to the very first phase (Nilsson, 2018). The phases along with a short description is shown in Table 9.

Table 9. The five phases a group passes (Processed by the authors from My Sourcing Leader, 2014)

Phase	Description
Inclusion	The team members start to get to know each other and avoid conflict. Structure and order is required and the team shows great dependence of the leader.
Comfortable	In the comfortable phase, the team feels that they are all part of the group. More risks are taken and members are less concerned about being accepted by the whole group.
Control	Begins when one or more of the members starts to control and direct the work. More risks are taken, more conflicts arise and these are solved by voting, compromise or by seeking external assistance. Feedback is often aggressive and members might go against the formal leader.
Idyll	Often preceded by a serious conflict. In this phase, leadership and roles are allocated and members show willingness to solve conflicts in a structured way. Language is more straightforward and honest.
Openness	Members initially only looks for what is best for their own group. but later understands the importance of seeing to the organization as a whole. Communication is open, direct and honest. Members demand consensus solutions and openly share ideas, feelings, and opinions.

In the rapid moving environment many organizations operates in today, it is not uncommon that many projects run in parallel, and that employees are members of several different project teams. Ideally, team members and project managers should participate in one single project at a time. However, this is many times unavoidable. The issue of being involved in many projects at a time, is that members will have to task switch and multitask. Multitasking reduces productivity, and people experience productivity losses as high as 20% to 40% when task switching. As a consequence, a person who is involved in two projects, will not be dedicated to a full 50% in each project. Instead, that person will be somewhere between 20% and 40% in each project. Consequently, as previously mentioned, one would ideally participate in one single project at a time. If this is not possible, one should try to reduce the number of projects that are running in parallel, since the productivity loss increases exponentially with the number of tasks one has to switch between (PMBOK® Agile Guide, 2017).

3.1.9 Cost Management

Cost management is known to be the most critical function for project success and it affects all aspects of a project. Therefore, to successfully manage cost in projects, a key element is to integrate different functions within cost management (Georgas & Vallance, 1986). Cost management covers for example the following activities; planning, estimating, budgeting, financing, funding, managing, and controlling costs. All activities are carried out to ensure that the project can be completed within budget. These activities are further on often divided into cost management function groups and the most common groups are; resource planning, cost estimating, cost budgeting, and cost control (des Bouvrie, 2016).

Resource planning is usually performed in the first two phases of a project, initiating and planning. When the resource planning of a project is executed it is possible to start estimating costs. Costs can be for example time required for the project, material, labor, and equipment. With a WBS for resource planning, it gives an advantage due to good overview of needed activities, which makes it easier to estimate costs (des Bouvrie, 2016).

Cost estimating should be done for the whole project life cycle in the beginning of, and throughout, the project. This function contains three blocks; economic evaluation, project investment cost, and cost forecasting. Economic evaluation is done in the beginning of the project to evaluate if the project is economically and technically feasible. Project investment cost is the function that forecasts and predicts future costs during the project, before all activities are completely defined. Cost forecasting processes possible trends and risks that might occur throughout the project (Georgas & Vallance, 1986). There are many different ways to estimate costs, depending on project type. It is although an important function to avoid negative surprises throughout the project (des Bouvrie, 2016).

Cost budgeting is the process of establishing procedures to manage investments in the projects. It can be budgets, standards and system for monitoring and controlling costs (Georgas & Vallance, 1986). This process should be executed in the planning phase of a project and gives an overview of the budget for the whole project (des Bouvrie, 2016; Georgas & Vallance, 1986).

Cost control is needed to alert variance from the budget and is used as a control mechanism (des Bouvrie, 2016). The processes of cost control is ongoing during the whole life cycle of a project and should contain activities such as to gather, analyze, monitor, report and manage different costs (Georgas & Vallance, 1986).

3.1.10 Project Triangle

Traditionally in project management, success for a project has been associated with how well the project manager delivers on project scope, time, quality and cost. These four parameters are also known as the project triangle, or the iron triangle. All four parameters are measurable, which has been criticized due to the fact that projects also requires soft skills. Included in soft skills are internal constraints belonging to the individuals involved and working on the project. As a result from this criticism, a soft triangle was introduced together with the iron triangle to cover all parts and constraints belonging to a project (Caccamese & Bragantini, 2012).

Moreover, the project manager is traditionally evaluated on how well that person manages trade offs regarding the four skills in the iron triangle. However, there are many more requirements for successful project management. For example, it should be added how well the project manager manages change, risk, establishment and monitoring of communication channels, and much more. Hence, for successful project management there are more factors of importance than the traditional scope, quality, cost and time. Further on, in our modern society and today's working methods, projects are made by individuals. This requires the project manager to be observant and consider soft factors such as team spirit, personal involvement, motivation and openness to teamwork. These are all factors included in the soft triangle. The soft triangle adds another three sides to the iron triangle, including motivational space, personal space and analytic/holistic space. The motivational space is available to motivate individual team members to the project. The personal space is available to activate acceptable behavior concerning both tasks and social behavior. Examples are punctuality on completing tasks, how to communicate and respect for consensus decisions. The final and third side of the soft triangle, analytic/holistic space, is applied to the project to manage and foster the individual development of thinking model (Caccamese & Bragantini, 2012).

3.1.11 Closing a Project

The definition of a project includes that it has a predefined ending point, such as a date or week. Consequently, all projects eventually close, and there are usually two basic reasons for closing: the project has been successful, or the project has failed. A successful project can be defined as it has met all the cost, time, and technical requirements and the objectives have been fulfilled and integrated in the customer's organization. A failed project has not met its cost, time, and/or technical performance objectives, or it is not suitable for the future of the organization. Unfortunately project termination, as in closing the project before it is finished, is often perceived as a failure and most commonly as a result of someone's failure. Regardless of the reason for the closing of a project, it should not be seen as a failure. Instead, one should see it as a strategic decision for what is best for the organization and stakeholders (Cleland, 1999). By having a structured process for how to close a project, and how to document this closure, an organization can save time and resources in future projects. One part of closing a project is to create a project summary or report. The report should be viewed by both the project manager and the stakeholders, to ensure that everyone regards the project closed (McBride, 2016; Semcon, 1995). The objectives of the project should be reviewed, and the basis for future development and control of product or service should be included (Semcon, 1995). This is further emphasized by Anbari et al., (2008), who argues that during the closure of a project, "a post-project evaluation needs to be conducted to measure the success of the project in terms of its original and modified objectives. This evaluation should contain explanations of major variances, lessons learned from the project, and recommendations to support further success of future projects".

The benefits of capturing lessons from previous projects are widely recognized. The process of lessons learned aims to capture results and experiences from terminated projects, and learn from the successes, failures, and near-misses. The lessons learned should then be absorbed by the organizational structure for future use (McClory et al., 2017). Knowledge management is another area aiming to learn from experiences, and Terzieva (2014) describes it as: "Knowledge management seeks to improve performance by leveraging and maintaining the present and future value of knowledge assets". If successfully managing an organization's knowledge, one enables usage of the information gained from previous projects and will as a result, perform future jobs even better than in the past (Terzieva, 2014).

Even though the benefits of lessons learned are recognized, research shows that very few organizations use and apply the lessons in future projects (McClory et al., 2017; Duffield & Whitty, 2014). In addition, there seems to exist some barriers to knowledge management. Carrillo and Chinowsky (2006) identified, through a case study of engineering design firms, a number of barriers to knowledge management. The most frequently mentioned barrier was lack of time. Other barriers mentioned were: lack of management support, employee resistance to sharing, poor IT infrastructure, accessing knowledge, "not invented here" syndrome, and lack of real-time integrated database (Carrillo & Chinowsky, 2006). McClory et al. (2017) further discuss the nature of projects as a barrier itself, given that a project is temporary with a focus on short-term goals which can disrupt the knowledge flow. McBride (2016) emphasize the importance of capturing knowledge and lessons quickly after the

project is terminated, before the team is fully involved in their next project. Another study showed that the most common reasons for lessons not being captured were: unavailable staff, shortage of qualified analysis personnel, pressures of work, and no agreed-upon criteria for evaluation (Collier et al., 1996).

Collier et al. (1996) suggests a five-step process for how to conduct lessons learned, which in this context is referred to project postmortem review. The process steps along with a brief description follows below.

1. Design and Promulgate a Project Survey: Establish a mechanism for how to collect project information without compromising the confidentiality of the respondents. Electronic surveys could be a time-efficient choice. In this stage, one has to determine what questions to ask to get the most relevant information.
2. Collect Objective Project Information: Objective data such as cost of resources, schedule predictability, and defect count is collected. Metrics of special importance to collect are cost metrics, schedule metrics, and quality metrics.
3. Conduct a Debriefing Meeting: Gather all project members for a structured meeting. The objective is to collect data and information that the survey might have missed. Important roles during the meetings are: (1) Chair person who encourages attendance, provides technical support, and has been a key player in the project; (2) Coordinator, who provides the infrastructure to support the meeting; and (3) Facilitator, who is in charge of leading the meeting, provides focus and direction. The facilitator is preferably someone who has not participated in the project.
4. Conduct a Project History Day: A meeting with selected project participants aiming to go from general analysis of the data, to a more detailed analysis. The root causes should be identified to allow for an action plan.
5. Publish the Results: A report consisting of the lessons learned, which is then used by the organization for improvement. The report should provide the reader of: a project description, a summary of the positive findings, a summary of the three worst factors impeding on ability to meet goals, and a prescription for improvement.

As previously stated, many organizations do not use the lessons learned for future projects. To respond to this, Collier et al. (1996) set up five requirements for their process: (1) Put in place a set of documented, well-understood procedures and guidelines that would be available to all participants prior to the postmortem; (2) Establish communication channels that would elicit even difficult findings without compromising individual safety; (3) Make clear to all participants that the process would be positive and blame-free; (4) Respond to the common concern that postmortem results are destined for a write-only repository and have no effect on future projects; and (5) Provide an appropriate balance between the cost of post mortems, and the return on investment.

3.2 Agile Project Management

In a world with rapidly changing business environments, and where the development of new technology accelerates, a fixed project management model is not always suitable. For product and software development, it has been found especially beneficial to use a flexible model. From this finding, agile project management is introduced. Agile project management is not a fixed way of working with projects, but can rather be observed as an incremental, and iterative way of performing a project (Larson & Gray, 2014).

During the past decade, agile project management has become increasingly popular. Agile methods and management have been especially successful in software development, and many believe that the agile revolution began within IT. However, this is not the case. Agile methodologies can be traced back to the 1930's, when the Plan-Do-Study-Act (PDSA) cycles were applied by Walter Shewhart to product development projects. Moreover, in 1986, a study was conducted of manufacturers who were releasing new and innovative products in a much faster way than its competitors. The study showed that these companies were not following the traditional product development process, but instead applied an approach similar to rugby, "where a team tries to go the whole distance as a unit, passing the ball back and forth". Consequently, one could say that agile has its roots in product development. However, the great movement of agile came with the development of the Agile Manifesto in 2001. The manifesto was developed by a group of developers, which could be a reason to why many believe that agile has its roots in IT (Rigby et al., 2016).

Even though agile development and methods are highly related to innovation, agile can also be useful in more routine processes and operations. Today, most companies operate in highly complex and rapidly changing environments. In this context, innovation might not be in the form of new products, but rather in the form of new innovative processes and operations which is just as important. There are however some conditions that could act as guidelines for when to use agile and not, and these are presented in Table 10 below (Rigby et al., 2016).

As mentioned previously, the Agile Manifesto was written in 2001, and four main values for agile development were established. The four values are; Individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan (PMBOK® Agile Guide, 2017). These four values have generated twelve principles for agile development as can be seen in Table 11 below. From then on, all frameworks that were developed in line with these values and principles would be known and considered as agile techniques (Rigby et al., 2016). All principles have however activities associated to every principle, which can be seen below.

Table 10. The Right Conditions for Agile (Processed by the authors from Rigby et al., 2016).

Conditions	Favorable	Unfavorable
Market Environment	-Customer preferences and solution options change frequently.	-Market conditions are stable and predictable
Customer Involvement	-Close collaboration and rapid feedback are feasible. -Customers know better what they want as the process progress	-Requirements are clear at the outset and will remain stable. -Customers are unavailable for constant collaboration
Innovation Type	-Problems are complex, solutions are unknown, and the scope isn't clearly defined. -Product specifications might change. -Creative breakthroughs and time to market are important. -Cross-functional collaboration is vital.	-Similar work has been done before, and innovators believe the solutions are clear. -Detailed specifications and work plans can be forecast with confidence and should be adhered to. -Problems can be solved sequentially in functional silos.
Modularity of Work	-Incremental developments have value, and customers can use them. -Work can be broken into parts and conducted in rapid, iterative cycles. -Late changes are manageable.	-Customers cannot start testing parts of the product until everything is complete. -Late changes are expensive or impossible.
Impact of Interim Mistakes	-They provide valuable learning.	-They may be catastrophic.

Table 11. Agile principles and their activities (Processed by the authors from PMBOK® Agile Guide, 2017).

Principles	Agile activities
Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.	Characteristics of project life cycle execution practises that help team deliver value
Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.	Backlog refinement
Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.	Common agile practices
Business people and developers must work together daily throughout the project.	Servant leadership empowers the team Backlog preparations Backlog refinement
Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.	Team composition Charter the project and the team Retrospectives
The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.	Team structures Daily standups
Working software is the primary measure of progress.	Execution practices that help teams deliver value How iterations and increments help deliver working product
Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.	Charter the project and the team
Continuous attention to technical excellence and good design enhances agility.	Common agile practices
Simplicity—the art of maximizing the amount of work not done is essential.	Backlog preparations Backlog refinement
The best architectures, requirements, and designs emerge from self-organizing teams.	Team composition
At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.	Retrospectives

3.2.1 Life Cycle Selection

There are a number of ways to undertake a project, and before initiating, one should put some effort into identifying the characteristics of the project. The more awareness the team has about the characteristics and options available, the more likely they are to successfully choose methods and approaches suitable for the specific project. By being aware of the characteristics, the team is enabled to identify the life cycle of the project. There are typically four different types of life cycles for projects; predictive, iterative, incremental and agile life cycles. None of the life cycle approaches is appropriate for all projects, hence it is important to notice the characteristics for a project, and combine the project with the most suitable life cycle approach. Project life cycles can also vary throughout the project, which could be referred to as the continuum of life cycles (PMBOK® Agile Guide, 2017). This is illustrated in Figure 7.

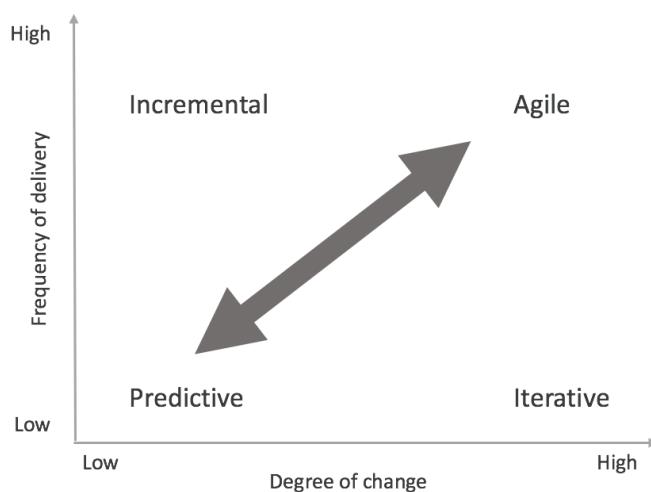


Figure 7. The Continuum of Life Cycles (Processed by the authors from PMBOK® Agile Guide, 2017)

The four project life cycles have different characteristics. As the names indicate, not all of the four life cycles are traditionally agile. However, independent of which type of life cycle a project has, they all have in common that there are characteristics for requirements, activities, delivery and goal (PMBOK® Agile Guide, 2017). An overview of the life cycle characteristics can be found in Table 12 below. A more detailed description of the agile life cycles follows the table, since this chapter is focused on agile project management.

Table 12. Characteristics of life cycles (Process by the authors from PMBOK® Agile Guide, 2017)

Approach	Requirements	Activities	Delivery	Goal
Predictive	Fixed	Performed once for the entire project	Single delivery	Manage cost
Iterative	Dynamic	Repeated until correct	Single delivery	Correctness of solution
Incremental	Dynamic	Performed once for a given increment	Frequent smaller deliveries	Speed
Agile	Dynamic	Repeated until correct	Frequent small deliveries	Customer value via frequent deliveries and feedback

Agile Life Cycle

An agile life cycle is one that fulfills the principles of the Agile Manifesto. A project characteristic suitable for an agile life cycle is, just like in the incremental life cycle, frequent changes of requirements. There are two main types of agile life cycles; iteration-based agile and flow-based agile (PMBOK® Agile Guide, 2017). An illustration of the two life cycles is shown in Figure 11.

In an iteration-based agile project life cycle, the team work in iterations to deliver completed features. Each iteration is given the same duration. The team decides upon which feature is the most important, and collaborates as a team to finish it. Thereafter, the team continues with the next most important feature. A few features can be worked on simultaneously, however, the team does not address all of the work at once (PMBOK® Agile Guide, 2017).

In a flow-based agile project life cycle, the team pulls features from the backlog based on its capacity to work. Unlike an iteration-based agile, the features are not given the same duration but might rather take different amount of time to finish. The workflow is put on a task board and the team aims to have small sizes of work in progress. This enables early identification of issues and hence reduces rework (PMBOK® Agile Guide, 2017).

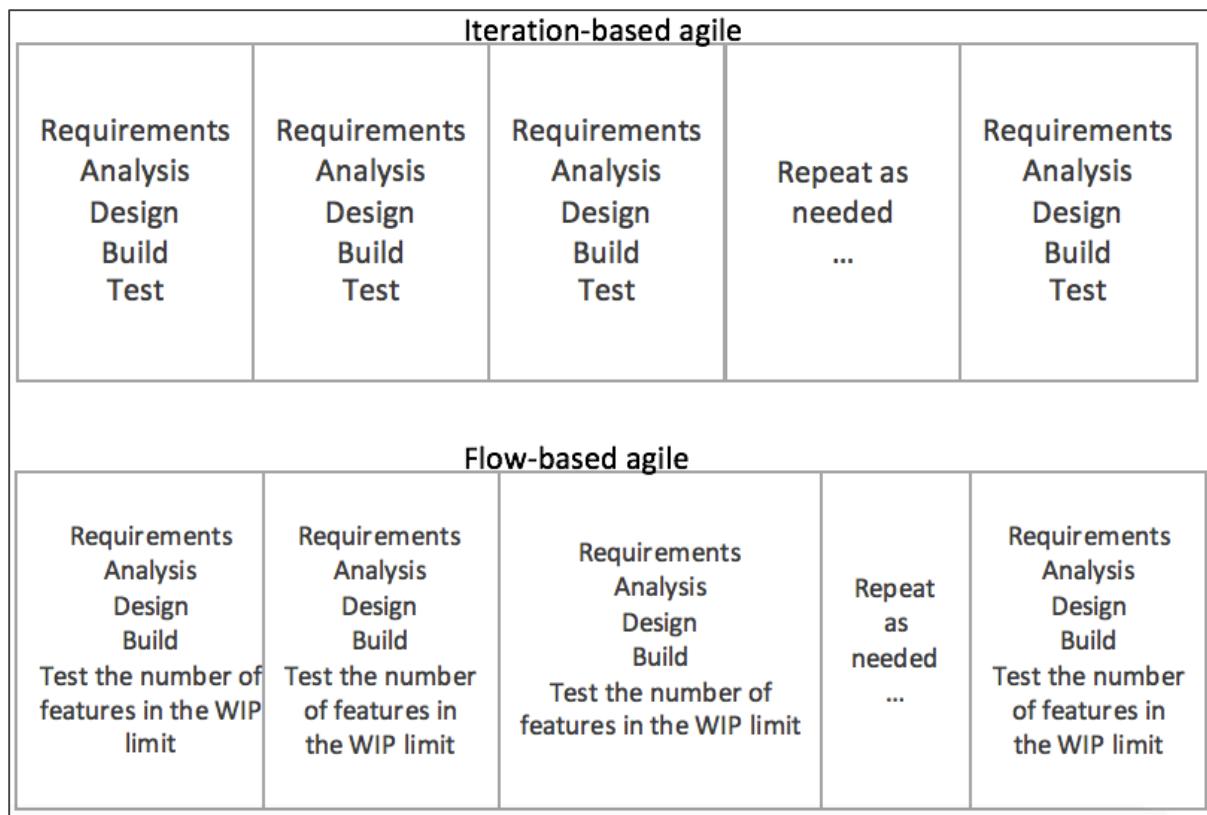


Figure 11. Iteration-based agile and flow-based agile life cycles (Processed by the authors from PMBOK® Agile Guide, 2017)

3.2.2 Agile Project Planning

Agile projects can look different, as shown in the previous life cycle section. Common for agile projects is that they use iterative processes to realize the final delivery. Agile teams do not plan a project in one chunk, but rather plan a little, deliver a part, learns, and then replan in an ongoing cycle. Agile teams consider resources and capacity in their planning, and do not plan for more than the current capacity could handle (PMBOK® Agile Guide, 2017). An agile project can be divided into several releases, where each release is composed by several iterations. In agile planning, one consequently breaks it down into two parts; release planning and iteration planning (Zhong et al., 2011; Alyahya et al., 2016). The activities to be included for both release and iteration planning are shown in Table 13.

Table 13. Release and Iteration Planning (Processed by the authors from Alyahya et al., 2016)

Activities to be performed	Release Planning	Iteration Planning
	Break down features into user stories through close communication between the development team and the customer	The product owner and the development team establish an iteration goal
	Identify the user stories for the release	The team members estimate the work that they will be able to complete in the iteration
	The development team estimates the size of each user story	The development team chooses the user stories from the product backlog that support the iteration goal
	The product owner prioritizes the user stories	The development team confirms that the selected user stories can complete the goal planned for the iteration
	The product owner identifies the release features given the available resources	If the development team finds any of the user stories do not fit in the current iteration, they can remove them from the iteration
	The product manager and the development team estimate the release date	The development team creates the iteration backlog tasks associated with each user story
	The product owner gets the development team commitment on the release date	Team members break the user stories into individual tasks.
	-	Team members allocate a number of hours to each task
	-	The development team confirms that they can complete the tasks in the time available in the iteration.
-		If a task exceeds the hours available, the development team will discuss with product owner what tasks/user stories are the best to remove
-		If the development team finds an extra time available within the iteration, they can include another user story
-		Each team member selects his/her tasks to accomplish

3.2.3 Agile Approaches

There are many different agile approaches, and an agile team often uses a couple of different approaches in their practice. Agile frameworks, just as other project management frameworks, are not tailored after a specific team. Therefore, agile teams usually practice agile approaches in their own way. A couple of agile approaches that are commonly used will be discussed further in this chapter (PMBOK® Agile Guide, 2017).

Scrum Framework

The scrum framework is a process used for management of product development. It is an iterative way of working and developing a finished product. The time frame for the project is built on sprints that has a duration of one month or less. Other events occurring in the scrum approach are sprint planning, daily scrum, sprint review, and sprint retrospective. Artifacts belonging to the framework are product backlog, sprint backlog and increments. A project with a scrum framework has a team that consists of scrum master, the developing team and a product owner (PMBOK® Agile Guide, 2017).

The Kanban Method

The Kanban method is originally founded from lean manufacturing and inspired by the just-in-time philosophy. It is further on used to schedule, control and replenish stocked inventory (Bergman & Klefsjö, 2010). In the world of agile approaches, the Kanban method differs from other approaches in its time frame. Kanban is not focused on an iterative process as much as other approaches, it rather focuses on having a constant and optimized flow of pulling items through the process. With this method, the workload is also optimized. The method is best used when the team or organization is looking for any of the following conditions; flexibility, focus on continuous delivery, increased productivity and quality, increased efficiency, team member focus, variability in the workload or reduction of waste. As described, Kanban is a holistic framework, and its defining principles and core properties can be seen in Table 14 below (PMBOK® Agile Guide, 2017).

Table 14. Principles and Properties of Kanban (Process by the authors from PMBOK® Agile Guide, 2017)

Defining Principles	Core Properties
Start with current state	Visualize the workflow
Agree to pursue incremental, evolutionary change	Limit work in progress
Respect the current process, roles, responsibilities, and titles	Manage flow
Encourage acts of leadership at all levels	Make process policies explicit
	Implement feedback loops
	Improve collaboratively

Scrumban

Another agile approach, which was developed and designed as a way to transition from Scrum to Kanban, is Scrumban. It emerged to being a hybrid framework, where the project teams use Scrum as a framework, and Kanban for process improvement. The Scrumban approach organizes the work in sprints, and uses a Kanban board to visualize and monitor it. To maintain collaboration between the team members, daily meetings are held. When the work-in-progress level is lower than a predefined limit, planning of the next work is done (PMBOK® Agile Guide, 2017).

3.2.4 Implementing Agile

Using agile approaches when managing a project will require the team to adopt the agile mindset (PMBOK® Agile Guide, 2017). According to van Manen and van Vliet (2014), the agile mindset consists of three especially important parts; collaboration, trust, and continuous improvement. An overview of the three parts and their definition is shown in Table 15.

Table 15. Elements of the agile mindset (Processed by the authors from van Manen & van Vliet, 2014).

Agile Elements	Definition
Collaboration	All results and improvements are achieved through intensive collaboration of everyone in the organization.
Trust	All employees should take responsibility for changes and issues, as they are empowered and trusted by the management to make their own decisions, while the organizational structure and processes reflect this trust.
Continuous improvement	Everyone in the organization strives for continuous improvement of all processes, people, and products, by maintaining an open attitude towards each others feedback.

In traditional projects, the project manager is at the center of coordination of the project, and represents the team's status to the rest of the organization. Today, projects often require people from many different functions, meaning there is more complexity involved than one person can manage. Consequently, the role of the traditional project manager is not the most suitable for agile projects. Instead, the project manager should act as a servant leader. A servant leader is one who: coach those who need help; acts as a facilitator for the team; foster great collaboration; encourage the distribution of responsibility; and aligns stakeholder needs. The team itself is self-managing its work processes and work product, and is hence rather self-going. The most effective agile teams usually consists of three to nine members, and are 100% dedicated to the project at hand. Ideally, the whole team is colocated in a space devoted to the team (PMBOK® Agile Guide, 2017).

Before initiation of all projects, it is important to charter the project so that the team know the project objectives, why the project matters, and where the team is headed. Agile teams require more than this, such as team norms and mutual understanding on how to work together. Since agile teams work closely together, well-established working agreements are essential. In addition, it is important that the projects' purpose and vision is communicated (PMBOK® Agile Guide, 2017).

The agile way of working in projects is considerably different from the traditional way. Implementation of agile thus involves organizational change, and overcoming organizational silos (PMBOK® Agile Guide, 2017). Managing organizational change can be difficult, and according to a study by van Manen and van Vliet (2014), the ability to change organizational culture was ranked as the number one barrier to adoption of agile methods. According to Näslund (2013), there are some CSF for change, and these are considered independent of change method. Top management support is one especially important CSF. It is argued that top managers should take charge personally, and be the ones leading the change. Top management support can in turn influence several other CSFs such as strategic alignment, project management, and training (Näslund, 2013). According to PMBOK Agile Guide (2017), there are two especially important CSFs when implementing agile practices. The first one being the adoption to the agile mindset. The second one is that of building a foundational trust and safe work environment for the agile teams. If done successfully, the team will know that they all have an equal voice, and that their suggestions are heard and considered. In addition, it is critical to communicate why the change of practices is needed, and why and how the team members are valuable (PMBOK® Agile Guide, 2017).

Agile Practices

When employing and integrating agile management, there are a number of tools and practices available to facilitate this process (PMBOK® Agile Guide, 2017). Below follows a description of a few of these agile practices.

Retrospective

One of the most important practices. It provides the team with the ability to learn, modify, and adapt based on the previous process and product. It can be explained as a flashback on what previously has been done, and use that to improve in the future of the project. Retrospectives can be executed in the end of every iteration, but also at different occasions such as when something is to be delivered to the customer, when a certain number of weeks have passed or when the team reaches a milestone. Both qualitative and quantitative data should be included in the retrospective and be concluded in the decision making for improvement, which could be both small and large. In qualitative data, more soft data should be brought up, for example feelings of team members. Moreover, more hard facts and measurements should be included in the quantitative data. In case many improvements are detected in a retrospective session, they should be ranked based on urgency and impact by the whole project team. Retrospectives are critical for teams and their learning. Both occasional and end of the project retrospectives are very important (PMBOK® Agile Guide, 2017).

Backlog Preparation

This practice includes all work needed for the project, and is presented in story format. Before the project is up and running, all stories do not have to be decided, only an overview so that the team understands the scope of the project. A roadmap of the project and its deliverables should on the other hand be provided by the product owner. This roadmap should be modified on the projects progression based on what the team delivers (PMBOK® Agile Guide, 2017).

Backlog Refinement

Backlog refinement is especially used for iteration-based agile development. The product owner holds these meetings to provide the team with information about upcoming stories. It also gives the team an idea of what is coming, challenges, and risks that are potential in the stories. Sometimes it is also difficult for the product owner to see how large a risk is, therefore the product owner can ask the team to spike the feature to be able to handle risks (PMBOK® Agile Guide, 2017).

Daily Standups

Daily standups are used to briefly go through the work and bring up both progress and issues in an efficient way. The meeting is limited to a maximum of fifteen minutes and everyone in the team can contribute. A Kanban board, see example in Figure 16, can be used to keep the meeting structured. Everyone in the team should answer the following questions at the daily standup, if the agile is iteration-based; What did I complete since the last standup, What am I planning to complete between now and the next standup, What are my impediments (or risks or problems)? If the agile instead is flow-based, the following questions should be answered at the daily standup; What do we need to do to advance this piece of work? Is anyone working on anything that is not on the board? What do we need to finish as a team? Are there any bottlenecks or blockers to the flow of work? (PMBOK® Agile Guide, 2017).

A daily standup is not to be confused with a status meeting. It is common, especially for teams that are used to work in a predictive environment, to fall into this antipattern. Another antipattern often seen, is that issues and problems that are brought up during the standup starts a discussion of how to solve the problem. The daily standup is not meant for solving problems, only to notify them and put them on the board. The team should however decide on an action for the issues during the meeting, for example a meeting where the issue is discussed more in depth and a solution can be brought to life (PMBOK® Agile Guide, 2017).

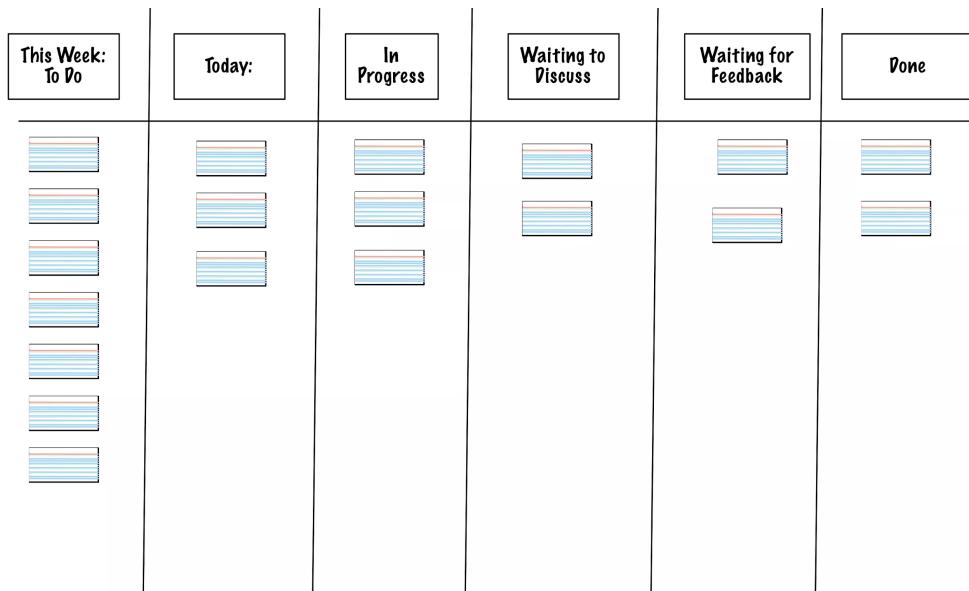


Figure 16. An example of how a Kanban board can be designed (Rothman, 2017).

Demonstrations and Reviews

Demonstrations and reviews are needed when features are completed by the team. Demonstrations or reviews are usually done at the end of every iteration if it is iteration-based agile. If it is flow-based agile, demonstrations or reviews are carried out by the team when enough progress has happened or when the features are ready to be reviewed. A general guideline is although to always review the team's progress at least every two weeks. The reason to not exceed two weeks is to keep flexibility in the development process and always be open to feedback. One of the keystones in agile development is to frequently deliver a working product. If a team is not able to deliver every two weeks, at the longest, the team needs to work on the agile techniques (PMBOK® Agile Guide, 2017).

Planning for Iteration-Based Agile

Everyone is different and therefore, all team's capacity is different. All product owners usually have different story sizes. Due to this, it is hard to know how much, and what exactly, a team can deliver. It is important to learn, which is an agile mindset, and if a team is working iteration-based, the team should plan a couple of iterations ahead. With this working method, the team learns how much they are able to deliver, and will with that knowledge be able to plan and deliver more reliable plans for the future work (PMBOK® Agile Guide, 2017).

Execution Practises that Help Teams Deliver Value

There are a couple of technical practices that help teams deliver at their maximum speed. These practices are particularly common in extreme programming (PMBOK® Agile Guide, 2017). Three technical practices are presented below.

- *Continuous integration* - Always integrate finished parts to the whole product. It does not matter what kind of product it is, and parts should always as soon as possible be integrated to determine that the product still is working as intended (PMBOK® Agile Guide, 2017).
- *Test at all levels* - Employ system-level testing, and test between all building blocks. Evaluate if and where integration tests might be needed in between the blocks. Agile teams usually have a strong preference for automated tests, to enable continuous building and maintaining momentum of delivery (PMBOK® Agile Guide, 2017).
- *Spikes (timeboxed research or experiments)* - Spikes are a useful practice for learning, and is often used in circumstances such as: “estimation, acceptance criteria definition, and understanding the flow of a user’s action through the product”. Spikes have been found particularly helpful when the project team is required to learn some critical technical or functional element (PMBOK® Agile Guide, 2017).

Troubleshooting and Measurements for Agile Projects

The main reason an agile approach came to life in the first place was the need for an approach that could handle large complexity, high rates of change, and uncertainty. In other words, managing a lot of issues that were found in predictive approaches. But, as for any approach, issues can occur within an agile project. Therefore, in Table 16 below, a couple of pain points are stated together with troubleshooting possibilities on how the issues could be solved (PMBOK® Agile Guide, 2017).

Table 16. A couple of pain points and troubleshooting possibilities for agile projects. (Processed by the authors from PMBOK® Agile Guide, 2017).

Pain Points	Troubleshooting Possibilities
Unclear purpose or mission for the team	Agile chartering for purpose - vision, mission, and mission tests
Unclear working agreements for the team	Agile chartering for alignment - values, principles, and working agreements
Unclear team context	Agile chartering for context - boundaries, committed assets, and prospective analysis
Unclear requirements	Help sponsors and stakeholders craft a product vision. Consider building a product roadmap using specification by example, user story mapping, and impact mapping. Bring the team and product owner together to clarify the expectations and value of a requirement. Progressively decompose roadmap into backlog of smaller, concrete requirements.
Unclear work assignments or work progress	Help the team learn that they self-manage their work. Consider kanban boards to see the ow of work. Consider a daily standup to walk the board and see what work is where.
Too much product complexity	For software and non-software encourage the team always to be thinking “What is the simplest thing that would work?” and apply the agile principle of “Simplicity - the art of maximizing the amount of work not done”. These help reduce complexity.
False starts, wasted efforts	Ask the product owner to become an integral part of the team.
Rush/wait uneven ow of work	Plan to the team’s capacity and not more. Ask people to stop multitasking and be dedicated to one team. Ask the team to work as pairs, a swarm, or mob to even out the capabilities across the entire team.
Unexpected or unforeseen delays	Ask the team to check in more often, use kanban boards to see the ow of work and work in progress limits to understand the impact of the demands on the team or product. Also track impediments and impediment removal on an impediment board.

3.3 Standards within Project Management

The following section will introduce the reader to three project management standards. To cover a wide range of standards, the authors have chosen one american standard, PMI, one british standard, IPMA, and one international guideline, ISO 21500.

3.3.1 Project Management Institute

PMI was founded in 1969 in Pennsylvania, USA with the aim to provide a means for project managers to associate, discuss common problems, and share information. Today, approximately 470 000 people worldwide are members of PMI. Through global standards, certifications, professional development courses, and network opportunities, PMI aims to advance careers and further mature the profession of project management. PMI has developed foundational standards within the areas of project, program, portfolio, and the organizational approach to project management. The standards are widely accepted and provide guidelines, rules, and characteristics for project, program and portfolio management (PMBOK®, 2017). The global standard PMBOK will be the baseline for this section.

PMBOK Guide

In the beginning of a project, objectives to be met are determined. When these objectives are met, the project has reached its end. Projects always have a definite beginning and end, and PMI defines a project as “a temporary endeavor undertaken to create a unique product, service, or result”. To manage projects efficiently, project management is needed, and it is defined as “the knowledge, skills, tools, and techniques for project activities to meet project requirements”. Projects should be aligned with the organizational strategy and before a project is initiated, a business case and a benefits management plan is usually outlined. The business case is used throughout the project life cycle to measure success and progress within the project in comparison to the outlined objectives. The benefits management plan is on the other hand a plan which describes the beneficial outcomes of the project and how the benefits will be measured (PMBOK® Guide, 2017).

From a generic point of view, project life cycles have four phases; starting the project, organizing and preparing, carrying out the work, and ending the project. In every phase in the project's life cycle, there are typically five different kinds of processes. These are divided into the following five process groups; Initiating processes, Planning processes, Executing processes, Monitoring and controlling processes, and Closing processes. To perform and execute the processes, good knowledge about project management is important. Therefore, ten knowledge areas are connected to the process groups as can be seen in Figure 17 (PMBOK® Guide, 2017). The four phases in the life cycle of a project, the process groups, and the ten knowledge areas will be further discussed later in this section.

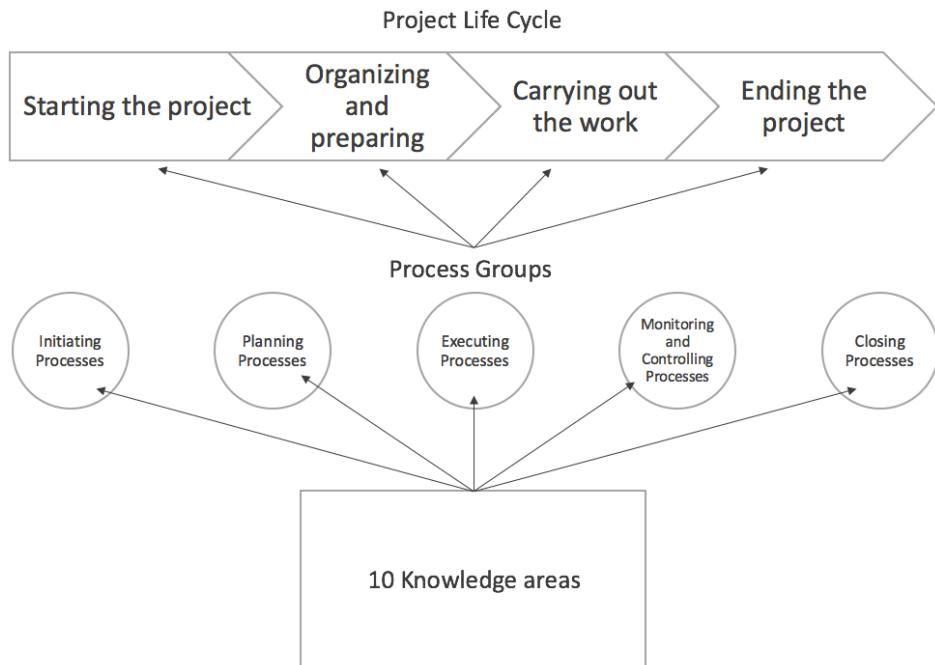


Figure 17. Project life cycle, process groups and ten knowledge areas (Processed by the authors from PMBOK® Agile Guide, 2017)

Project Life Cycle

All phases that a project goes through, from start to completion, is known to be the project life cycle. The structure of the phases can be either sequential, iterative, or overlapping. A phase is moreover defined to be controlled by time, with a starting point and end, and can also have control points, known as a phase gate, control gate or phase review. At a control point, business documents belonging to the project such as a project management plan and project charter should be reevaluated based on the current state of the project (PMBOK® Guide, 2017).

The Process Groups

To meet a project's objectives, PMI have established project management processes and divided them into five groups. The process groups included are, as previously mentioned: Initiating, Planning, Executing, Monitoring and controlling, and Closing. They are independent of application area, and can be applied to any project. For large projects, the process groups can be applied in each phase. They are not to be confused with phases, and they usually overlap. Often, outputs from one process group contribute as an input to the next process group (PMBOK® Guide, 2017). The process groups are briefly described below, and descriptions of all the processes within the process groups can be found in Appendix C.

Initiating Process Group

The initiating process group refers to the activities performed to define a new project or a new phase within an existing project. The purpose is to align stakeholders' expectations and the purpose of the project, as well as to inform all stakeholders of the project scope and objective. Together with the stakeholders, one should discuss their participation in the project and how expectations are to be met (PMBOK® Guide, 2017).

Planning Process Group

The planning process group refers to the activities that establish the total scope of the effort, and define and refine the objective. Additionally, a course of action on how to meet the objectives and requirements should be developed. Planning is not a one-time activity but is rather performed iteratively throughout the project as more information and characteristics of the project is gathered. The key benefit of the planning process group is that by defining the course of action, one is more likely to successfully carry out the project or a project phase (PMBOK® Guide, 2017).

Executing Process Group

The third process group, execution, consists of all processes required to perform and execute the project. If the execution process is performed efficiently, one will ensure that project requirements are met and that activities are performed according to the project plan (PMBOK® Guide, 2017).

Monitoring and Controlling Process Group

Activities within the process group monitoring and controlling are used to track, review and regulate the progress and performance of the project. These processes have a large impact by keeping the project on track, oversee the project at its most active paths and give flexibility in making fast changes to the project when needed (PMBOK® Guide, 2017).

Closing Process Group

The closing process group contains processes for formally closing and completing a phase or a project. This is done when all tasks that were planned for the phase or project are completed, and when necessary documentation regarding the project or phase has been done. Documentation for projects that can be useful is for example an assumption log, change log, issue log, milestone list, and lessons learned register (PMBOK® Guide, 2017).

Knowledge Areas

According the PMBOK®, there are ten knowledge areas that are specifically important when practicing project management. A knowledge area is defined as “a set of processes associated with a particular topic in project management”, and in Table 17 below the ten knowledge areas are presented together with a short description (PMBOK® Guide, 2017).

Table 17. The ten knowledge areas (Processed by the authors from PMBOK® Guide, 2017)

Project Management Knowledge Area	Description
Project Integration Management	Managing processes regarding identifying, defining, combining, unifying and coordinating diverse project management activities.
Project Scope Management	Managing processes ensuring that the project covers the work needed, not more or less, for the final product to reach the customer's expectations.
Project Schedule Management	Management of process regarding the project duration. For example look to that the project will be finished on scheduled time.
Project Cost Management	Managing process to plan, estimate, budget, finance, fund, manage and control costs. This is an important knowledge area to ensure that the project is completed within its frame of budget.
Project Quality Management	Management of project quality involves to manage processes for planning, managing and controlling projects based on the organization's terms of quality.
Project Resource Management	Overlook and ensure that the project has the right amount of resources in order to be completed.
Project Communications Management	Management of project communications involves to manage processes to plan, collect, distribute, store, retrieve and dispose information regarding the project.
Project Risk Management	Risk management regards management of risks concerning the project. It involves processes such as plan, identify, plan responses, implement responses and monitor risks.
Project Procurement Management	Project procurement management handles processes needed for resources outside the project team.
Project Stakeholder Management	The final knowledge area, project stakeholder management, includes processes to manage stakeholders for the project. Example on processes are to identify stakeholders who could have or have an impact on the project,

3.3.2 International Project Management Association

IPMA was founded in 1965 in Switzerland and has the vision of “promoting competence throughout society to enable a world in which all projects succeed”. The federation consists of 70 member associations located all over the world which aims to develop management competencies. IPMA offers, among other things, certifications, education and learning, and assessment of project management maturity of entire organizations. Certifications are offered in four different levels, A-D, and in 2015, there were approximately 250 000 IPMA certificants worldwide (IPMA, 2017). IPMA offers three standards focused on different aspects of project management; IPMA Individual Competence Baseline (ICB), IPMA Organisational Competence Baseline (OCB), and IPMA Project Excellence Baseline (PEB). Together, the three standards provides a comprehensive way of assessing projects (IPMA PEB, 2016).

IPMA defines a project as “a unique, temporary, multi-disciplinary and organised endeavour to realise agreed deliverables within predefined requirements and constraints” (IPMA OCB, 2015). The management of projects is “concerned with the application of methods, tools, techniques and competences to a project to achieve goals” (IPMA OCB, 2015).

Project Excellence Model

With the purpose to provide guidance to organizations in assessing the ability of their projects and programs to achieve project excellence, IPMA has developed the Project Excellence Model (PEM). Project excellence is a set of characteristics, and an excellent project must show excellent performance in the management of people, resources, processes, purpose, and results (IPMA PEB, 2016).

The PEM provides guidelines for excellent project management, regardless of the project's size, maturity and context. There are three levels of the model; Areas, Criteria, and Examples. The first level is divided into three areas; People and Purpose, Processes and Resources, and Project Results, see Figure 18. The areas show the overall structure of the key enablers and their outcome, and enables feedback on an executive level (IPMA PEB, 2016).



Figure 18. The three areas in the PEM (IPMA PEB, 2016).

Each area consists of a number of criteria, which is the second level of the model. The level includes the key factors of the project excellence areas, and enables detailed feedback about the excellence levels of a particular project. The third level, examples, refers to actual practices in excellent projects. The findings can be used by practitioners to improve their project management performance. A description of all three areas and their respective criteria follows below (IPMA PEB, 2016).

People and Purpose

The area of People and Purpose is considered to be the foundation of project excellence. A project managed and supported by excellent leaders, with the appropriate people, are crucial to reach project excellence. Moreover, it is of great importance that all share a common vision of success. The area is divided into three criteria which are briefly described below (IPMA PEB, 2016).

Leadership and Values

The first criteria emphasizes the importance of the project leaders. The leaders in excellent projects act as role models, and guides the project team in the right direction to enable project success. Leaders should create high-trust and high-inspiration environments, and guides the team with regards to values, objectives, and working standards (IPMA PEB, 2016).

Objectives and Strategy

Objectives and strategies for a particular project are developed and defined by the project leaders. The leaders should assure that objectives and strategies are aligned with the stakeholders' requirements. Throughout the course of the project, the objectives and strategies are regularly reviewed and adopted, if necessary (IPMA PEB, 2016).

Project Team, Partners, and Suppliers

In an excellent project, achievement of personal goals is equally important as achievement of organizational and project goals. In addition, both project team members, partners, and suppliers are highly valued. As a motivation, and to reach project success, achievements in excellent projects are communicated, recognized, and rewarded (IPMA PEB, 2016).

Processes and Resources

The Processes and Resources area refers to the practices that are required to reinforce excellence. Focus is on the efficient and effective management of the key processes, and the resources required to realize them. The area consists of two criteria which are briefly described below (IPMA PEB, 2016).

Project Management Processes and Resources

To achieve project objectives, teams in excellent projects identifies, in cooperation with stakeholders, the key management processes and their required resources. Tools, methods, and processes are selected, developed and optimized to reach the objectives in the most efficient and effective way (IPMA PEB, 2016).

Management of other Key Processes and Resources

Excellent project teams, together with stakeholders, identifies project deliveries and support processes required to reach project success. This could be factors such as product design, maintenance, logistics, and handover and acceptance (IPMA PEB, 2016).

Project Results

The first two areas presented are considered to be the enablers for project excellence, whilst this last area is the outcome from successful management and leadership. The area aims to demonstrate the proof of excellent results. The area is divided into four criteria which are briefly described below (IPMA PEB, 2016).

Customer Satisfaction

Customer satisfaction is high in excellent projects. This criterion reflects how well the project team corresponded to the customer needs and requirements (IPMA PEB, 2016).

Project Team Satisfaction

Project team members are highly satisfied in excellent projects. IPMA PEB (2016) states that “the perceived satisfaction is consistent with the fulfilment of the project objectives, engagement of the team members in the project and their identification with the team”.

Other Stakeholder Satisfaction

Stakeholder satisfaction is high in excellent projects, and important to note is that also stakeholders representing environmental aspects are highly satisfied (IPMA PEB, 2016).

Project Results and Impact on the Environment

Excellent projects are managed and supported by excellent leaders. The outcome will consequently be outstanding results and high performance levels. Just like in the previous criterion, the positive results on the environment are clear (IPMA PEB, 2016).

3.3.3 ISO 21500:2012

ISO 21500:2012 is a guideline for project management conducted by the International Organization for Standardization (Zandhuis & Stellingwerf, 2013). The guide can be applied and used for any type of project or organization, large or small, simple or complex. Further on, ISO 21500 is a guide that provides detailed processes and concepts of how to practice project management. The guide does not cover how to manage project portfolios or the management of programs (ISO, 2012). The definition of project management according to ISO 21500 is: "Project management is the application of methods, tools, techniques and competences to a project. Project management includes the integration of the various phases of the project life cycle. Project management is accomplished through processes." (Zandhuis & Stellingwerf, 2013)

According to the guide there are two different types of projects. The first one is investment projects which are projects that are executed to change the organization. The other project type is projects that are performed to generate income, and are executed by a performing organization (Gasik, 2013). A project is defined as: "A project is a unique set of processes consisting of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective. Achievement of the project objective requires deliverables conforming to specific requirements, including multiple constraints such as time, cost and resources." (Zandhuis & Stellingwerf, 2013)

Just as PMI, ISO 21500 presents process groups for the life cycle phases in a project that can be seen in Table 18. These are; Initiation, Planning, Implementing, Controlling, and Closing (Gasik, 2013). The process groups are based on, and developed from, the Deming circle. Deming's circle is also known as Plan-Do-Study-Act and is widely used for continuous improvements. Within the process groups, subject groups are described, which can also be seen in Table 18. There are five process groups that combined have 39 processes for how to manage projects. The ten subject groups are: integration, stakeholders, scope, resource, time, cost, risk, quality, procurement and communication (Zandhuis & Stellingwerf, 2013).

*Table 18. Process groups, subject groups and their belonging activities according to ISO 21500
(Processed by the authors from Zandhuis & Stellingwerf, 2013).*

Subject groups	Process groups				
	Initiating	Planning	Implementing	Controlling	Closing
Integration	Develop project charter	Develop project plans	Direct project work	Control project work Control changes	Close project phase or project Collect lessons learned
Stakeholder	Identify stakeholders		Manage stakeholders		
Scope		Define scope Create work breakdown structure Define activities		Control scope	
Resource	Establish project teams	Estimate resources Define project organization	Develop project team	Control resources Manage project team	
Time		Sequence activities Estimate activity durations Develop schedule		Control schedule	
Cost		Estimate costs Develop budget		Control costs	
Risk		Identify risks Assess risks	Treat risks	Control risks	
Quality		Plan quality	Perform quality assurance	Perform quality control	
Procurement		Plan procurements	Select suppliers	Administer procurements	
Communication		Plan communications	Distribute information	Manage communications	

In comparison with other ISO standards, for example ISO 9001, ISO 21500 does not have requirements. ISO 21500 only includes guidelines, is informative in its nature and therefore, a company cannot be certified with ISO 21500. For the near future of ISO 21500, it is likely that the guideline structure will switch towards a more standard and normative structure containing requirements for certification (Zandhuis & Stellingwerf, 2013)

4 Empirical Research

In this chapter, the information gathered through the empirical research is presented. All interviews conducted for this chapter have been executed as described in Chapter 2. Firstly, the current state at ESSIQ is presented. Secondly, information gathered from the benchmarking interviews is presented.

4.1 ESSIQ

ESSIQ are, as previously mentioned, a consultancy firm with a main focus and high competence within product development. Since it was founded in 2005, ESSIQ have driven a somewhat traditional consultancy business meaning their main business have been to have their consultants based at their customers. However, to mitigate risks and to meet the demands of a continuously changing market, ESSIQ have begun to bring in in-house projects. In-house projects are in this context projects that still originate from a customer request, but the whole project is managed and run in-house by ESSIQ.

ESSIQ have run three in-house projects within the past year. The projects have been managed by three different project managers, and the team members have changed during the course of the project depending on who is available. Frequent change of team members in in-house projects is normal, and is more rule than exception for consultancy firms. The three projects have been run differently, not only depending on the project manager, but also largely depending on the customer. If there has been a formal project management model present at the customer, ESSIQ have followed it. If not, it has until now been up to the project manager to decide how to run the project. Even though the project managers at ESSIQ have great experience and knowledge within project management, ESSIQ have identified a need for their own project management model. The main motive is that ESSIQ acknowledge the benefit of unifying how their organization is going to manage projects. It is perceived as beneficial for both project managers, project members, and customers.

During interviews conducted at ESSIQ, interview guide can be seen in Appendix A, the employees were asked to place ESSIQ on a level on the PMMM. All employees experienced ESSIQ to be on the first level in the PMMM. As previously mentioned, in Chapter 3, there are no standard processes in place on level 1, and both project managers and team members act in an ad hoc manner.

From the interviews held at ESSIQ, it was also noted that all interviewees found agile approaches interesting and wanted in the new model. All interviewees also agreed that the model should be simple to follow and easy to adjust to different customer's needs. Most interviewees also said that the model preferable should be easy to use and not feel overwhelming. Many large corporations use heavy documentation, which would not be suitable for a young and innovative company like ESSIQ. Further on, communication was discussed during the interviews where almost all interviewees found communication as one of the hardest and most critical activity during a project life cycle. Another issue, which was discussed during the interviews was, starting projects too early. Thereby, many interviewees found the initiation phase as one of the most critical ones.

4.2 Benchmarking

This section will describe the results obtained from phase three of this MT project, benchmarking. Information from six companies from different industries was gathered through the method described in Data Collection, and a total of seven interviews were conducted. The interviewees will be held anonymous. A list of the participating companies can be found in Table 19 below. The authors have also met independent, senior project managers with considerable experience in the field of project management. These interviewees are in other words not connected to a specific company. The chapter is divided between the different interviewees, and all information in the respective chapter is based in the information gather from the specific interviewee. The purpose of this phase is to gather best practices, from well-established and experienced companies, to use in the development of the framework. This will give the framework greater credibility.

Table 19. Companies participating in benchmarking interviews, presented in alphabetical order, as well as the title of the interviewee (Authors)

Participants	Title
Alfa Laval	Factory Manager & Strategic Purchasing Manager
Axis	Project Manager
Cybercom	Project Manager
Expert within Project Management	PMI Certified (PMP)
Haldex	Global Project Director
Höganäs	Head of Project Management Office
Sandvik	Project Manager

In Table 20 below, a summary of the benchmarking interviews are shown. The order of the interviewees is not related to the order of the companies in Table 19 above, and the interviewees are randomly numbered in Table 20. As can be seen in Table 20, the initiation phase is the most critical phase according to most interviewees. Further on, communication is stated by most of the interviewees as a critical activity. Lack of communication is also considered a main reason for project failure, together with lack of commitment, not enough time spent on the initiation phase, as well as frequent change of team members. The project charter seems to be the most critical document according to almost all interviewees. All interviewees said that lessons learned are conducted, but less than half of them are actively using these documents after the project has been closed.

Table 20. Summary of benchmarking interviews (Authors).

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6	Interviewee 7
Existing project management model?	No	Yes	Yes	Yes	Yes	Yes	No
Most critical phase?	Initiation phase	Initiation and Execution phase	Planning phase	Initiation phase	Initiation phase	Initiation phase	-
Most critical activity or factor?	Communication	-	Communication	Documentation Communication	Planning	Communication Top management commitment	Secure resources
Why do projects not succeed?	Not enough time spent on the initiation phase	-	Lack of commitment	Lack of communication	Not enough time spent on the initiation phase	Lack of commitment Lack of communication	Frequent change of team members
Important documents?	Project charter Communication plan	Project charter	Decision log	Project charter Check lists	Project charter	Project charter	Project plan
Lessons learned conducted?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lessons learned used?	Yes	Yes	No	No	No	Yes	No

4.2.1 Interviewee 1

The initiation phase is a critical part of every project, and needs to be carried out carefully with a lot of focus. It is truly important to pinpoint details correctly in an early stage of a project. In-house projects need extra focus during the initiation phase, and communication is especially critical to specify in the initiation phase for these projects. Another important fact to address in the initiation phase is to specify the scope of the project. What is to be done in the project, but also what is not included in the project. If the project is complex and not familiar to the organization, it can be beneficial to have a project manager included early in the process to specify budget and timeline more easily.

During the planning phase of a project, it is important to start with a rough estimation. The rough plan should be shared and discussed with customers, if existing, as early as possible. If the project is changing in its nature, it is usually not efficient to plan details far ahead since the project is likely to change. Future trends are that most projects are flexible and change with time. Therefore, rough planning is the most efficient method for planning. In addition, agile planning can be used where shorter iterations are planned in detail. It is important that the project team has an open mindset for changes when working in projects with this nature. If the project is known to be more stable, detailed planning can be done for a longer time ahead. In addition, to support the planning process, milestones combined with gates provide a good overview of the project. To pass a gate, approval is needed by the sponsor of the project. The gates are usually a good support for the project leader to receive feedback if to proceed with the project or not.

During the execution phase of a project, it is important to ensure a couple of control activities to support the work. A critical activity is communication, both internally and externally. Since communication is a critical part of the execution phase, it is important that the communication plan has been specified in the beginning of the project. The communication plan should be clear for both customers and project teams, and communication should occur as often as possible. If the project is performed by a consultancy firm, it can also be beneficial to have meetings between sales responsible and the project manager. Internal issues can be brought up at these meetings and it provides extra support to the project manager. For in-house projects, the internal team communication can for example occur on an online platform, although it is important that the customer does not have insight to that platform. In an internal project, the communication is as important as the specific development work.

To visualize the work for the project team, with for example daily stand-ups combined with a Kanban board, increases the commitment from team members. Methods like this also helps the project manager to engage members of the team since activities become more clear. It is also known to have positive effects on the team spirit.

Agile methods are fun to work with and will be used more frequently in the future. When a sprint is finished or when a project meeting is scheduled, it is important to document what is said. Documentation does not have to be complicated. The most important is that short minutes or logs are written down together with decisions, and why decisions were taken. Documentation is basically only needed to ensure what was decided if any conflicts arises.

The final phase of a project, often named closing phase, is important to have and go through in every project. It is common to skip this phase, which is not to recommend. The project team needs to understand that the project is closed, and the product or service developed in the project should be handed over to the new owner. A good guideline is that a project should not be longer than a year. Further on, in the closing phase, lessons learned should be conducted. They can include questions such as; what went well, what did not go as thought, and possible improvement areas should also be discussed. These questions should be answered and written down so other members of the organization can learn from the project as well.

4.2.2 Interviewee 2

An order for a project is usually created when a need is identified. The order is further on provided to a project manager who creates a pre-study for the project. The pre-study is then reviewed by a manager who can accept or decline the pre-study. The pre-study should include how the project is to be carried out, which resources that should be included, and a budget. If the pre-study is not detailed enough, the deciding manager can ask the project manager to re-do it. When the pre-study is accepted, the project starts and gets a project number provided together with a financial account.

The project team plans projects based on the requirement given by the control group. If large changes are needed for the timeline of the project, the project team needs to get the changes approved by the control group before they are applied.

During the execution phase of a project, it is often encouraged to use pulse meetings with the project team. Depending on project, they should occur at least once a week, and up to daily meetings. If the project has all team members at the same site, it is further encouraged to use a board where activities are visualized. From meetings, notes should be written, in combination with decision logs. The decision logs are the most important documents to keep track on from meetings. Every project should have its own intranet where documents and support documents are available. Examples of available documents are decision logs, risk analysis documents, quality documents and reports. Both the control group and project team have access to the intranet and the project.

An ending report is mandatory before closing a project, and is to be done by the project manager. In the report it is also mandatory to conduct a lessons learned with both good and bad events learned from the project. Having lessons learned is a key factor to be a learning organization and be able to improve in the future.

4.2.3 Interviewee 3

When an order for a project, based on a market analysis, is received by a project manager, the order is controlled by the project manager to ensure that all required details are included. The project manager should, based on the order, analyze if the project is doable and if there are enough resources available for the project. An order should have specific requirements, but there should be room for creativity in how the requirements are to be fulfilled. The order should also include a budget and a timeline for the project.

The planning phase is a difficult part of a project cycle. The project team both need to conceptually construct a solution, based on the requirements given in the project order, as well as they need to estimate activities, budget and resources based on the project order. These activities are supposed to lead to a concrete plan and timeplan, even though it is based on loose thoughts.

During the execution phase, it is up to every project manager to decide how the team should work. The word strict should not be used since it tends to kill creativity. Although, it is efficient to have control activities to support the project team. For example, during the execution phase, a settled communication plan should be decided between the team and every stakeholder for the project. Additionally, management meetings occur every month or when a gate is to be passed, to control the project and decide if it should proceed. Daily stand-ups are also used if possible. Every project has its own internet site with information regarding the project. Here, a decision log can be found as well as meeting notes. As mentioned, it is up to every project manager to decide exactly how things should proceed, but certain activities as communication plans are mandatory to include in the project.

Agile methods are the correct way to execute projects today. It increases commitment from team members and is suitable for complex products with changing customer requirements from today's business atmosphere.

The most important activity in the final phase of the project is to close down all financial accounts belonging to the project. Lessons learned should also be written in this phase and include the following; good, bad, what to bring with us to future projects, and something positive. Lessons learned are very important and every new project should start with reviewing old lessons learned from previous projects. The hardest part with lessons learned is that it is usually not motivating to look into history. Therefore, it is important to ensure that lessons learned are not forgotten in the beginning of a project. A kick out should also be held with the team in the closing phase, combined with a happening to celebrate the project closure.

4.2.4 Interviewee 4

A project is formally initiated when the project sponsor issues a project charter. The project manager has a start-up meeting together with the main project manager to discuss areas such as resource requirements and project budget. To have great knowledge of the project budget is crucial in this phase. In addition, the initiation phase includes that all process owners develop a checklist of activities required for the project. The purpose of the checklist is that it will act as a reference when controlling how the project proceeds.

The planning of the project is divided into gates and milestones. Often, this work is highly complex, especially if one is to design and produce a completely new product. Before passing gate one, which is at the beginning of the planning phase, one should have a rough project plan, as well as an estimation of cost and time needed. The planning phase is then initiated by gathering involved employees across the relevant departments. The participants discuss what is to be done during the respective phases in the project. Each process owner is responsible for estimating the required time for their specific process, enabling the estimation to be as accurate as possible. The compound of all the estimations make up the first draft of the time schedule. Detailed planning is then performed iteratively to ensure that the project meets requirements and the right activities are prioritized. After passing the third gate, which is at the end of the design phase, no more changes are allowed without consulting all involved parties. This is due to the reason that the later changes are made, the higher the cost implication will be. The planning phase also includes budgeting of the project. Before passing gate two, which is at the end of the planning phase, one should be able to present an exact number of how much the project will cost, and the time required. The final results of time and costs are later compared to these numbers to see how well one met the plan.

During the execution phase, which often represent the majority of the time in a project, it is important to control that the project runs according to the plan. A control mechanism for this is meetings. The meetings are held weekly with the core team and main project managers from all involved functions. The purpose of the meetings is to ensure that the project runs smoothly and according to plan. Weekly meetings are also held internally with the core team, such as the production team, to control activities and ensure that everybody is on board. The control group, which all projects have, meets once every month to get updates about the project.

Communication during the project is important, and communication within the core team is close and continuous. The project manager is responsible for the communication with the project sponsor. The process of communication depends on the nature of the project, as well as on the stakeholders.

Documentation during the project is important. In general, not enough time is spent on documentation. However, during the meetings presented above, minutes are taken. During the core team meetings, there is also a common logbook. In the logbook, the team should note what decisions and changes are made, and why. The project manager keeps a personal project journal, which is considered crucial to enable control and keep up with

updates if managing several projects in parallel. The journal can also act as a base for the project manager when reviewing the project upon completion. An important question to ask before beginning documentation, is how and for whom the documentation adds value.

In the closing phase of a project, lessons learned are performed. The purpose of conducting lessons learned is to gather information about what worked well, and where improvement is required. The receiver of the lessons learned is the process owner, and it is up to them to update the lessons learned document. There is hence a process for how to conduct lessons learned. However, it is rare that one makes use of previous lessons learned when starting a new project. One reason for this is that many projects look alike, and the project manager and team have so much experience that reviewing lessons learned is considered as a waste of time. Another reason why lessons learned are rarely used is the difficulty of communicating them to the organization. There is no process in place for how to do this efficiently. Before ending a project, a final report has to be conducted by the project manager. To formally close a project, the final report needs a signature from the project sponsor.

4.2.5 Interviewee 5

Many projects are initiated after a market survey has been conducted, and a need has been identified. The market survey leads to a project order, which is created in the form of a project charter. The project charter should describe the market, the requirements of the product or service, an overall time schedule, and costs. In addition, one should establish a preliminary payback time and market potential, as well as an examination of possible risks. The project charter acts as a base for assessment of the project potential. If accepted, the project charter is sent to the assigned project manager who then assigns the project team. It is crucial that all members understand the project and what is expected of them. From the project charter, a more detailed technical specification and a project plan are developed and sent to the project owner for confirmation. This is an iterative process and once accepted by the project owner, the project plan includes detailed information regarding the product, the market, values, costs and involved functions. For the project success, it is essential that the project owner carefully reads the project plan before accepting it.

The planning of a project is a highly complex task, and much time is spent on this phase. To facilitate planning for future projects, the company is currently working on a WBS. The aim is to continuously log and update all activities together with their planned required time, and their actual required time. The long term goal is to create a database with all these activities and their respective time, to enable a much quicker and more accurate planning process for future projects.

Communication is a crucial part of all projects. During the planning phase, one should aim to have around one hour long weekly meetings with the project team. This phase is as mentioned highly complex and critical for project success, and therefore continuous communication is essential. During the execution phase, weekly 30 minute standing pulse meetings are held with all lead engineers. There is no formal process for documentation, but having one is considered to be beneficial. The challenge is to decide what one should

document, and what level of decisions. In addition to team meetings, the project manager has continuous contact with the project orderer to ensure that the project is heading in the right direction.

In the closing phase of a project, there is a process for conducting lessons learned. However, these are not used and there is no process for how to use them. The quality of the lessons learned is highly dependent on the author. One of the main reasons why lessons learned are not used is that once a project is initiated, everyone is so focused on getting started and not interested in looking backwards. An interesting version of lessons learned could be to focus on risks, and to compare the risks identified as potential risks, to those that actually occurred.

4.2.6 Interviewee 6

Before initiating a project, the project manager needs a project approval from senior management. Senior management makes their decision on the business case, which includes information on why the project should be approved, and what the potential value for the company is. Once accepted, one should conduct a pre-study which results in the creation of a project directive. The project directive and what should be included is described in Table 21. A purpose of the project directive is that it acts as a security measure for the project manager when issues arises. After the development of the project directive, it is suggested to have a start-up meeting with the project team. During the meeting, the project manager should present the project directive and discuss the members' roles, responsibilities, and expectations.

Table 21. Aspects to include in the project directive

Aspects in project directive	Explanation
Scope	<ul style="list-style-type: none"> - What is included in, and expected of, the project? - What is not included?
Overall time schedule	<ul style="list-style-type: none"> - When should the different phases be executed? - What milestones do we have?
Project Manager	<ul style="list-style-type: none"> - Dedicate a project manager
Communication plan	<ul style="list-style-type: none"> - How are we going to communicate (within the team, to stakeholders, to the organization)? - How often? - Who are receivers and who are givers?
Resources	<ul style="list-style-type: none"> - What resources are needed for this project?
Budget	<ul style="list-style-type: none"> - Overall project budget

The planning phase is initiated by a start-up meeting together with the customer. The purpose of the meeting is to get a deeper understanding of the project and what is to be done. Thereafter, one goes back to the project directive which acts as a base for planning. Normally, the project plan is created in the form of a Gantt-chart. Milestones are usually included at the end of each phase, and represents important decisions that are to be made. A rough estimation of the budget is conducted before the project is initiated, but the more precise and detailed budgeting work is included in the planning phase.

Upon completion of a project, it is of great importance to validate it. One should discuss the project's success, what went especially well, and the most important improvement areas. This procedure is generally performed during a kick-out meeting with the project team. Thereafter, it is a responsibility of the project manager to summarize the findings in a final report which is presented for the control group. If there are activities remaining in the project, they should be included in the final report in the form of a backlog. It is emphasized that even though there are things remaining, one should close the original project and instead start a new one to complete the remains. Otherwise, projects tend to last forever.

4.2.7 Interviewee 7

The project initiation process normally consists of a bidding process, where one should try to answer the following questions before offering a bid:

- What resources do we have?
- What are the economic conditions?
- What is asked for?

If the bid is accepted, a project plan should be made. The project plan have to take into consideration the client's requirements and wishes. In this phase, one should ask such questions that will help to better understand what the client is asking for, such as scope and more detailed explanations of the project. In addition, a communication plan should be conducted.

The process of project planning is highly dependent on what type of project it is. However, the majority of projects have an overall plan with a start date, an end date, and releases in between. Due to the nature of the projects at this company, detailed planning is usually performed in sprints. A sprint is generally two weeks, and hence the project team plans the activities for the two weeks to come. The client is invited to the sprint planning, which sometimes can result in re-prioritizations of activities.

During the execution phase, it is important to maintain control of the project. This is done by having daily standup meetings with the project team, where the team discusses what has been done, and what is to be done. The meeting should not exceed ten minutes. If issues arises, they should not be addressed during the meeting. Instead, one schedules a suitable time for when to solve them. Another control measure is to keep close communication with the client, and weekly meetings together with clients are held to control that the project is running according to plan and that critical activities are prioritized. There are also monthly

meetings together with the client, and the client is welcome to attend as many internal meetings as wished for as well. However, the engagement and interest is usually rather low due to limited resources.

Documentation is an important part in a project, but it is perceived that not enough time is spent on it. During the weekly meetings, notes are taken in the form of an Action Points list where all members are assigned tasks. In addition, problems that need to be solved are identified. The list is updated every week, and everyone involved in the project have access to the list. Other aspects that are documented are product or service requirements, and results from testing. All documentation is done by the use of a software program. As stated, it is perceived that not enough time is spent on documentation, and it is believed that it would be beneficial to include more documentation when running projects. This would be specifically valuable for the project handover.

During the closing phase of the project, a lessons learned session is conducted. However, the results obtained are rarely used as a tool for future projects.

5 Conclusions

The model developed in the MT project is presented in this chapter. Firstly, the development process of the model is presented, followed by an overview of the model. This is followed by a more detailed description of each phase of the model and findings made in the MT project. Further on, the implementation and use of the model is discussed. Finally, the chapter ends with discussing further development of the model.

5.1 The Development of the Model

The purpose of the MT project was to develop a project management model that can be used to manage small projects in flexible environments. The model has been developed to be suitable for in-house projects at ESSIQ. However, it is argued that the model can be applicable and useful for other companies operating in similar environments. The model is heavily based on the findings from the theoretical framework in Chapter 3, as well as on the empirical research in Chapter 4. From the empirical research, it is mainly the information gathered through benchmarking that has contributed to the development of the model. The reason is that, in comparison to the benchmarking companies which are all older and larger corporations, ESSIQ has relatively low experience in running their own projects. There are currently no common or standard procedures at ESSIQ for how to manage in-house projects, hence the need for a project management model.

The model that has been developed is similar to other project management models, and generic in its nature. This was done on purpose since the authors did not want to create a model that at first glimpse could appear complex or difficult to understand. As previously mentioned, ESSIQ finds themselves at the first level in the PMMM. The authors considered this, in consent with ESSIQ, as an indication that a generic model would be most suitable at this stage. However, to account for the nature of ESSIQ as a company, and how they have expressed their preferences of working, the model includes agile elements. Agility has been found, in both theory and during benchmarking, to increase flexibility in projects and enables a team to more easily respond to changes.

5.2 Project Management Model

The model is generic in its nature and consists of the five following phases: (1) Project Selection; (2) Initiation; (3) Planning; (4) Execution; and (5) Closing. The phases will be thoroughly described in the next section. The model also consists of five gates, represented by G0-G4 in the model shown in Figure 19. Each gate and its purpose is briefly described below.

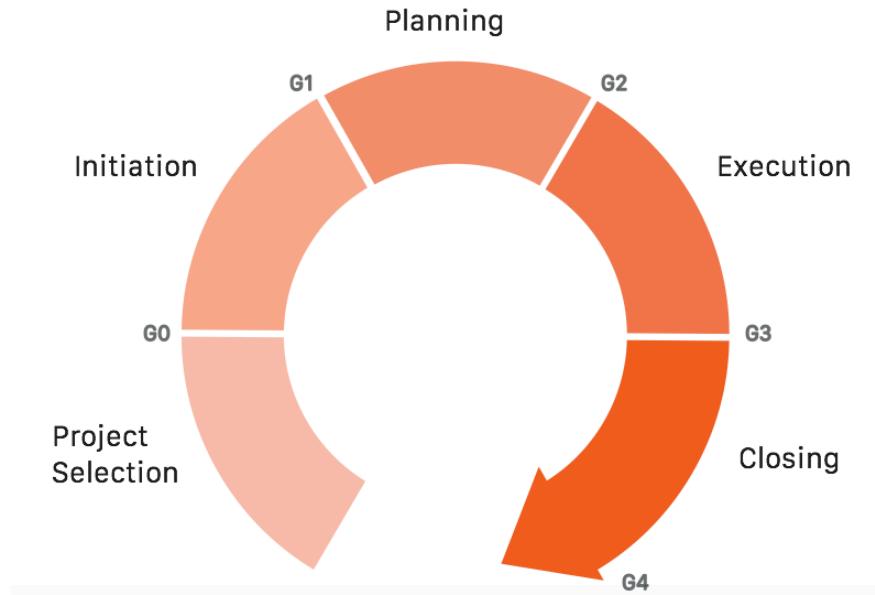


Figure 19. Project Management Model (Author's)

G0 - To pass the first gate, placed between the Project Selection and Initiation phase, the organization have to decide whether they will select the project or not. In addition, the gate is a security for the customer so that they can evaluate whether the organization is the appropriate choice. After passing the first gate, the project offer is signed and the project is officially initiated.

G1 - The second gate, between Initiation and Planning, can be passed when the project specification is approved by the customer. The approval process is iterative and when both parties agrees on the project specification, one can proceed to the next phase.

G2 - To pass the third gate, located after the Planning phase, the overall project plan has to be approved by the customer.

G3 - The fourth gate involves the handover of the agreed-upon deliverables.

G4 - After passing the fifth and final gate, the project is officially closed. Before this, lessons learned have been conducted with the project team, a closing meeting has been held together with the customer, and both parties consider the project completed.

The full model will be described thoroughly in the next section. In Table 22 below, a summary of the model is shown. Each phase has in-data that is required to begin the phase, as well as out-data required to leave the phase. The summary also shows some of the processes included in each phase, as well as the gate requirements.

Table 22. Summary of the model (Authors)

	In-data	Phase Process(es)	Out-data	Gate Requirement
Project Selection	Customer request	- Evaluate project based on a set of questions	Signed project offer	Signed project offer passes the project through G0
Initiation	Signed project offer	- Development of project specification	Project specification	Signed project specification passes the project through G1
Planning	Project specification	- Develop overall project plan - Acquire resources	Overall project plan	Signed project plan passes the project through G2
Execution	Overall project plan	- Detailed project planning - Perform activities	Finished product or service	Product or service handover passes the project through G3
Closing	Finished product or service (Experience from the project)	- Closing meeting with customer - Closing meeting with team where lessons learned are conducted	Lessons learned	Lessons learned conducted passes the project through G4

5.2.1 Project Selection Phase

For consultancy firms, projects often arise based on a request or collaboration with a customer. If the project is a request, the phase of project selection is critical. To enable successful projects, it is of great importance to choose the right projects. The importance of project selection has also been stressed in the empirical research of this MT project. To choose the right projects, managers should evaluate possible project's potential value based on a predefined set of criterias. The first criteria that should be met when selecting a project is that the project is aligned with the company strategy. If the project is aligned with the organizational strategy, the following criterias and questions need to be researched:

- Can the project be completed?
- Should the project be strived for?
- Can the project be acquired?

All three questions above need the answer yes to continue. If so, a more detailed research or survey of the possible project can be carried out. For a complex project, or if a similar project have not been done before, it can be helpful to integrate the intended project manager in the project selection work. During the project selection phase, many estimations need to be done and therefore, using both experience from a sales manager and a project manager can help the estimations to become more reliable. It is further on important for the estimations to become close to reality since they are the basis of a bid for the project. In this stage, the following questions can be helpful to decide whether to bid on a project or not:

- Do we have time for the project?
- Do we have the right resources available for the project?
- Do we have the right competence to complete and succeed with the project?
- Is the project profitable?
- Does the project give us value in terms of knowledge?
- Does the project give us value in terms of a new valuable relationship?

During the phase of project selection, it is also beneficial to perform a risk analysis over the upcoming project. A risk analysis can be beneficial and secure higher chances for project success since critical areas within the project are highlighted. During a risk analysis in this stage of a project, customer satisfaction is a key factor to investigate. Do we believe that the customer will be satisfied with the upcoming project? Will the product or service be useful for the customer? The last question, if the product or service will be useful, can be extended into a market analysis and be neglected if the question is out of interest. The question if there are any large internal risks associated with the project should also be researched in this stage of a project. Further on, a more covering risk analysis will be executed in the next phase of the project.

To exit the project selection phase, G0 needs to be passed. G0 requires, as previously mentioned, that the project is selected and that the project offer is signed by both parties. With G0 passed, the project continues into the initiation phase.

5.2.2 Initiation Phase

The initiation phase is the most critical phase during a project life cycle. Therefore, it is important that the initiation of a project gets the attention it needs. During this phase, a project specification is to be developed. If a project is well specified from the beginning, the likelihood of project success increases. Further on, a project specification should contain the following elements:

- Scope
 - Define deliverables
 - Define what is not included in the scope

The scope of a project defines the deliverables for the project. It is also important to define what is not included in the scope. The reason to be clear about what is expected from the project is to avoid misunderstandings about the final outcome.
- Project Purpose

The purpose of the project should be defined in the project specification. It is a brief description of the project, dedicated for top management and for those who are not familiar to the project. The goals for the project should be included as well as the connection to the organization's objectives.
- Resources

All resources required for the project need to be specified. It is important for the team and individuals to be dedicated, and engagement from the team and managers is a key factor to reach a successful and excellent project.
- Time Schedule

A time schedule should be stated in the project charter, and milestones should be defined here. It is beneficial both for the customer and the project team to develop a rough time schedule and its accompanying milestones early in the project. This enables the parties to be aware of approximately when, and what is expected to be delivered to the customer.
- Cost Estimation

The cost estimation of the project should be set in the project specification. It is important to specify the costs in the project specification to keep it clear for both the customer and the project owner. How to estimate costs can vary from project to project.
- Risk Management

Risk management should also be included in the project specification. To consider possible risks before beginning a project enhances the possibilities of project success. It is suggested to use the PMI framework presented in Chapter 3. When possible risks have been identified, the organization should place them in the risk matrix which will enable them to direct their focus towards the most critical risks. The time spent on risk management is highly dependent on the project and its complexity.

However, it is suggested to always include some kind of risk management regardless of project.

- **Communication Plan**

A clear communication plan is necessary to successfully carry out a project. As mentioned in Chapter 4, lack of communication is a common reason for project failure. Communication is also very difficult to manage and therefore, it is helpful to state, as clear and early in the project as possible, how communication should be managed. In a clear communication plan, the following six questions need to be answered:

- Why do we communicate?
- How do we communicate?
- Who will communicate?
- What will be communicated?
- Where will we communicate?
- When will we communicate?

- **Project Handover and Closure**

Project handover and closure should be stated in the project specification. The reason that it is important to specify early in the project is to avoid any misunderstandings, which might occur if it has not been specified how the project will be handed over and closed. Specifying project handover and closure can be very simple. It can for example be that the two parties agree that the project should be handed over during a closing meeting and then be closed. It is also important that the customer understands when the project is closed and that the project team will no longer be working with the project.

- **Quality Assurance**

It can be beneficial to have someone responsible for assuring the quality of the project. It also ensures the customer that the project is overlooked in terms of quality. As an organization develops to a higher level on the PMMM, this role can be further developed. But as a starting point, the person responsible for quality assurance is suggested to control that the gates are passed correctly, and that the lessons learned are conducted and stored in the end of the project. The person responsible for quality is also suggested to ensure that lessons learned are overlooked in the planning phase of a new project.

- **Effort required by the customer**

It is very important to specify the effort that will be required from the customer. To succeed with a project, the customer needs to be involved and give their opinion and thoughts about the progress of the project. The level of commitment from the customer should be discussed and they need to know what is required by them in terms of communication, testing, equipment, and availability.

If a project is similar to a project the project team has done before, or is simple in its nature, all elements listed above might not be necessary. It is usually up to the project manager to decide which activities should be covered in the project specification. Although, elements that always should be specified to increase the possibility of a successful project are: scope, budget, time schedule, resources, communication plan and effort required by the customer.

To exit the initiation phase of a project and enter the planning phase, G1 needs to be passed. As previously mentioned, passing the gate happens when both the customer and the project owner agree on, and sign, the project specification.

5.2.3 Planning Phase

When the project specification developed in the previous phase is approved and complete, the project enters the planning phase. The planning phase is an important and critical part of a project. In consent with Baird and Riggins (2012), it is suggested that the method for planning is a combination of traditional and agile project planning. Consequently, to ensure flexibility in the project, planning should be done in the two levels presented below.

- An overall project plan with milestones for the whole project
- A detailed project plan in sprints of two weeks

During the planning phase, focus should be on developing the overall project plan. This should be based on the information found in the project specification as well as information through contact with the customer. The overall project plan should include the start and end date of the project, milestones, and key activities and when they are to be performed. The milestones enable a results-oriented approach and ensures continuous feedback from the customers. As previously mentioned, the overall project plan should be approved by the customer to pass G2.

It is suggested to have a start-up meeting together with the whole project team in the beginning of the planning phase. During the start-up meeting, the project manager should present the project specification in detail, preferable in presentation form. When the project team is well aware of the project objectives and goals, one increases the chance of success. In addition, this enables the project members to contribute to both the overall and detailed project planning. Moreover, the start-up meeting includes the process of searching for, and taking advantage of, lessons learned conducted in similar projects.

The resources required for the project are specified in the project specification developed in the previous phase. During the planning phase, the resources that will build the project team should be acquired. As has been emphasized in both the theoretical framework, and in the empirical data, it is strongly suggested that the resources are fully dedicated to the project. This means that the same people should work in the team from project start until project closing. Ideally, no member will leave and new members will not be added during the course of the project. By having one consistent team setup, the team will evolve together and continuously become more efficient.

Detailed planning should be done in sprints of two weeks. This enables the team to be more flexible and one can more easily respond to changes if they occur. In addition, it enhances the focus on continuous delivery. With regards to these factors it is suggested, in accordance with PMBOK® Agile Guide (2017), to include parts of the Kanban method. A Kanban board should be used to plan weekly activities, and an illustration of how it can be designed can be found in Figure 18. Columns that can be used are for example; backlog, to do, WIP, development, testing, and finished. By visualizing and prioritizing the tasks, one enables the team to focus on what is most important during a specific week or sprint. In addition, the action of moving a task from work in progress to completed, gives people a great sense of satisfaction. If the project team has a dedicated space for project work, one can make the Kanban board physical by drawing it on for example a white board. However, it could be more efficient to have the Kanban board online, integrated in a software tool, so that team members can follow the progress even though they are not physically present. Whichever method one chooses, it is recommended to use either a physical or an online board. This is to hedge for the risk of having discrepancies between the two boards.

The two planning levels are also similar to the two agile planning parts suggested by Alyahya et al. (2016). The release planning could be represented by the milestones in the overall project plan, and the iteration planning by the detailed sprint planning.

5.2.4 Execution Phase

The execution phase is initiated as soon as the overall project plan has been approved by the customer. The sprint planning, described in the previous section, is initiated and then performed during the whole execution phase. To further enhance the flexibility of the projects, one should adapt the life cycle to the project.

For projects within software and UX design, it is suggested to adopt an iteration-based agile life cycle. This life cycle approach is suitable for these kinds of projects since they are relatively easy to break down into smaller features, of which all can be about the same size. The team will work in iterations of which all are given the same duration. Together, the team prioritizes the features, and work on what is most important. The team collaborates to finish the features.

For projects within mechanics, one should rather adopt a flow-based agile life cycle. Tasks in mechanics projects are perceived to vary more in their size and complexity. In addition, a mechanics project team is more likely to be dependent on external parties such as material suppliers. Hence, the task duration in this project life cycle will vary. The team should aim to have small sizes of work in progress since it can enable early identification of issues which in turn reduces the amount of rework. From the backlog, the team pulls features based on their capacity to work.

Regardless of the life cycle approach, there are activities that should be done during the execution phase. In consent with Johannessen and Ossen (2011), the importance of continuous communication is emphasized, and it should be given the same attention as time, cost, and quality. The importance of communication was further emphasized by all benchmarking companies. To communicate within the project team, it is suggested to begin each day with a daily standup meeting in front of the Kanban board. The meeting should not exceed ten minutes, and one should focus on the questions shown in Table 23. Important to note is that the meeting is not meant for solving problems, only to notify them and put them on the Kanban board. However, during the meeting, the team should schedule a new meeting to discuss the issues more in depth. The project team should keep a common log book where they can note decisions and changes that have been made, and why. The log book is preferably online-based. To continuously improve as a team, it is suggested to include a retrospective meeting in between sprints. The retrospective will enable the team to emphasize what has worked especially well, but also what has not worked as planned.

Table 23. Questions to ask during daily standups (Authors)

Iteration-based Agile	Flow-based Agile
<ul style="list-style-type: none"> - What did I complete since the last standup? - What am I planning to complete between this and the next standup? - What are my impediments, risks, or problems? 	<ul style="list-style-type: none"> - What do we need to advance this piece of work? - Is anyone working on something that is not on the board? - What do we need to finish as a team? - Are there any bottlenecks or blockages to the flow?

To maintain continuous communication with the customer is essential for project success. How communication is to be done is dependent on what the organization and the customer agreed upon during the initiation phase, when developing the communications plan. Regardless of how and when the parties communicate, the project manager, or assigned member from the project team, should take meeting minutes. It is suggested as especially critical to take minutes of decisions and why the decisions were made. Depending on the customer relationship, and the degree of transparency one has agreed upon, the distribution of the minutes vary. If the parties have decided to have full transparency, the customer could be invited to the software tool used by the organization. There, a minutes log book can be created in which both parties can make changes and add minutes. On the contrary, if full transparency is not out of interest, it is suggested that the minutes are sent by email. Important to note is that the minutes should be written in the email and not attached in a document, since this increases the traceability.

When the execution phase is getting close to an end, and the agreed-upon deliverables are completed, it is time for project handover and customer closing meeting. The process of how to hand over the project have been decided in the initiation phase. Once the handover is done, the project can pass the fourth gate, G3. In addition, during the closing meeting, the customer's experience of the project should be discussed. After the closing meeting, all accounts related to the project should be closed.

5.2.5 Closing Phase

When the product or service is delivered to the customer and G3 is passed, the closing phase begins. During the closing phase, a team meeting should be held to close the project. During this closing meeting, a lessons learned should be conducted. A lessons learned is a way to keep the organizational learning and ensure to bring new experiences into the whole organization. Lessons learned should be used in upcoming project's planning phase to start new projects with old experiences and they should include the following elements:

- Shortly the scope and purpose of the project
- What was good
- What was bad - things which prevented the project team to accomplish goals
- Improvement opportunities

It is also important to create keywords for the document so they are easy to find when new, similar projects are initiated. When the lessons learned has been conducted, the project should be declared as officially closed and the team members are available for new projects. Moreover, if issues regarding processes in the PM model is found when conducting lessons learned, they should be presented to the whole organization so direct improvements can be made. When the lessons learned is created, G4 can be passed.

To become and strive towards a more learning organization, it is a good idea to have get togethers with project managers and discuss closed projects. During these discussions, lessons learned can be a great underlying support.

Having lessons learned is one way to assure quality in a project organization. It is suggested that the person responsible for quality assurance in a project, also is responsible for ensuring that the lessons learned is conducted. It is common that lessons learned are skipped or not used in future projects. Therefore, having someone responsible for ensuring that the lessons learned is conducted and stored in the right way, is very beneficial for the long term learning in an organization. In consent with Collier et al., (1996), it is suggested that the person responsible for conducting lessons learned, is preferably someone who has not participated in the project.

5.3 Implementation and Use of the Model

The model that has been developed in this MT project will be used to manage in-house projects at ESSIQ. The overall structure of the model is generic, and similar to those suggested by for example PMI. This was, as previously mentioned, done intentionally so that the fundamental phases of the model will be easily recognized. However, the model does include quite a few agile elements, which distinguishes and makes the model different from traditional project management models.

To successfully implement the model, it is essential that top management communicates to the organization why this new way of working is important, the purpose of implementing the model, and what the benefits are for the employees. The implementation of the model will require organizational change, and as has been emphasized in the theoretical framework, top management support is the number one CSF for change. It is considered especially important to encourage the project managers at ESSIQ to use and implement the model in their daily work. They can in turn inspire team members and help them adapt to the new way of working in projects. Encouragement of adopting the agile mindset of collaboration, trust, and continuous improvement is also important when using agile approaches in project work.

It is suggested that top management introduces the model to the organization through a presentation. In addition, the model and its accompanying documents should be made available to all employees. This could be done by having it on the online platform used by ESSIQ.

The model that has been developed may seem excessive for some very small or low-complexity projects. However, this has been done purposely. The model should be viewed as a guideline on how one can work in projects, and project managers should pick the bits and pieces they consider relevant and important for their specific project. One might think that this would result in project managers continuing to manage projects in their traditional and old way of working. However, the authors argue and strongly believe that by having a larger model by default, project managers will consider a higher number of factors that can have an impact on the success of the project.

When taking on in-house projects, there are more aspects that have to be considered and managed apart from the actual project. One important aspect is that of prioritizing in-house projects to external projects. There is a lack in theory regarding this, but is an issue that has been emphasized during the interviews at ESSIQ. Consequently, ESSIQ has to make sure to establish guidelines with regards to this, and should have at least one person assigned for this task.

5.4 Further Project Management Development at ESSIQ

As previously mentioned in Chapter 4, ESSIQ employees were asked during interviews to mark where on the PMMM they perceived ESSIQ are in their current situation with regards to managing in-house projects. All employees experienced ESSIQ to be on the first level in the PMMM. Even though in-projects have been successful within the company, they have been run in an ad hoc manner. However, this MT project is a sign that ESSIQ are keen to move towards organizational processes and standards, which also places them between level one and two in the PMMM. The reason to have a common project management model in an organization is to develop together and strive towards the same goals.

After the MT project is closed and the developed model is handed over to ESSIQ, the company will be between level two and three on the PMMM. In the second level, there are defined and documented project management processes in place. This will be fulfilled with the model developed for ESSIQ in this MT project. However, in level two there is no requirement that these are used or followed. Status report processes are ad hoc and not consistent across projects. In the beginning of the implementation of the model, it might not be followed strictly which keeps them in level two. Moreover, on the third level, there are defined and documented standards and processes just like in level two, but in this level it is required that these are used. However, it is understood that one size does not fit all, and adjustments and adaptations are allowed. When ESSIQ has implemented the new model and are comfortable running projects with it, the model should be followed more closely, and all documentation should be the same for all projects, in accordance with level three.

To further develop project management at ESSIQ, they should strive to climb the PMMM and always reach for a higher level. To have a model which can be adjusted for all in-house project and structured working methods around it is a great start. Combined with the large amount of experienced professionals ESSIQ has as employees, they company will be able to strive towards a high level on the PMMM, as long as they are committed.

Further on, the next step in ESSIQ's project management development, they should strive to be fully on the third level at the PMMM. The third level, as previously mentioned, requires that standard processes and documentation is always used when managing projects. ESSIQ is a flexible company in its nature and therefore they will most likely easily adapt the understanding of one size does not fit all, and adjustments and adaptations are allowed, as mentioned for level three.

6 Discussion

The discussion chapter includes a reflection of the chosen methodology, suggests future research within the field, and the benefits of this MT project in terms of contributions to the industry and academia.

6.1 Reflections on the Methodology

The research strategies chosen in this MT project have been proven to be successful. The exploratory strategy applied in the beginning of the project gave the authors a thorough understanding of the subject of project management. The strong theoretical foundation the exploratory strategy generated, enabled the authors to create relevant and well-designed interview questions for the empirical phase of the project. The descriptive strategy, which was applied in the empirical phase of the MT project, was considered to be a successful choice. The strategy guided the authors in their way of working during this phase, and directed their focus towards what was currently most important. The third and final strategy, the problem solving strategy, enabled the authors to conduct the analysis required to solve the problems identified in the empirical study. The project plan and procedure has been closely followed which have permitted the authors to give all parts of the MT project the attention they required.

Before conducting the interviews, the questionnaire was reviewed by the supervisor at LTH. Given the profound knowledge and long experience the supervisor has within project management, the review was considered to increase the credibility of the MT project. The interviews conducted at ESSIQ were semi-structured, and the benchmarking interviews were open in their nature. All interviews were recorded and notes were taken afterwards. The chosen interview structures proved to be successful as the authors got their desired and required information. The method of recording the interviews was also fortunate as it minimized the chance of missing some important information. The authors went back to the recordings several times to ensure that the information was interpreted correctly. In addition, the feedback sessions conducted at ESSIQ enabled the authors to further validate their interpretations of the information gathered during the first round of interviews. However, no feedback sessions were conducted with the benchmarking companies. Consequently, there is a risk of the author's having misinterpreted some information gathered during the benchmarking interviews.

Further on, the authors have worked in the MT project by following the developed model which proved to be very successful. However, not all aspects, such as Project Selection, covered in the model could be applied in this MT project. In the beginning of the project, the authors and ESSIQ together developed what could be compared to a small project specification. It was specified what was to be included in the model, what was required of ESSIQ during the MT project, what was to be delivered, how the handover would go about, and a time schedule. Early on, an overall project plan was developed, represented by the procedure found in Figure 1. The detailed planning was then performed iteratively during the whole project, in sprints of one to two weeks. The project handover followed what had been

specified in the beginning of the project, and the authors have reflected on what they learned and how they can improve future projects. The successful application of the model in this MT project is argued to further validate the model.

The choice of conducting case studies as research method proved successful and suitable for the qualitative nature of this MT project. Reflecting back on the MT project, the action research method has not been fully completed. The authors consider the first two steps completed, and the third step as initiated. The problem has been identified and a solution has been proposed. ESSIQ have also given their feedback on the model, which the authors consider as a step within the third phase of action research. To fully complete the method, the model should be tested in the next in-house project at ESSIQ, and fully implemented in the whole organization.

6.2 Future Research

As the market becomes more competitive, flexibility becomes a key factor within companies to succeed. Therefore, adopting agility in organizations will most likely become even more important in the future. As the literature was collected for this MT project, it was noted that there is a lack of research regarding agility in projects that are not software projects. There is extensive research of how to apply agile working methods in software projects, but considerably less of how to apply agility in projects within for example mechanics. During this MT project, the research of combining agility with hardware projects has been initiated. However, future research within the subject of is considered needed.

The purpose of this MT project was to develop a project management model for ESSIQ, a consultancy firm. Even though this MT project had an extensive benchmarking section, the majority of the companies were larger, traditional corporations. The way of working in projects, especially during the project selection phase, differs quite a lot between consultancy firms and traditional corporations. Consequently, it would be interesting for future research to do a similar study but with more consultancy firms participating as benchmarking companies.

During the theoretical studies, the authors noticed some imbalances of how deep and thorough the studies were on the different phases of a project. It was perceived that the areas of project initiation and project handover were rather lowly represented in the literature. It is hence suggested for future research to focus on some specific phases more in depth.

6.3 Benefits of Thesis

The MT project have generated a new project management model suited for in-house projects at ESSIQ. The model will help ESSIQ to manage in-projects more efficiently and reach a unity in how to manage in-house project within the company. Further on, the developed model has a structured method for selecting projects, which can benefit ESSIQ by increasing the number of successful projects. The developed model in this MT project is overall flexible and easy to use, which is further beneficial for ESSIQ since they can apply it to all projects. This MT project has also provided ESSIQ with a deeper understanding of the organization's current maturity of project management, and of how to proceed to become more proficient within the area.

The developed model is also perceived as being applicable and useful for other companies. As mentioned, the model is generic and easy to adapt to all kinds of projects, and its area of use is hence argued to be wide.

The MT project has contributed to academia with a new project management model. The model is inspired by both agile and waterfall methods, and gives a contribution to development towards a more agile approach at industries. The suggested way of working in projects, described by the detailed description in the previous chapter, is considered new and unique. The model presents a new way of combining traditional project working methods with agile methods. Furthermore, the MT project has explored agile methods in combination with mechanics projects, an area that has not been given as much attention as agility within software projects.

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Appendices

This chapter includes three appendices. First, in Appendix A, the interview guide used for the interviews at ESSIQ is presented. Secondly, in Appendix B, the interview guide used for the benchmarking interviews is included. Lastly, in Appendix C, a detailed description of all processes in the process groups by PMI is included.

Appendix A - Interview Guide at ESSIQ

Appendix A shows the interview guide used during the first interview session at ESSIQ.

Demographics

1. Shortly describe ESSIQ's position at the consultancy market.

2. What is your position at ESSIQ?

3. How many years of experience do you have from project management?

<5 years 5-10 years 10-15 years >15 years

4. Are you certified by PMI/IPMA or similar? If yes, which?

In-house projects

5. Have you been a part of a in-house project? If yes, please tell us a little about the project.

6. Do you use a project charter when initiating a project?

7. What is the first step when a project is started?

8. How do you plan a project?

9. How often do you want/need to have contact with the customer?

10. What communication do you have with the customer during a project?

11. How do you make budgets for projects?

12. How are decisions and progress regarding a project documented?

13. What requirements do you have regarding flexibility of a project management model?

- How much do you need to adjust to your customer?

14. How do you control that the project plan and specifications are followed in a project?

15. Do you have control mechanisms during the project life cycle?

- For example for budget, time, quality and customer satisfaction

16. How do you end a project?
17. Do you discuss the project with the customer after it is closed, based on customer satisfaction?
18. Is there an internal bank with new experiences retrieved from closed projects?

Closing questions

19. What need to you consider ESSIQ has for a project management model?
20. What have been working well in previously managed in-house projects?
21. Please place ESSIQ on a suitable level on the Project Management Maturity Model in Figure A below.

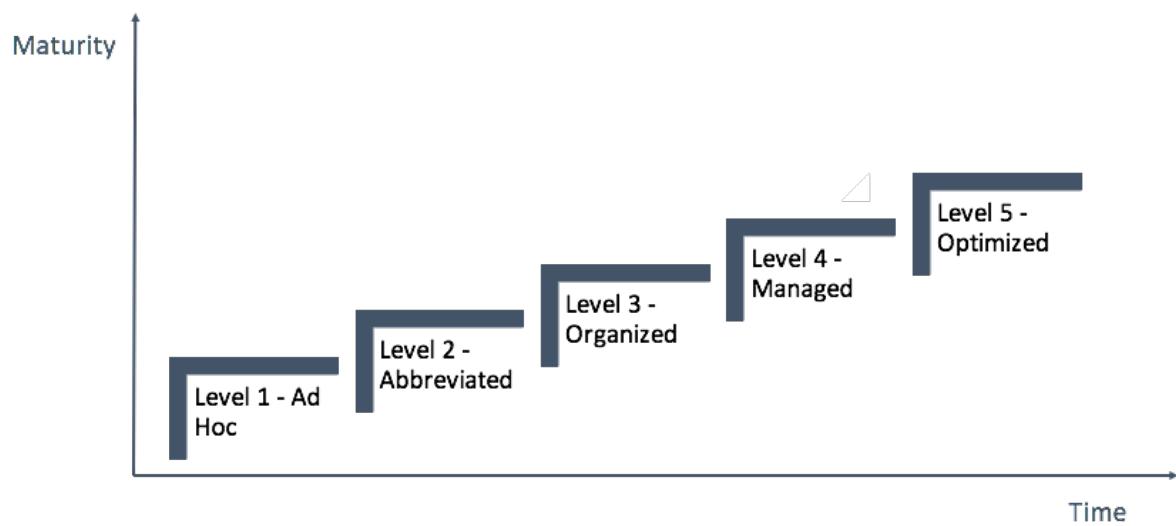


Figure A. Project Management Maturity Model (Processed by authors from PM Solutions, 2012)

Appendix B - Benchmarking Interview Guide

Appendix B presents the interview guide used at the benchmarking companies.

Demographics

1. Shortly describe your position and the company you are working for.

Project Management

2. Do you have your own project management model? If yes, can we take part of it?

3. How do you decide if a project should be started? Do you have any pre-study?

4. What is the first step after a project has been decided to be started?

5. Are there clear phases in your projects? If yes, which?

6. How do you plan a project?

7. How do you communicate internally during the project?

8. Do you have daily stand-ups?

9. How do you make budgets for the projects?

10. How is project progress and decisions documented?

11. Are there any requirement for how flexible a project management model needs to be to fit different projects?

12. How do you control that the project plan and specifications are being followed?

13. Do you have control mechanisms during the project life cycle?

- For example for budget, time, quality and customer satisfaction

14. How do you end a project?

Closing questions

15. Is there an internal bank with new experiences retrieved from closed projects?

16. Do you work with any agile methods? If yes, which ones do you think are beneficial to use?

Appendix C - Process groups

PMI have established project management processes and divided them into five groups. The groups included are, initiating, planning, executing, monitoring and controlling and closing process group (PMBOK® Guide, 2017). Below is a detailed description of each activity in the process groups.

Initiating Process Group

Development of Project Charter

The project charter is a document that formally authorizes the existence of the project. The key benefit of developing a project charter is that it creates a link between the project and the strategic objectives of the organization, as well as it creates a formal record of the project. As soon as the project charter has been approved, the project manager is authorized to apply organizational resources to project activities (PMBOK® Guide, 2017).

Identify Stakeholders

The process of identifying stakeholders is an ongoing process performed periodically when needed. The purpose is to gather relevant information about ones stakeholders, such as stakeholders interest, involvement, interdependencies and potential impact on project success. By performing this process, one can enable the project team to identify the appropriate focus for each stakeholder or group of stakeholders (PMBOK® Guide, 2017).

Planning Process Group

Develop Project Management Plan

The process of developing a project management plan aims to define, prepare, and coordinate all components and activities. Thereafter, one should consolidate this information into an integrated project management plan. The required inputs of this process are; the project charter, output from other processes, enterprise environmental factors, and organizational process assets. Upon completion of this process, one should have the output of a project management plan. To produce a comprehensive document like the project management plan, describing the basis of the project work and how it will be performed, is considered highly beneficial (PMBOK® Guide, 2017).

Plan Scope Management

During this process, one creates a scope management plan that shows how the project and project scope will be defined, validated, and controlled. This provides the team with guidance on how scope will be managed. The required inputs of the process are; project charter, project management plan, enterprise environmental factors, and organizational process assets. The process is performed once or at predefined points. The expected outputs from this process are a scope management plan, and a requirements management plan (PMBOK® Guide, 2017).

Collect Requirements

During the collect requirements process, one is to determine, document, and manage stakeholder requirements and needs to meet objectives. This provides a basis for defining the product and project scope. The inputs required for this process are; project charter, project management plan, project documents, business documents, agreements, enterprise environmental factors, and organizational process assets. The process aims to generate outputs in the form of requirements documentation, as well as a requirements traceability matrix (PMBOK® Guide, 2017).

Define Scope

The define scope process includes the development of a detailed description of the product and project. A thorough product description will ease the work and can help set result boundaries and acceptance criteria. The inputs required for this process are the following; project charter, project management plan, project documents, enterprise environmental factors, and organizational process assets. From these, the expected outputs are; project scope statement, and project documents updates (PMBOK® Guide, 2017).

Create a Work Breakdown Structure (WBS)

The creation of a WBS is the process of dividing the project into smaller and more manageable parts. This enables the creation of a framework demonstrating what needs to be delivered, which is highly beneficial. The inputs required for this process are; project management plan, project documents, enterprise environmental factors, and organizational process assets. The expected outputs are the following; scope baseline, and project documents updates. The scope baseline includes the approved scope statement and the WBS with its dictionary (PMBOK® Guide, 2017).

Plan Schedule Management

The process of Plan Schedule Management includes establishing documents, procedures and policies. These will be used to plan, develop, manage, execute and control the project schedule. The required inputs for this process are; project charter, project management plan, enterprise environmental factors, and organizational process assets. The output is the schedule management plan (PMBOK® Guide, 2017).

Define Activities

To produce the required project deliverables, one must identify and document the activities and actions needed. This is what is done in the Define Activities process. By defining the activities, one facilitates the project work. The required inputs are; project management plan, enterprise environmental factors, and organizational process assets. This process generates a number of outputs; activity list, activity attributes, milestone list, change requests, project management plan updates (PMBOK® Guide, 2017).

Sequence Activities

The Sequence Activities process includes identifying and documenting the relationships between the activities identified in the previous process. This is a process that is ongoing throughout the project. The inputs required for this process are; project management plan, project documents, enterprise environmental factors, and organizational process assets. The process aims to generate the following outputs; project schedule network diagrams, project documents updates (PMBOK® Guide, 2017).

Estimate Activity Endurance

During this process, one estimates the endurance of all identified activities with the available resources. The time is defined as in how many work periods are required to complete each activity. To perform this process, the following inputs are required; project management plan, project documents, enterprise environmental factors, and organizational process assets. The expected output are; duration estimates, basis of estimates, and project documents updates (PMBOK® Guide, 2017).

Develop Schedule

The Develop Schedule process is needed to create a model for how to execute, monitor, and control the project. The creation of the model is done through an analysis of the activity sequences, resource requirements, and schedule constraints. The process is ongoing throughout the project and the required inputs are; project management plan, project documents, agreements, enterprise environmental factors, and organizational process assets. The process is expected to generate a number of outputs such as; schedule baseline, project schedule, schedule data, project calendars, change requests, project management plan updates, and project document updates (PMBOK® Guide, 2017).

Plan Cost Management

The processes in planning cost management defines how the project will be budgeted, estimation of costs and how costs will be controlled, monitored and managed. In order to perform these processes the following inputs are needed; project charter, project management plan, enterprise environmental factors and organizational process assets. From these inputs the output will be the cost management plan (PMBOK® Guide, 2017).

Estimate Costs

To estimate costs for a project a process is needed for determining an approximation of the resources needed to complete the tasks within the project. Inputs that are needed for this process are a project management plan, project documents, enterprise environmental factors and organizational process assets. From the inputs a cost estimation can be outlined as well as a basis for the estimations and project document updates (PMBOK® Guide, 2017).

Determine Budget

From the costs that previously has been estimated, processes for determine a budget can be performed. The budget is a compilation of the estimated costs and an authorized baseline. Determining a budget makes it easier to control and monitor the projects costs. Inputs needed for the processes in this group are; project management plan, project documentations, business documents, agreements, enterprise environmental factors and organizational process assets. Further on, expected outputs would be; a cost baseline, project funding requirements and project documents updates (PMBOK® Guide, 2017).

Plan Quality Management

The quality requirements for a project or deliverables are identified in the process of plan quality management. This process is beneficial since it gives a guidance in how to manage and verify quality throughout the project. Inputs needed for the processes in this group are; project charter, project management plan, project documents, enterprise environmental factors and organizational process assets. The outputs from the processes in quality management are; quality management plan, quality metrics, project management plan updates and project documents updates (PMBOK® Guide, 2017).

Plan Resource Management

To define how to estimate and manage resources is called resource management. The largest benefit by this process is that it establishes both the approach and the level of management commitment and effort needed in order to manage resources for the project. Required inputs for this process are; project charter, project management plan, project documents, enterprise environmental factors and organizational process assets. From the process, outputs aims to be; a resource management plan, team charter and project documents updates (PMBOK® Guide, 2017).

Estimate Activity Resources

To perform project work, one must be aware of the resources needed. This process aims to estimate the necessary resources such as project teams, type and quantity of materials, equipment, and supplies. The inputs required are; project management plan, project documents, enterprise environmental factors and organizational process assets. Expected outputs from this process are; resource requirements, basis of estimates, resource breakdown structure, and project documents updates (PMBOK® Guide, 2017).

Plan Communications Management

Communication is an essential factor in all projects, and this process aims to develop an appropriate plan for project communication activities. The plan should consider and be based on the information needs from each stakeholder, the available organizational assets, as well as the needs of the project itself. Having a structured communications plan will enable and facilitate information sharing in a timely manner. This process requires the following inputs; project charter, project management plan, project documents, enterprise environmental factors and organizational process assets. The expected outputs are; communications management plan, project management plan updates, and project documents updates (PMBOK® Guide, 2017).

Plan Risk Management

Performing risk management is critical in a project. This process includes the development of the risk management activities one should conduct. Inputs required for the risk management process are; project charter, project management plan, project documents, enterprise environmental factors and organizational process assets. The process aims to create an output in the form of a risk management plan (PMBOK® Guide, 2017).

Identify Risks

This process includes identification and documentation of risks and their characteristics. One should identify both individual project risks as well as sources of overall project risks. The required inputs are; project management plan, project documents, agreements, procurement documentation, enterprise environmental factors and organizational process assets. The expected outputs are; risk register, risk report, and project documents updates (PMBOK® Guide, 2017).

Perform Qualitative Risk Analysis

During this process, which is performed throughout the course of the project, one should prioritize individual risks and assess them based on impact and likelihood of occurrence. The inputs required for this process are; project management plan, project documents, enterprise environmental factors and organizational process assets. The expected output is project documents updates (PMBOK® Guide, 2017).

Perform Quantitative Risk Analysis

This is the process during which one numerically analyzes the combined effect of project risks. This knowledge can help in the risk response planning. This process required the following inputs; project management plan, project documents, enterprise environmental factors and organizational process assets. The output is project documents updates (PMBOK® Guide, 2017).

Plan Risk Responses

The Plan Risk Responses process includes the development of actions, strategies, and options on how to address both the overall and the individual project risks. This can help in the allocation of resources. The inputs required are: project management plan, project documents, enterprise environmental factors and organizational process assets. This process aims to generate the following outputs; change requests, project management plan updates, project documents updates (PMBOK® Guide, 2017).

Plan Procurement Management

During this process, one should document the project procurement decisions, specify the approach, and identify potential sellers. Inputs to the process are; project charter, business documents, project management plan, project documents, enterprise environmental factors and organizational process assets. The outputs from this process are many, and consists of; procurement management plan, procurement strategy, bid documents, procurement statement of work, source selection criteria, make-or-buy decisions, independent cost estimates, change requests, project documents updates, and organizational process assets updates (PMBOK® Guide, 2017).

Plan Stakeholder Engagement

This process aims to develop approaches for how to involve project stakeholders. This should be based on the stakeholders' needs, expectations, interests, and potential impact on the project. The required inputs are; project charter, project management plan, project documents, agreements, enterprise environmental factors and organizational process assets. The output is in the form of a stakeholder engagement plan (PMBOK® Guide, 2017).

Executing Process Group

Direct and Manage Project Work

The process of directing and managing project work is performed throughout the project. This to ensure that the team are performing activities according to the project management plan, and that approved changes are implemented to achieve project objectives. The required inputs for this process are; project management plan, project documents, approved change requests, enterprise environmental factors, and organizational process assets. The expected outputs are; deliverables; work performance data, issue log, change requests, project management plan updates, project documents updates, organizational process assets updates (PMBOK® Guide, 2017).

Manage Project Knowledge

To achieve project objectives, one must not only manage and use the existing knowledge, but also create new knowledge. In addition, the creation of new knowledge will lead to organizational learning. This process is performed throughout the whole project. The required inputs are; project management plan, project documents, deliverables, enterprise environmental factors, and organizational process assets. The process aims to generate the following outputs; lessons learned register, project management plan updates, organizational process assets updates (PMBOK® Guide, 2017).

Manage Quality

In this process, one translates the quality management plan, developed in the previous process group, into executable activities. This increases the probability of meeting quality requirements, as well as it enables identification of causes of poor quality. The process requires the following inputs; project management plan, project documents, and organizational process assets. The expected outputs are; quality reports, test and evaluation documents, change requests, project management plan updates, and project documents updates (PMBOK® Guide, 2017).

Acquire Resources

This process is about acquiring the resources needed to complete the project work, and is performed periodically throughout the project. Resources can be in the form of project team members, equipment, materials, facilities, supplies, and other resources. The required inputs are; project management plan, project documents, enterprise environmental factors, and organizational process assets. The process should generate the following outputs; physical resource assignments, project team assignments, resource calendars, change requests, project management plan updates, project documents updates, enterprise environmental factors updates, and organizational process assets updates (PMBOK® Guide, 2017).

Develop Team

The develop team process aims to improve the interaction between team members, as well as to ensure that the overall environment is in place to enhance project performance. This can lead to improved competencies, increased motivation among team members, and improved project performance. The inputs required for this process are; project management plan, project documents, enterprise environmental factors, and organizational process assets. The outputs expected to be generated are; team performance assessments, change requests, project management plan updates, project documents updates, enterprise environmental factors updates, and organizational process assets updates (PMBOK® Guide, 2017).

Manage team

To optimize project performance, one must manage the project team. This could be done by tracking team member performance, resolve issues, and provide feedback. The process requires the following inputs; project management plan, project documents, work performance reports, team performance assessments, enterprise environmental factors, and organizational process assets. The process generates the following outputs; change requests, project management plan updates, project documents updates, and enterprise environmental factors updates (PMBOK® Guide, 2017).

Manage Communications

By managing communications, one can ensure that project information is collected, distributed, stored, retrieved, created, monitored, and managed in an ultimate and timely manner. If managed correctly, the information flow between the project team and the stakeholder will be both efficient and effective. The required inputs are; project management plan, project documents, work performance reports, enterprise environmental factors, and organizational process assets. The outputs are; project communications, project management plan updates, project documents updates, and organizational process assets updates (PMBOK® Guide, 2017)

Implement Risk Responses

In the previous process group, it was planned for how to respond to potential risks. In this process, one should implement these agreed-upon risk responses. If performed efficiently, project threats will be minimized and project opportunities will be maximized. The inputs required for this process are; project management plan, project documents, and organizational process assets. The two outputs that are expected are; change requests and project documents updates (PMBOK® Guide, 2017).

Conduct Procurements

During this process, one should select suppliers and establish contracts. This will ensure a selection of a qualified seller. The required inputs are; project management plan, project documents, procurement documentation, seller proposals, enterprise environmental factors, and organizational process assets. The expected outputs are; selected sellers, agreements, change requests, project management plan updates, project documents updates, and organizational process assets updates (PMBOK® Guide, 2017).

Manage Stakeholder Engagement

The last process in this process group is to manage stakeholder engagement. This is the process where one should communicate with stakeholders to ensure that their expectations and requirements are met. In addition, issues should be addressed and stakeholder involvement encouraged. This should be done throughout the project. The inputs required are; project management plan, project documents, enterprise environmental factors, and organizational process assets. The process is aimed to generate the following outputs; change requests, project management plan updates, and project documents updates (PMBOK® Guide, 2017).

Monitoring and Controlling Process Group

Monitor and control project work

This process is needed to track, review and report the progress to meet objectives for performance which are also stated in the project management plan. Inputs are project management plan, project documentation, work performance information, agreements, enterprise environmental factors and organizational process assets. Outputs are workprofrmance reports, change requests, project management plan updates and project documents updates (PMBOK® Guide, 2017).

Perform integrated change control

Perform integrated change control is a process where change requests are reviewed, changes are approved, changes of the deliverables are managed as well as organizational process assets, project documents and the project management plan. Inputs that are needed for this process are project management plan, project documents, work performance reports, change requests, enterprise environmental factors and organizational process assets. Outputs are approved change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Validate scope

The process of validating the scope is to formalize accept the complete deliverables of the project. Inputs needed for this process are the project management plan, project documents, verified deliverables and work performance data. The process generates outputs as accepted deliverables, work performance information, change requests and project documents updates (PMBOK® Guide, 2017).

Control scope

The process of controlling the scope regards monitoring the status of the project and the project scope. It also handles changes to the scope baseline. Needed inputs for this process are project management plan, project documents, work performance data and organizational process assets. Output are work performance information, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Control schedule

Within this process the status of the project is monitored and thereby updates to the project schedule. Changes to the schedule baseline are also managed. Inputs that are needed for this process are project management plan, project documents, work performance data and organizational process assets. Outputs are work performance information, schedule forecasts, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Control costs

This process manages changes to the cost baseline of the project. It also monitors the status of the project in order to update the project's costs. Inputs required are the project management plan, project documents, project funding requirements, work performance data and organizational process assets. Outputs are work performance information, cost forecasts, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Control quality

Control quality is the process of monitoring the quality management of the project. It is also a process to control that the outputs from the project are meeting the customer's expectations. Inputs for this process are; project management plan, project documents, approved change requests, deliverables, work performance data, enterprise environmental factors and organizational process assets. Expected outputs are; quality control measurements, verified deliverables, work performance information, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Control resources

This is a process to ensure that assigned resources are available to the project as planned. The process also involves overlooking the utilization of resources as planned and how it turned out. Inputs needed are; the project management plan, project documents, work performance data, agreements and organizational process assets. Expected outputs are; work performance information, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Monitor communications

Monitor communications is a process for ensuring that the needed communication to both the project and its stakeholders are met. Inputs needed for this process are; project management plan, project documents, work performance data, enterprise environmental factors and organizational process assets. From these inputs the expected outputs are; work performance information, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).

Monitor risks

This process is used to; “monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project.” Needed inputs for the process are; project management plan, project documents, work performance data and work performance reports. Expected outputs are; work performance information, change requests, project management plan updates, project document updates and organizational process asset updates (PMBOK® Guide, 2017).

Control procurements

Within this process the following activities are handled; management of procurement relationships, monitoring performance of contracts, managing changes and closing contracts. Inputs needed for this process are; project management plan, project documents, agreements, procurement documentation, approved change requests, work performance data, enterprise environmental factors and organizational process assets. Further on are expected outputs; closed procurements, work performance information, procurement documentation updates, change requests, project management plan updates, project document updates and organizational process asset updates (PMBOK® Guide, 2017).

Monitor stakeholder engagement

The final presented process within the monitoring and controlling process group is monitoring stakeholder engagement. It involves overlooking relationships with stakeholders and making strategies to engage stakeholders. Inputs needed for this process are; project management plan, project documents, work performance data, enterprise environmental factors and organizational process assets. Expected outputs are; work performance information, change requests, project management plan updates and project document updates (PMBOK® Guide, 2017).