NTNU
Norwegian University of Science and Technology

Project Management System at a Research Institute

An exploratory case study

Jonas Aarsland Forsberg

Problem Description

Within a defined time perspective, one can assume that an organization can be considered as a permanent entity and the projects as temporary entities. In a project-based organization, friction can occur in this interface. A project management system (PMS) is a meta-level system put in place to harmonize this interface. This study will investigate a PMS in a research institute, a project-based organization with a broad range of projects. The study will address the challenges and how a PMS can harmonize the interface between projects and organization. More specifically, investigate how standardized project management (SPM) such as reporting, routines, documentation, education, tools, measurements and so forth, and PMS can be used in practice.

ii

Preface

This master thesis was written at the Norwegian University of Science and Technology (NTNU), Department of Industrial Economics and Technology Management. This master thesis is the last fragment of the Master of Science in project management program at NTNU. The thesis started in January 2017 and had a time span of 20 weeks, where the student is performing research on a selected scientific area within project management. This study is written with cooperation with an external research institute. The initial contact of the research institute was established spring 2016 at NTNU – Career day. Together, with NTNU, the student and the research institute collaborated in generating a problem description that satisfied all of them.

Prior to the thesis, the student wrote a specialization project, which worked as a theoretical and in-depth review towards the problem definition. The specialization project directed this study towards a standardization perspective.
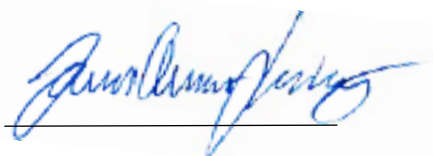
I would like to thank my supervisor Associate Professor Ola Edvin Vie at the Department of Industrial Economics and Technology Management for excellent and sympathetic guidance throughout the semester.

I would also like to express my thanks express my thanks to my co-supervisor at the research institute. Olaug guided me throughout the process and assisted in selecting interview objects at the research institute.

My last grateful thanks go to my family and classmates, which were fantastic theoretical and practical discussion partners throughout the whole process. They provided moral support and encouragement when needed.

I hope you enjoy reading!

Trondheim, June 2017,

Jonas Aarsland Forsberg

Abstract

Projects have become a more central way of organizing work in today's fast phased and competitive environment. Projects can be defined as a temporary organization which operates under the constraints of time, budget, and other resources. Within specified timeframe, an organization can be defined as permanent entity and projects as temporary. Here, a potential complication arises, between the temporary and permanent. In this interaction, some level of guidance and control are required. This study has addressed how to handle this interface from a project management perspective and has defined this interface as a Project Management System (PMS). To narrow the focus, a project-based organization, more specifically a research institute has been selected as a focal point. This has resulted in an explicit standardized project management (SPM) system for the research institute, and a general PMS, which ban be beneficial for project-based organizations.

These findings are based on an exploratory case study. 11 project practitioners in a research institute were interviewed regarding the PMS and its aspects. The project practitioners ranged from experienced project managers, department heads, and other executives in the organization. The widespread sample of project practitioners made it possible to create a more practical and specified SPM system which is connected to the project reality and organizational capabilities. One of the theoretical findings suggests that it is not beneficial to control a complex project reality using linear systems. Instead, an adaptable approach directed towards the project reality and dynamics is more advantageous. A flexible approach was developed by making a project categorization system which is a part of the SPM system. This can be used as a tool to separate the projects from each other based on their intrinsic nature. From these separations, a more detailed project management approach can be valuable. The application and benefits of the SPM have been investigated. The study concludes with a model of a holistic PMS and how it can be connected and created to enhance project success.

Table of Contents

Abbreviations

ORQ – Overarching Research Question

PM – Project Manager

PMO – Project Management Office

PMS – Project Management System

PPM – Program and Portfolio Management

R&D – Research and Development

RQ – Research Question

SPM – Standarized Project Management

List of Figures

List of Tables

1 Introduction

Project management evolved from the 50's when management tools were centered on the delivery of qualitative products (LaBrosse, 2007). In the 80s-project management developed exponentially as the complexity and volume of resources increased. Many companies adopted and formalized of project management (Urli and Terrien, 2010). However, in today's dynamic business environment and global competition. Companies try to find new ways to make projects into powerful, competitive weapons (Brown and Eisenhardt, 1998). Projects can be defined as a temporary organization and process that have been created to achieve a specific unique goal under the constraints of time, budget and other resources (Shenhar, 2004). In an organizational context, projects should be initiated as a part of a "grand plan" which is consistent with business strategy and is conceived at the corporate or business unit level. This strategy is translated into the project level, where each project has an individual project strategy, which in theory is an alignment of the business strategy (Patanakul and Shenhar, 2012). In today's fast growing competitive market environment, project strategies are to create new ways to not just creating a quality product/service but also enhance competitive advantage (Shenhar. 2004). Project management is not only about meeting time and budget goals, but also about creating competitive advantage and winning the market (Porter, 1985). However, it does not mean that constraints like budget, time and quality are of no importance, but the strategy is to be considered a significant part. That is, projects can be implemented according to budget, time and specification but end up as failures in the eyes of the market while other projects, which have even time and/or cost overruns, become successful. Shenhar states that a good project strategy is a roadmap that will create the best competitive advantage (Shenhar, 2004).

One way businesses achieve competitive advantage can be to differentiate themselves from their competitors (Porter, 1980). One method of doing this is to be innovative; "*the process of translating an idea or invention into a good or service that creates value or for which customers will pay*" (Merriam-Webster Dictionary, 2017). Engaging in new product development (NPD) or processes to optimize the current flow of resources. Using existing resources to create new product or services that do not currently exist in the market. Besner et al. (2009) concluded in their research that the best firms emphasize and integrate their innovation strategy at all level of their company. A firm's innovation path is shaped by the dynamic interaction between the firm's technological capabilities and its market (Brady and Hobday, 2011). There are three main points addressed in this statement, firstly, the company can foster growth by initiating projects within its existing technology and market, by creating specialized or product specific use of

resources. Secondly, initiate new projects and redeploy the resources and diversify into new technology and/or markets. Thirdly expand into new markets using existing technology to meet requirements for different markets. The project is usually the means where innovation takes place and are therefore the key way of organization innovation. For the firm, these projects will be critical either for exploring new markets or exploiting possibilities. Initiation of example research and development (R&D) projects or research programs can create a keystone of a company's business and increase the capability of exploring future markets. However, R&D projects have increased complexity than traditional projects (Hobday, 2000) and if the outcome might be very different from the initial specification. The ouctome could still be valuable for the company, e.g. unintended product discovery, or generating of intangible value, as experience and knowledge for the project team. Also, the research process itself during the project implementation could be as useful as the project itself (Vicente-Oliva, et. al, 2015). It is then possible to assume that a correct management between the strategic intentions and the complex project reality be beneficial to achieve success.

1.1 Applied Context

To investigate these issues further, and to narrow down the study, a research institute has been selected as a focal point. There are several differences between a research institute and an ordinary organization. Firstly, is the type of projects conducted. Regarding complexity whereas the research institute is operating to explore the frontier of research (ERC, 2016). This means they are generating new knowledge and are exploring new areas of science and technology. Secondly, the projects are usually recognized with higher uncertainties, especially regarding methodology. This generates projects with greater risk, with the argument that the projects have a hypothesis or a vision of an end goal/product but the methodology or roadmap to reach it can be unknown and are sensitive to external changes (Kline and Rosenberg, 1986). Moreover, since they are exploring the frontier of research, they are researching technology and using solutions that have never been used before. Also, in involving risk from different technologies and processes that most likely have not been done before and the impact could be unknown. The processes itself could also be complex and sensitive changes, example change or interference from the environment. A research institute also conducts research for clients, in this instance; a conflict could arise between external and internal projects. How can project management and the organization handle these complex aspects?

1.2 Theoretical Context

This thesis will look at how projects are conducted by a research institute. An organization, that is consistently undertaking new projects. The organization itself can be looked as a permanent entity, in contrast with projects, which are per definition temporary. Meaning that from a project perspective the organization is more or less static and are not changing with the same phase as the projects. It is becoming visible that a potential dilemma arises. The interaction between the permanent and the temporary can create frictions which could potentially lead to conflicts. This paradox needs to be addressed by a kind of interface that is embedded to the needs of the two entities. In this study, this interface is defined as a project management system (PMS). To understand the system a bit better, the project context is explored first.

Moreover, it is important to highlight that organizing projects is a temporally limited process, but projects, as temporary systems, are likely to be embedded in more permanent contexts (Sydow, et. Al., 2004). This creates an interface between the organization and project. One characteristic of this interface is the embeddedness of contextual management structures like standards, processes, routines, tools, information systems and procedures (Cooke-Davies et al., 2009), which is the contents of a PMS. The PMS should be the platform in which the different interfaces interact with each other, which in this case is the borderline between the organization (permanent) and the project (temporary). These levels work jointly in the development and evolution of the firm. The PMS will become a platform that creates a logical interface for the organization; it should be adapted to the environment, the organizational type and the different projects that are conducted by the company.

Figure 1-1 – Project Management System Concept

Figure 1, is created to create a visual illustration of the PMS system, it is placed in the borderline between the project and the organization and should be a viable tool and solution for projects in changing environments. The PMS is not necessarily an objective system; it is a meta-project

management system, which should be configured by the organization, environment and project type. Moreover, it is a product of the project and organizational needs. Companies typically have their own set of methods and procedures for project management (Dinsmore and Cabanis-Brewin, 2014). Their principal role is to provide structure and commonality of practice so reporting can be reliably monitored. In this study, the PMS is the interface between the project and organization, which should be optimized to the environment and project types. A rigorous and adaptive application of PMS can have a significant influence in managing complex projects. To achieve this, some fundamental elements needs to be in place; a PM skilled in leadership, a project control system and processes that are systemically sound, a project structure where the members know where they fit and know what they should do, and a well-conducted communication.

This introduces the overarching research question (RQ), which is: *Can meta-level project management system (PMS) harmonize the interface between the organization and projects, in a research institute?*

PMS is a comprehensive system containing a lot of different connection between the entities. To reduce and focus the answer, this thesis will try to investigate how PMS can be addressed with standardization. Standardization is a measure the organization can facilitate to create a common ground, between the project and organization. This is common ground could be standardization of procedures, like reporting, documentation, education, tools, measurements and other PM practices, this is hereby defined as standardized project management (SPM) (Milosevic & Patanakul, 2005).

Before continuing the reasoning with standardizing. A management paradox is introduced. In management, there is a paradox, 'control,' which can be defined as the power to direct and impose order. On the other side of the paradox is the need for 'chaos,' which can be defined as disorder or the lack of a fixed organization (De Wit and Meyer, 2014). De Wit and Meyer (2014) continues with the managerial perspective, whereas the managers will try to control and manage the complex system an organization is. Since organizations are complex social systems, populated with self-thinking individuals, whereas each has their own feelings, ideas, and interest (De Wit & Meyer, 2014). These people act for themselves on a daily basis without the direct intervention of the managers.

Relating this perspective to a standardized project management system, one can say the same paradox are present. To some extent organizations and projects are alike, both complex social

4

systems in which requires a direction, such as goals, deliverables, and purpose. Moreover, projects are per definition temporary, will be initiated, and terminated frequently. Since these projects are continually emerging and are per definition unique, the level of control from a project manager would vary. "One size doesn't fit all" (Shenhar 2004) is a critical perspective to keep in mind when managing project. Potentially each project will create their own social systems and unique goals. Taking the paradox down one 'level', one can say that the paradox is valid for project managers. Relating this paradox to SPM, the system needs to be flexible so the project processes fit the project context, but also be strict enough so the managers and organization can achieve some degree of control. In this case, control could be status control, economic control, and resource control. There is a need to have managerial control to direct the developments in the projects and make the necessary changes in the project structure, processes, and culture. This to realign the project with the demands of the environment (De Wit & Meyer, 2014). Lastly, standardization in the organizational-project interface can simplify the interaction. It will create some ground rules that sets the foundation for each project. Instead of inventing new processes for every project, some processes are standardized for the organizational needs and other can be flexible to the project's characteristics.

1.3 Research Questions

The overarching research question is *"Can meta-level project management system (PMS) harmonize the interface between the organization and projects, in a research institute."* This question can have a various range of answers, depending on the perspective. To narrow it down project standardization has been introduced. Standardized interface or standardized project management (SPM) is a concept that can be used to manage this interface which leads us to the following research questions.

1.1 How can SPM contribute to the PMS in a research institute?

To be able to answer this question, a PMS need to be investigated related to a context. In this study, the context is a research institute, that is a project based organization that handles projects on a contractual practice. What requirements does a research institute have, regarding SPM and what actions can be initiated from an organizational perspective? On the other side, what project types that are constructed by a research institute, what is the characteristics, and what processes and actions regarding a SPM can be facilitated? Combined these questions will answer the second research question:

1.2 What aspects of a SPM system is most advantageous to standardize?

This question will look at the standardized aspects of the interface. Moreover, it is knowledgeable to understand how standardized project management is done in practice. This introduces the third research question, which is two sided:

2.1 What identifies the current PMS in an active organization?

2.2 To what extent are the current PMS affecting the project practitioners in the organization?

Project practitioners in this instance are all the persons related to each project, such as, project member, manager, owner, and steering groups.

The rationale behind these questions is the assumption that standardization of certain processes and activities could be supportive towards the organization. Cooke-Davis et al. (2009) argues that one source of project failure is a misfit between the projects characteristics, processes and the selected management approach. This led us to believe that choosing and selecting the correct approach related to the project characteristics can lead to project success. At least increase the chances of project success. Also, several authors claim that management of a project should be adapted to its specific characteristics (Shenhar, 2004, Cooke-Davis, 2009). Regarding the interface between the permanent and temporary as mentioned earlier. Example, in physics, friction will arise between such entities, and one can assume that this also applies to organizations as well.

1.4 Structure of Thesis

The overarching research question will be answered in the last chapter, 10. The general question regarding PMS is general, and the whole study can be considered as an answer to this question. To make this thesis more practical, the answer has first been narrowed down to a research institute, then to standardization. This to make the PMS more concrete, specific and grounded in theory and research. Figure 1-2 below describes where the answers for the different research questions can be found in the thesis.

Chapter / Reseach question and foundation	1	2	3	4	5	6	7	8	9	10
Can meta-level project management system (PMS) harmonize the interface between the organization and projects, in a research institute?				x						x
1.1 How can SPM contribute to the PMS in a research institute?				x					x	x
1.2 What aspects of a SPM system is most advantageous to standardize?				x					x	x
2.1 What identifies the current PMS in an active organization?							x	x		x
2.2 To what extent are the current PMS affecting the project practitioners in the organization?							x	x		x
Theoretical Foundation	x	x	x							x
Empirical Foundation						x	x			x

Figure 1-2 – Chapter Structure

To establish a good foundation to answer the overarching research question the research questions are answered in reverse order. The rationale of this is grounded in the nature of the questions itself. Question 2.1 and 2.2 are directed towards a research institute and generates a foundation to answer research question 1.1 and 1.1. The answer to question 1.1 and 1.2 have its basis in the answers and special findings that arise in question 2.1 and 2.2. This is done to limit and narrow the scope the answers to question 1.1 and 1.2. In addition, providing a practical context to the answers. Figure 1-3 below is addressing the context and the relationships for the research questions. In this figure ORQ is the overarching research question.

Purpose:		Chapter:
Possible Effects	ORQ	4. Project Management system 10.3 Conceptual PMS
Investigate Actions	RQ. 1.1 and 1.2	4.2 Passive PMS - Standardized Project Management 9. Development of a SPM System
Establish a Foundation	RQ. 2.1 and 2.2 Theory	8 Analysis of Empirical Findings 2 Organizational Context for a Research Institute 3 Special Project Factors
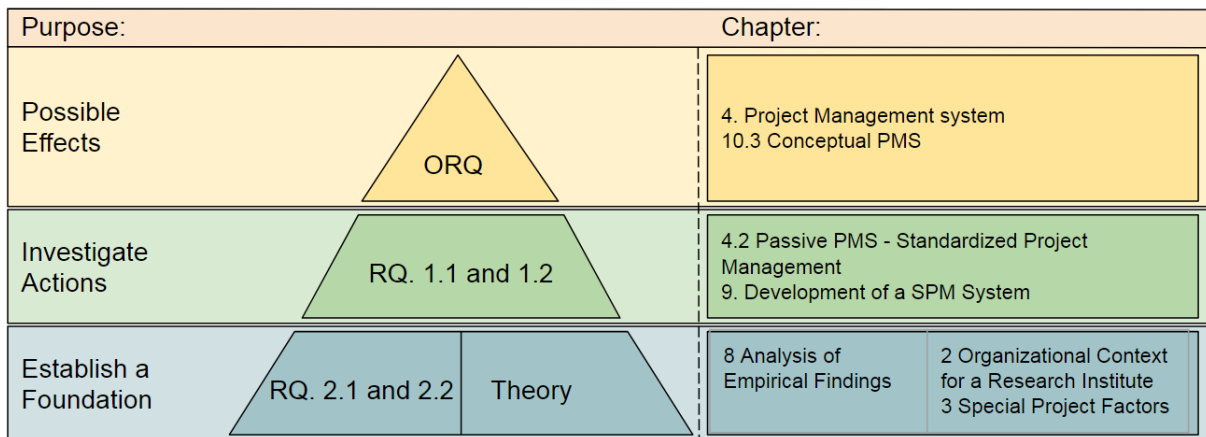
Figure 1-3 – Structure of Thesis

All the research questions will be answered in their dedicated chapter, and the answers are interconnected with the other chapters. This fact has resulted in dedicated chapters where the research questions are answered separately.

Before the research questions are answered, a theoretical review is performed. This to create a theoretical foundation before proceeding with the research. The theoretical review is creating a context and elaborates of what kind of context and issues that can arise in this environment. This to create foundation and to get familiarized with theory and dilemmas before analyzing and investigating a case company.

Moreover, the theoretical review touches upon the answers for the research questions. This will create a potential outline for the answers for the RQ and will be used for the analysis, discussion chapters, and development of a SPM.

2 Organizational Context for a Research Institute

As the intention of the study is to address how a PMS interface can be harmonized, the understanding of the context related to environment, organization, and projects are essential. The environment and context a research institute needs to be investigated further. The challenges, the reasons and why it exists and what makes it different, needs to be understood before continuing with the study. The environment and context and all its details will contribute to the overall complexity. Coping with this complexity in a beneficial manner is essential. A trait for a research institute is that they are a project-based organization, which are dealing with projects on a contractual basis. This will be elaborated in the following chapters.

2.1 Project Based Organization

A research institute is continuously undertaking new projects externally or internally and can be defined as a project-based organization. Project-based organizations can evade traditional barriers to organizational change and innovation since each project is presented as a temporary, relatively short-lived, phenomenon. As such, it does not pose the same threat to economic investments, as the creation of a permanent new department or division would. Moreover, project-based organizations allow for low-cost experiments. Because of their limited duration, project-based organizations do not constitute irreversible resource commitments of fixed costs (Sydow et. al, 2004).

The project-based organization will have the possibility of using a project as an organizational form which is contingent upon the increasing environmental complexity, and the organization requires an integration of a diverse set of specialist skills, knowledge bases, and sub-systems to cope with the complexity (Söderlund, and Tell, 2009. Project are used to match the environmental contingencies. Firstly, to guarantee more flexibility and responsiveness in the organization. Secondly, it integrates the idea of adaptation to the dynamic environment. Also, it works as a mechanism to structure and manipulate interdependency between the organization and the environment (Levinthal and Warglien, 1999).

Another significant aspect is the organizational structure. A firm's organizational structure can affect the efficiency of innovation activities, with some structures better suited to certain environments. For example, a greater degree of organizational integration may improve the coordination, planning, and implementation of innovation strategies. Organizational learning depends on practices and routines, patterns of interaction both within and outside the firm, and

the ability to mobilize individual tacit and explicit knowledge (Nonaka, 1994) and promote interaction. Such learning can be encouraged through careful design of practices, routines, and relationships, or through a more flexible, fluid organization in which individuals are encouraged to develop new ideas and ways of doing things. (OECD, 2011). There are naturally some merits and demerits to have a project under different organizational structures. There are studies that mostly concentrated on the adaptability of a project with the organization without taking into account other contingency elements and their effect on forming organization aspect of the project (Turner, 1999).

2.2 Contractual Research Organization

When organizations choose to outsource their research or production to third parties on a contractual basis, the receiver is called a contractual research organization (CRO). Generally, one of the characteristics of this industry is the highly regulation and restrictions in the markets, both during development but also during production (Gad and Spainhour, 2011, p. 2). The main reasons of outscoring projects to a CRO is too mainly to save time money, free up resources and migrate and reduce risk (Caudy, 2001). Gad and Spainhour (2011 p. 53) also argues that there are two fundamental drivers for outsourcing in the healthcare industry which are the need to access resources of information, and to reduce the excessive cost and time involved in development. Development of systems, procedures, and methodology that already developed within a CRO, such as production lines, knowledge, equipment, machinery and so forth.

For the CRO itself, short-term transactional relationships are not the most beneficial, because their knowledge and expertise will not be benefited optimally. The CRO will benefit more from a long-standing relationship, which gives them enhanced stability and increased knowledge sharing (Nicholas et. al., 2002) and the possibility to exploit potential synergies that come with partnerships. Moreover, the success factors in the interactions are to have a developed authentic and meaningful relationship with the clients, communication and relationship management is a key to the arrangement (Caudy, 2001). Firms should always deal openly, honestly, and fairly with their providers. A trusting relationship is built on shared information, the avoidance of surprises, quality time spent with the client, the establishment of clear rules, and integrity between the parties. Moreover, the CRO must provide value and deliver outstanding service; this will help the CRO creating long-term relations and providing their clients with improved solutions. The clients count on CROs to generate information, then assemble, analyze, and return the information to them in an easily understood format, quickly and consistently. Equally

important is the organization's plan for accountability and responsiveness (Nicolas et. al., 2002). Every process, every project team member should work smoothly toward that goal. Excellent customer service will demonstrate a commitment to the overall service of excellence. However, the downsides of CRO and contractual research is that; the client becomes dependent on the CRO, it could be a misalignment in the shared vision and objectives, the external company loses control over the project. The CRO usually allocate resources to these projects instead of focusing on internal projects. In addition, in theory, a more sophisticated management mindset is required in the more intense client relationship as, specify contracts, purchasing, relationship management (Piachaud, B, 2002).

The context and nature for a research institute is complicated and can be described as complex, as there are different reasons for outsourcing projects to such an organization. Moreover, the characteristics and importance of establishing long-term relationships and shared vision between the actors contributes to the overall complexity. This information makes it essential to continue the exploration of complexity and the environment to increase the understanding of the context surrounding a research institute. Lastly, an understanding of the characteristics of a research institute is essential to address a PMS. Before continuing exploration of the specific characteristics and factors in a research institute, there will be an introduction of complexity and environment. This is done to get a better understanding of the context and surroundings.

2.3 Complexity and Environment

This chapter will investigate complexity and its impacts. As mentioned, the environment and context for a research institute are dynamic. The projects can have different purpose, ownership, value focus and draw resources from various parts of the organization. Every project has the potential to utilize different aspects of the organizational capabilities (Knight and Cavusgil, 2004). These factors are contributing to the overall complexity, as the number of unknowns is increasing.

Next sections are directed towards complexity in projects; this is essential to understand what challenges a PMS needs to address.

The competitive, dynamic and fast-phased and the challenging characteristics of the project and its environment can be viewed a major contributor to the complexity. Navigating the complexity includes having the right control and contingencies in the organizational structure, leadership roles, flexibility, resilience and knowledge regarding the context (PMI, 2016). The

understanding, importance, and causes for project complexity are wildly known and acknowledged, (Baccarini, 1996; Morris and Hough, 1987; Wozniak, 1993) for example:

- Project complexity helps determine planning, coordination and control requirements
- Project complexity hinders the clear identification of goals and objectives of major projects
- Complexity is an important criterion in the selection of an appropriate project organizational form
- Project complexity influences the selection of project inputs, e.g. the expertise and experience requirements of management personnel
- Complexity affects the project objectives of time, cost, and quality. Broadly, the higher the project complexity, the greater the time and cost

This is just some of the impact and consequences of complexity; there are several frameworks regarding complexity in projects. Moreover, there is no unified definition of project complexity which is acknowledged by the research community. Project complexity has been broken into two aspects, organizational and technical complexities. These types are an integration from Maylor (2003) and Xin and Lee (2004) research on project complexities.

Organizational complexity – number of people and relationships within and outside the departments/organization. The number of locations, nationalities, languages, cultures and time zones involved. Lastly, the number of formal organizational units and specializations. There could potentially be different and conflicting interests, loyalty, cultures, and relationships among the project practitioners that will influence the project and the decision-making. In addition, there is always uncertainty in the decisions that are made in complex situations, as it is hard to grasp the complexity and get a complete overview of the situation. This will make the decision very unpredictable. Also, the number of interactions between the team members would increase the complexity. A bigger project group will increase the number of interactions and increase its complexity (Cooke-Davies, 2011). This could be magnified by the diversity inside the group itself, as there potentially could be different cultures, professionals, nationalities and so forth.

Technical complexity – the level of uniqueness of the technology, system, or interface, and uncertainty about the process or the requirements. In addition, the number of relationships inherent in the system as the number of and relationships between the inputs, outputs, tasks, or technologies.

From these definitions, it is possible to extract two perspectives, the organizational perspective, which entails mainly the organizational complexity. Secondly, the technical complexity belongs to the project. Moreover, the interaction between these perspectives, (previously called entities), will also contribute to the overall complexity. Complexity in a project environment comes not only organizational and technical complexity and their interaction but from the external dynamic effects from the environment. If one of the factors change, the interaction will also change, causing further change in other parts of the project system, so the complexity is both structural and dynamic (Whitty and Maylor, 2007). Correlating this with the aspects of a PMS, one could argue that the organizational complexity belongs to the organizational aspect of the PMS, and the technical belongs to the project aspects, meaning that a PMS needs to address these issues beneficially. These two aspects are highlighted to explain the complex nature and differences that exist in a research institute. The technical complexity is at project level. This will be elaborated further in Chapter 3.

Next section will address how these complexities can be addressed in practice. A project manager in a complex environment should adopt different kind of capabilities that includes different perspectives that make the project manager operate with an increased awareness and sensitivity to the underlying assumptions that are presented within as specific problem or project (ICCPM, 2012; Müller and Turner, 2007). Moreover, project practitioners will attempt to simplify the reality, using tools and models is an attempt to grasp an understanding of the situation. The purpose is to create an interface between the reality and how it works. Models tend to be more implicit than explicit, and they are likely to differ in important respects from other people's models (Cooke-Davies, 2011). Why it like this is a psychological phenomenon, and will not be elaborated in this study. Moreover, models can inform and direct what we intend to do, if the model is left unexamined they can potentially lead to unforeseen systematic effects towards the project work. A reality simplified by models, and decision making based on the assumptions created by them would be too simplistic and create a complex situation. Complexity itself is difficult to manage, and the model will just create a truth based on the implicit assumptions made in the model creation process.

It is stated that complexity will affect the different aspects of the projects and can be solved by either grasping and understanding the overall project context or have enough information to make the correct decisions. An important tool to reduce the complexity is by modeling it (Cooke-Davies, 2011). This highlights the importance of having a PMS which is rigid enough to actual grasp the important aspects of the project context. By reducing the number of

uncertainties is a valuable action in order to reduce the complexity. By having, the right focus throughout the project can reduce the number of interactions and simplify the decision-making process, which can lead to more successful, efficient and effective projects.

The aspects of how a PMS can be addressed in practice is described in chapter 4. Later in the study, a PMS will be investigated in a case study, but first a more in-depth study of factors and project context which makes a research institute special.

3 Special Project Factors

It becomes clear that the context of a research institute is quite complex. This chapter will break down the complexity that is naturally embedded in the projects in a research institute. In addition, it will create a foundation for the technical complexities, as stated in chapter 2.3. The purpose is to increase the understanding of the complexity inherent in the project context. It is a fact that more knowledge about the complexity and its embeddedness can be a key action in coping with complexity and uncertainties which can result in better migration and reduction of project complexity.

A research institute is a project-based organization. Constantly undertaking new innovation and R&D projects from clients. What are the characteristics of these projects, and how can this be handled from a PMS perspective?

To break down and improve the understanding of the specific project contexts. Four distinctive topics have been extracted from the context and environment of the research institute. These are Innovation and R&D, ownership, value and risk; the topics are briefly described in Table 3-1 and elaborated in the next subchapters. Understanding these factors and handling them will aid reducing the overall uncertainty and complexity in the organization.

An understanding of these factors will aid reducing the overall complexity which can be associated as a form of risk handling strategy, increasing knowledge, reducing uncertainties and so forth. The information from these chapters will be used as a foundation to create a PMS and SPM system between the organization and projects.

Table 3-1 – Project Theory Reasoning

Topics	Description
Innovation and R&D	An understanding of the innovation process and R&D, which are one of the key activities for a research institute, is a key to increase the understanding of the project contexts.
Ownership	The nature of the research institute makes the ownership factor significant. The ownership would vary between the projects. In addition, how will this ownership affect the project? Ideally, long-term relationships with clients are most beneficial. To create this, the organization needs to be good at communicating with the client and establish a shared vision. The research institute needs to be service minded.
Value and Focus	Maintaining and generating knowledge is one of the focuses in a research institute to support its market position. In addition, the research institute, also needs to have resources to create a 'seedbed' to maintain this knowledge. These resources can be created with money; this makes economy an aspect that cannot be neglected. This creates a belief that constant balancing economy and knowledge generation is important to be sustainable. Moreover, what value focus is needed from the organization and can a correct value creation focus assist the research institute in reducing the complexity?
Risk	Risk handling in projects is essential. A research institute has a wide range of projects with fundamental differences. The differences can also be variations in risk factors. Understanding risk, and risk management methods are therefore important.

3.1 Innovation and Research

To understand the difference between research and development (R&D) and innovation. It is important to set the two different terms in perspective. As it is possible to achieve innovation without R&D and it is possible to perform R&D without being innovative. However, there is a close relationship between the two terms as, the next sections will describe.

OECD (2002, p. 30) defines R&D as; "*research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.*" R&D can be broken up into three activities, basic research, applied research and experimental development (OECD, 2002) Simply put, research refers to exploring activities that a business chooses to perform with the intended result of a

discovery that will either create an entirely new product/service or strengthen an existing product/service with new or additional features. On the other hand, development refers more to the actual application of the new science, method, thinking so that a new and better product/service can take place. R&D can be described as a pillar for technological advancement and economic growth. Consequently, a relationship between scientific research and innovation is an important one (Lim, 2004).

Innovation is defined as "*the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD, 2005, p. 46). The innovation process covers a wide specter of different scientific, technological, organizational, financial and commercial activities, including investments in new knowledge, which should lead to implementation of technologically new or improved products, services, and processes (OECD, 2002). R&D could be one of these activities and can be carried out at different phases and stages of the innovation process. R&D can be the source of the ideas or as an incentive for the innovation processes, or being called upon at any point of the problem-solving or implementation process.

Innovation has different aspects and requires insight from different disciplines and approaches to understand the phenomenon (Fagerberg, 2015). Example, innovation is bringing together researchers with different backgrounds, which are trying to develop a common knowledge base and work towards a shared understanding of the phenomenon. Simply put innovation is the attempt to try out new or improved processes, products, or the way of doing things.

From an organizational perspective, innovation is a tool to improve the company's performance (Porter, 1980). Innovation does not occur in a vacuum (Fagerberg, 2015). Innovative companies, therefore, do not only depend on what happens inside the firm but also on the environmental context. Innovations could potentially increase the competitive advantage over competitors, allowing a higher market share. Example, a process innovation, a productivity-enhancing process innovation a company could gain a cost advantage over its competitors. In addition, a company can gain an advantage with more specialized products in the current market, diversify into new markets using new technology. Alternatively, utilize internal knowledge and technological capabilities to expand into new markets using existing technology (Brady and Hobday, 2011). Moreover, innovation in companies is usually referred to planned changes in the company's activities with the purpose of improving the company's performance. Whereas the company utilizes existing knowledge, new knowledge, insights or a combination.

New knowledge may either be generated by the innovation company during the innovation activities or acquired externally through different channels (e.g. consultants, purchase of new technology).

Moreover, a result of innovation and R&D is knowledge or technical spillovers (Jaffe, 1986) the benefits of creative innovation are rarely fully appropriated by the inventing firm. Companies that innovate by adopting the innovation can benefit from knowledge spillovers or from the use of the original innovation (OECD, 2005, p. 35). Meaning that companies or persons can acquire and use information created by other companies or persons without being involved in the process itself. An involuntary or voluntary exchange of useful technological information.

Innovation takes place under significant uncertainty (Rosenberg, 1994). Developments in knowledge, technology, markets, product demands and potential users can be highly unpredictable, although the uncertainty will vary in the different sectors. The adoption of products or processes or the implementation of organizational and marketing methods are also uncertain. In addition, the innovation outcome is also uncertain. It is not known from beforehand what the results of the innovation activities will be. Whenever, if it will be a successful project, or how much time and resources that are needed for adaptation or implementation of innovation.

Commonly it is distinguished between radical and incremental innovation. Incremental innovation, are improvements of already existing products using the existing technology base, is not about huge sweeping changes. On the contrary, firms that innovate incrementally tend to do so just a little bit at a time (Leifer, 2000). It usually empathizes on cost or feature improvements on existing products or services and is dependent on the exploitation competencies. On the other hand, is the radical innovation, which can fundamentally alter the underlying technological or market base of the business, such as disruptive technology. It can transform the economics of a business and requires exploration resources (Leifer, 2000 p.5).

In addition, the incentives for an innovation project could be different from the incentives for other types of projects. Innovation projects could either include a top-down strategic approach led my upper management, or unplanned bottom-up project from the researchers (Davies et. al, 2006). Top-down incentives often start with a common base strategy, as diversification into new markets/technology, expansion strategy and so forth. The common denominator is that there is involvement from management and it is assigned and delegated appropriate resources

to reach the strategic goal. The projects are initiated with a strategic focus with a clear goal to "manipulate" the future. The focus is to achieve the company's overall business objectives. Moreover, bottom-up projects are initiated at operational levels. Frequently used to initiate growth and diversification where the purpose is to use existing technology, experience, and knowledge as a seedbed to promote new experimental initiatives. Some of these projects can grow into separate business units.

Characterizing the complexity in an innovation process is not simple. Sometimes it is easier to describe its complexity by explaining what it is "not" (Fagerberg, 2015). Let us assume that innovation follows a "linear model." It follows linear steps, which consists of distinct stages. Firstly, research (science), then development, and finally production and marketing. Moreover, the fact that research comes first it becomes easy to assume that research is the "only" critical element. Which defends the interest of researchers and scientist and the organization, which they work in.

There are some problems with this "linear model" as Kline and Rosenberg (1986) highlighted. Firstly, it generalizes the chain of relationships that only holds for a minority of innovations. Meaning that some innovations come from scientific breakthroughs, but not all. Innovation in organizations is typically initiated because there is a belief of some form of commercial need, and can be reached by reviewing and combining existing knowledge and if this fails to work, investing or sourcing the research (Kline and Rosenberg, 1986).

Secondly, the linear model ignores the many feedback loops that occur between the different stages of the process. Shortcomings and failures could occur at various stages can lead to a reconsideration of earlier steps, and sometimes lead to potentially new and different innovations. All projects have some degree of dynamism because of projects definition "achieve a unique goal." Since it is unique, it contains uncertainty in different levels that most likely includes non-linearity. Non-linearity occurs when there is an interaction between two or more elements that could not have been predicted at the time the system was designed (Perrow, 1984).

Moreover, innovation, R&D and change are often dependent on project work, one-time incentives to launch new projects, processes, and ventures (Brady and Hobday, 2011). Innovation and R&D projects have an increased complexity compared to "standard projects." In addition, one of its most striking features is that the outcome might be very different from the initial specification but still valuable for the firm (Vicente-Oliva, et. al, 2015). It could create

value through unexpected product discovery, or value in the form of knowledge. The learning through an unsuccessful project could itself be precious and a learning experience for future innovation projects.

Another important characteristic of innovation and R&D projects is that collaboration is a key mechanism that facilitates sharing of ideas, resources, and power. Hobday (2000) argued that collaboration (example group dynamics) is viewed as a major success factor in many project-based industries such as engineering, construction and consulting. In this type of environment, collaboration is a challenge, because of the limited duration of a project, and collaboration needs to build and sustain in order to experience the benefits (Bourgault and Daoudi, 2014). Moreover, Bourgault and Daoudi (2014) defined three types of collaboration that are critical factors in innovative success, collaborative decision-making process (Diversified viewpoints, thought and ideas shared collective decisions), collaborative climate (shared understanding of norms, culture) and collaborative communication (mechanisms that manage interdependencies of the planned task, ensuring integration of individual contributions).

To summarize, innovation and R&D have a considerable complexity embedded in the processes, as they can be described as non-linear, and contains a significant number of unknowns. However, this complexity is contributing to the technical complexity. Towards a SPM system, the technical complexity is dealt with at a project level. Meaning that the project team is handling this complexity. Moreover, a PMS can address the complex nature in innovation and R&D by ensuring that the process and procedures to maintain good collaboration, strategic focus, and communication. These aspects can be addressed by selecting the right project management approach.

Towards a PMS system, the innovation process itself needs to be aligned with the organization and its needs. As a contributor to the complexity and its embeddedness in the research institute innovation and R&D processes needs to be controlled. The PMS will have to address this.

3.2 Value and Focus

The purpose of this chapter is to explore the value focus for a research institute. Understanding value and focus in a project can aid the project manager and project team in understanding what activities that should be focused on the project and what kind of attention they should have. It can be criteria's such as customer satisfaction, time, quality, and cost (Shenhar, and Dvir, 2007). Getting this communicated throughout the project and its participants are essential.

As competition increases, research institutes are investing substantial resources in R&D to gain competitive advantage and develop the economy (Jeng and Huang, 2015). R&D management is then necessary as it is optimizing the maximal use of innovations and technologies and keeping the company up with the pace of the technological developments. R&D projects are tools for the company's management to outpace competitors and obtain new information about new promising technologies and methods. With such new information, companies aim to defend and construct sustainable competitive advantages (Porter, 1980). More importantly generating knowledge during the innovation process is identified as an important source of competitive advantage (Bierly, et al., 2009). At the same time the organization generates new knowledge, it needs to sustain its profitability. The research institute needs financial stability and income in order to perform their main activities. This brings us to the value and focus; value can be categorized into tangible and intangible value. Tangible value is defined as assets that are capable of being appraised at an actual or approximate value (Merriam-Webster Dictionary, 2017), contra intangible value which is more subjective, such as assets that do not have a physical or financial embodiment. Furthermore, intangible assets are also referred to knowledge assets or intellectual capital (Nolan, 2011). Intellectual capital is the sum of everything everybody in a company knows that gives it a competitive edge (Stewart, 1997). One key component of intellectual capital is the intellectual material such as knowledge, information, experience, intellectual property. Moreover, intangible assets are usually directed towards R&D. key personnel and software (Nolan, 2011).

In a research institute, one can argue that the relationship between the value types are codependent, one need financial value in order to create intangible value and vice versa. Which makes a balance between the firm's technological capabilities (Urueña, et. al, 2016), strategy (Shenhar, 2004; Porter, 1980) and financial value generation are essential to be profitable (den Hertog, et al., 2010). In this statement, three aspects are emerging. Firstly, the firm needs to develop the technological capabilities, this through generating new and maintaining intellectual material. Secondly, make sure to develop the right intellectual capital (Nolan, 2011) and selecting the right projects through a strategic focus. Lastly, be able to generate profitability to grow and earn money.

Towards the PMS, measures to ensure a clear value focus can become an action to ensure better project success; it's mentioned frequently that having a clear project strategy (Shenhar, 2004) is a key for project success. To create the strategy, a focus or a direction is essential to create project vision (De Wit and Meyer, 2014; Shenhar, 2004).

3.3 Ownership and Control

For a research institute, the project ownership would vary between the projects. Some projects are contract-based projects initiated by an external customer. Other projects could be initiated from the research institute themselves to explore new knowledge, products, and technology, or investigate and optimize internal routines and procedures within the organization itself. Lastly, projects could also be a part of a research cluster. Out of these superficial examples, the ownership of the project would vary with different degrees of ownership. To understand this, the phenomenon of project ownership needs to be explored further.

Project ownership, simply put, distributes control and responsibility during the project duration. Meaning that the control rights and residual profit responsibility are distributed in the project (Olsson, et.al. 2008). The project owner bears the owner rights and responsibilities of the project and is partially accountable for the project's success. In addition, the project owner holds the business case (Morris, 1998). Meaning that the project is aligned with the organization's strategy. Furthermore, the project owner provides financial resources, monitors the project and accepts project forecasts, plans millstones throughout the project (Turner & Simister, 2000). Hence the definition from PMI (2013) *"The project owner provides the financial resources for the project delivery, accepts the project milestones, and eventually accepts the project completion."* The combination of control and responsibility for both cost and income from the owned resource put project owners in a unique position (Olsson and Berg-Johansen, 2016). A project owner should be responsible for the project at the business level. Meaning that the project owner should be located at the organizational hierarchy level where the responsibilities for project investments and operations meet. Lastly, the responsibility for day-to-day management of the project, are delegated from the project owner to the project manager, which should delegate the project to agreed objectives and deliverables (PMI, 2013).

In this interface between the project owner and manager can establish a principal-agent relationship (Müller and Turner, 2005). A theorem that in this case describes asymmetry in the relations between the project owner (principal) and project manager (agent). It could entail situation in which one of the two parties is better informed than the other and the instance that the parties do not share the same interests (Ceric, 2014). Moreover, the project owner depends on the project manager to undertake a project on the project owner's behalf. This can information asymmetry during the process and can entail, hidden characteristics, information, intention, decision making (Ceric, 2014) and can create mistrust between the partners (Müller and Turner, 2005). Since sometimes, the project manager has to make decisions on the owner's

behalf. This could be a decision that is based on information that the project owner do not have. Furthermore, this asymmetry creates tensions between the principal and agent. These tensions can be summarized into two problems, *the adverse selection problem* and *the moral hazard problem* (Moe, 1990). The adverse selection problem entails that the project manager (agent) have more information about the project than the project owner. The owner cannot be very certain about why the manager makes the decisions they do, and whether they are making the right choices on the owner's behalf. The other aspect, the moral hazard problem, is that the project manager and project could have a conflicting interest. In addition, will do what is best for themselves and act in their own interest, which is not necessarily aligned with the project owner's interests.

These two problems can create misalignment between the project owner and project manager (Müller and Turner, 2005). This can lead to uncertainty in the project deliverables, progress, budget, quality, schedule requirements, control mechanisms as there are no guarantee that, this information is communicated with the right intention. A lack of understanding of, e.g., the requirements or project context can prevent the project manager from understanding the overall strategic or business objective of the project, which can prevent them from full collaboration with the project owner, because of the difference in knowledge (Turhan, A., 2005).

To counteract these problems, communication and collaboration are key conditions for high-performance projects (Müller, 2003). Collaboration between the project owner and project manager facilitates a better understanding of the projects context, business case, and strategy can generate successful project. Moreover, the communication between the actors will change over the project life cycle, in the initiation phase, the bigger picture needs to be developed, and this will create a foundation for future decision-making in the project (Müller and Turner, 2005). Moreover, the information about objectives, specifications, and constraints are important during the planning. Moreover, in the execution phase, the manager needs to keep the owner updated with correct information on the project processes and progress.

In a research institute, there are three distinct ownership categories. The projects can be initiated [1] internally by the researchers or the organization, [2] externally by a customer or client, or [3] a consortium or research cluster where the research institute contributes with its aid and assistance could also be an option. The difference here is the project owner. Different owners would require various types of control, collaboration and information from the project side. If it is an internal project, example a bottom-up research project, the project group have the project mandate themselves and are more autonomous and independent. Sometimes the project owner

can be the project manager as well, meaning the project team is setting up the project specifications, limitations, goals, and purpose internally within the frames of the organization. On the other hand, a project initiated externally by a client, the organization assigns a project group fit to do the specified project within the project owner's requirement, limitations, goals, and purpose. The perspective changes, from being autonomous, to be heteronomous.

These differences need to be addressed by a PMS system, later, the study will explore different processes that can fit with the different degrees of ownership. As mentioned in the aforementioned chapters, the agent-principle theorem can influence the interaction between the actors. Moreover, it could be significant differences in an internal project owner and an external project owner. How are the various types of ownership affecting the projects in the organization? This is essential to investigate to create a PMS that can counteract adverse effects and principal-agent issues. That can arise in the projects, and in client relationships. This is investigated in chapter 7.

3.4 Risk

The nature of a research institute is changing the perception of risk; they are dependent on intangible assets such as knowledge. In addition, the research institute operates in a market, which is highly restricted by national and international laws, regulations and restrictions (Lam. 2001). Which naturally creates an organic framework and culture in coping with risk, as its being embedded in the day-to-day activities of the employees. To some extent makes coping with risk more natural. However, it has been stated that the nature of a research institute is relativity unpredictable and complex by nature. One of the key activities performed, research, is an unpredictable process, with a relative uncertainty 'roadmap' and outcome (Fagerberg, 2015). In addition, other factors could affect the projects uncertainty, as funding, allocation of resources, time, and technical issues to mention a few. The factors and variation will contribute to the overall complexity and uncertainty. This uncertainty forms the basis of project risk and constitutes the basis to engage in risk management.

Risks might be significant for projects containing unique technical elements or unproven technology, as science and know knowledge (Pinto, 2007). Therefore, risks for projects with new technology deployment should be identified, assessed, and managed through proper risk management. This process should be proactive rather than reactive in order to increase the likelihood of project success.

Risk management defined by the Project Management Institute (PMI, 2013) as "*the systematic process of identifying analyzing and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives*". Whereas project risk is the uncertainty event or condition, that if occurs can affect the project objectives such as scope, time, cost and quality negatively or positive (PMI, 2013). If the project risk occurs it, have a consequence over the project output and deliverables. The project risk can become a threat to project success; however, they can sometimes be accepted if the reward is higher than the consequence, or that the consequence is acceptable. Moreover, by anticipating and identifying the risk at the beginning of the project, it can become easier to create contingency plans for issues that may affect the project in the future.

Risk management can be broken down into four main areas (Pinto, 2007; PMI, 2013). These are risk identification, analyses of the probability and consequences, risk mitigation strategies, risk control and documentation. Each of these steps has their own individual actions. However, risk identification is selected risk identification, as it's one of the steps to assess the overall complexity of a project.

The process of risk identification is to determine the specific risk factors that can be reasonable to expect throughout the project. There is different type of risk; this study will investigate three different types of risk, as they contribute major to the selection of processes when managing projects. This definition will be used in later chapters. The classifications are extracted from PINTOs book "Project Management Achieving Competitive Advantage". They are described in Table 3-2 below

Table 3-2 – Selected Project Risk Factors

Risk Type	Description
Financial risk	Refers to the financial exposure the organization accepts when it develops a project. Risk where the consequences will affect the economy in the project
Technical risk	When the project contains unique technical elements or unproven technology or they are being developed under significant technical risk. This is a significant aspect in the nature of the research institute, as it is reliant on knowledge and intangible assets which are per definition hard to define and control.
Execution risk	As a project based organization, execution of high technology project may result in increased risk in the project. The project should fit with the current resources, processes, and facilities in the organization, without obstructing the other projects in the organization.

The different risk factors are defined. These factors are increasing the understanding and indicate the complex nature that the research institute operates in. These risk factors will vary with the project type. A project management system is in its simplest form a mechanism to counteract the risk and complexity that will arise between the organization, project, and environment. Understanding risk is therefore essential. Moreover, the risk is a broad term, and this is the reason why only a few aspects of risk and what it entails are inspected in this study. However, one can argue that ownership, project type such as R&D, innovation and so on are contributing to the overall risk.

3.5 Summary

So far, the technical complexities that are inherent in the nature of a research institute are explained. The projects are complicated, not only towards the output and input, but also the "road-map" to achieve project success. The project has intrinsic complexity at all levels, internally towards the technicalities in the project, but also externally, context, ownership and so forth. Meaning that there is a lot of variety in the projects, indicating, that a simplistic approach to project management is unbeneficial.

Because of these variations, the PMS need to be flexible and adaptable towards the complicated nature of projects. How this can be done in practice, is another question. The literature has little to now answer, in how a meta-project management system, such a PMS can address these issues in a research institute.

Moreover, compiling the answers and essence in the chapters above. In light of processes, one can encounter challenges in innovation and R&D by collaboration, and being aware that the process is dynamic and sensitive to change. Ownership, communication is essential, between the owner and project manager. The ownership can vary external and internal, which both requires different ways of communication. One can argue that internal owned project contra an externally owner project does not need the same attention in terms of collaboration and communication between the project owner and project manager. As the owner and manager are internal and have this can increase the transparency between the two parts, as it is possible to assume that they are both exposed or have access to the same information. These factors, including the risk inherent in the system, are complicating the projects, whereas a clear value focus and direction can be essential to reduce the number of uncertainties and set a direction towards the projects.

All these factors need to be addressed by a PMS, at the same time, meet the requirements from the organization. As stated before, the business relationship aspects are essential for a research institute; the PMS needs to address the nature and meet both requirements. This will be investigated further in the next chapter.

4 Project Management System

As mentioned from the chapters above, the project context such as innovation, R&D is complex. Besides, other factors such as ownership and value focus will affect all projects conducted in the organization. A PMS will have to address these issues, at the same time be fit with the contexts and environment of the organization. Moreover, this chapter will introduce answers for the general research question. To create harmonization between the organization and the projects one need establish a contextual and theoretical foundation before developing answers for the other research questions.

One can argue that PMS is a 'meta-level-thought model.' As mentioned in the introduction, one can look at the organization as a permanent entity and the projects as a temporary entity. Within a specific timeframe, one can argue that the organization is static, while the projects are dynamic and changing, per project definition. In mechanical physics, the interaction between the static and dynamic will create friction. Higher friction will result in slower movements, which results in a waste of energy. A PMS could become the tool that reduces the friction between the two entities.

Another reasoning could be "system theory" (Flood and Carson, 1993) where the PMS should be adaptable to the inputs and outputs. Continuing this reasoning standardized project management (SPM) is a tool to break down the complexity further. The SPM will become an action within the "black box" to increase the similarities between each of the projects. The effect of increase the similarities is to reduce the number of uncertainties and variations inside and outside the projects. Furthermore, it is a method of reducing risk. The input to the system is the perquisites and requirements from the organization and the projects, and the output is the project control systems, which should reflect the specified success criteria's in the organization.

A PMS is based on two perspectives the project perspective and the organizational perspective. One can argue that the project perspective is the bottom-up perspective and organizational perspective is the top down perspective toward the PMS. The project perspective will address the nature of processes and leadership from a project perspective. Also, recalling the complexity chapter 2.3, the organizational complexity and organizational perspective, and technical complexity and project perspective are well aligned. The system should address the reality by creating the right incentives and processes. Processes are not completed without addressing organizational capabilities. These capabilities can be described as passive and active capabilities towards projects.

A PMS have two control measures, the passive and active aspects.

The **passive** aspects concern applicable static procedures and routines such as standardization and SPM. These are created as a foundation towards project work. A passive system in this context can be organizational standards, which are initiated to maintain control and is an attempt to assure an optimal way of performing projects. This passive system could be standardized routines, for resource distribution, project mandate, project procedures, process control, quality assurance and so forth. As mentioned, they are initiated to ensure a control to simplify the and reduce the complexity. If followed these passive standards can contribute to the transparency within the organization, since the comparability between the projects is increased, since they have the same foundation.

The **active** PMS is a more dynamic and have a more participating or engaged approach towards project work. The active measures are then the system mostly existing of project professionals, controlling and guiding projects for the organization. On the other side, is the passive system, that is consisting of procedures and policies made for the PMS system.

Figure 2 is illustrating how a PMS constructed and how the correlation is between the different aspects. The input is the needs of projects and organization. In addition, the PMS is handling this and creating a desirable output. The PMS system is controlled and steered with passive and active elements. The projects are illustrated as a cloud, all the different aspects and varieties of the projects create a complex system. The cloud represents chaos, which reflects the widespread project reality, as described in Chapter 3.5
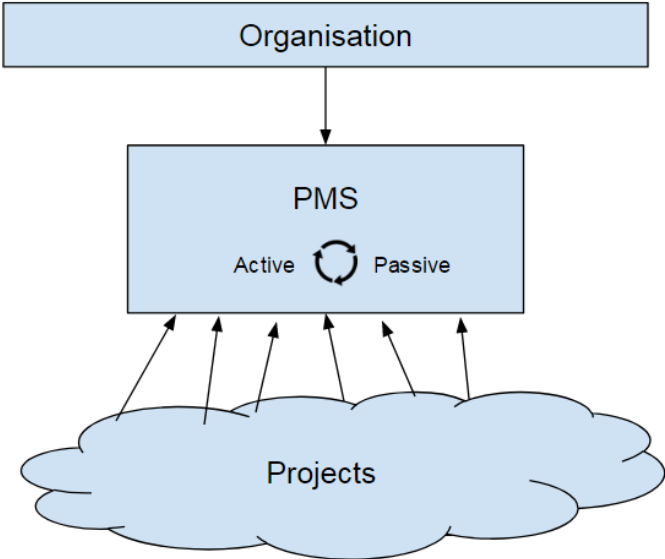
Figure 4-1 – PMS General Overview

Figure 4-1 is also describing the relationship between the passive and active aspects of a PMS. The active and passive system is not independent and stand-alone systems. Some active entity (organization, system, management, etc.) to make sure that the passive system is updated with procedures and routines that fit the situation. It is required a dynamic interaction between the entities. The entities are depended on each other, one of which corresponds to the other, and they govern each other.

So far, it stated clearly that a research institute has a broad range of projects, different focus, different ownership, different methodology and so forth. Nevertheless, in managing these projects, "one size does not fit all Projects" (Shenhar, 2001). This implies that projects need a more of project-specific management style and processes, different types of projects need to be managed in a variety of ways (Müller and Turner, 2007). The approach towards need so is adapted to the project type and environment, classifying the project characteristics then adopt an approach, instead of using the same method for all projects. In a project management system, the project leadership and the processes have been selected. As correct leadership is a key to project success. Furthermore, having the right processes will create a foundation that can enhance the interaction between the project and organization which could lead to increased efficiency and effectiveness, which again can result in greater success.

From an organizational point of view, creating the foundation for the right project processes will assist the project practitioner in selecting the right approach. The same with leadership, the right project leadership, can assist in reducing the complexity.

From the organizational perspective, this is measures that the organization can implement to achieve this control. Projects cannot be considered as singular entities (Engwall, 2004) and they need to be adapted to the organization. This chapter will not consider the specifics of the organizational structure, but the organizational measures that can be put in place for a potential PMS. Strategic alignment and implementation are necessary, and projects are initiated either as an alignment or enhancement of the organizational strategy. The organization will try to utilize its resources in the most beneficial manner to achieve a competitive advantage.

4.1 Active PMS

Active measurement put in place by the organization should assist and simplify the interaction between the project and the organization. This chapter will mention a few active functions that are proven to work in other project-based organizations. These are mainly program and portfolio management and project governance systems. Projects are commonly initiated and

governed within a context created by the management and governance systems within the organization. Project-oriented organizations such as a research institute, are complex organizations because of their dynamic and drifting boundaries and contexts. The number and the sizes of the projects are constantly changing, and they are using both permanent and temporary resources which are distributed between the portfolio of projects. In addition, the strategic business goals and objectives will vary between the projects both in the project and for the organization.

Active PMS is related to project governance systems as they are addressing the same issues. Müller (2012) defines governance as a framework for decision making and managerial action within an organization that is based on transparency, accountability and defined roles. It also provides a clear distinction between ownership and control of tasks. The aim of project governance is a consistent and predictable delivery of projects and programs in accordance with the planned contribution to corporate strategy and stakeholder's expectations (Müller, 2009). The purpose of governance structure is the alignment of the objectives at the different management levels of the organization to allow for most effective and efficient project planning and execution (Müller, 2009). Project governance should ensure a consistent and predictability within the limitations of the organization. When put in place an optimal project governance system will make sure that the project structure and the correct level of control are integrated into the project and design the projects to optimize delivery and reduce unnecessary complexity. Moreover, it is important that proper governance is conducted at all hierarchy levels in the organizations, as the board of directions, steering groups and project level (Müller, 2011). The board of directors needs to define clear objectives and strategy to achieve a governance structure as roles, responsibilities within the organization (Cooke-Davies, 2011b). In addition, it is the board of directors that influences the decisions of implementing potential steering groups, project management office (PMO) and program and portfolio management (PPM).

4.1.1 Steering groups

Steering groups should give governance and supports towards the projects (Crawford et al., 2008). They appoint a project manager and set the project's constraints. They perform project governance by providing resources controlling projects milestones and deliverables. Moreover, they can assist the project management when needed, and they are partially working as a support function towards the projects.

An effective steering group is necessary for project success (Lechler and Cohen, 2009). They should take an active role in steering, define initiated and control the execution of the project

throughout the project lifecycle. Some authors even mean that the steering group is the main decision-making body, and makes the significant decisions including approval of the project results and output (Zwikael, and Smyrk, 2011). Also, the steering group should have a sufficient mandate for decision-making on behalf of the organization about project results and resource reallocation. Moreover, commitment from the steering group is also a factor for project success (Kutila, et al., 2014).

Lastly, the importance of a well functional steering group is highlighted above. Moreover, it is crucial that the steering group members have sufficient time and interest towards the project. Therefore, they can guide the project manager towards success.

4.1.2 Program and Portfolio Management

To manage the dynamics of project-oriented organizations besides corporate activities, such as strategic planning activities, and continuous organizational development. Specific active and integrated functions, such as clustering projects in programs and explicitly managing the project portfolio, can be performed (Gareis, 2000). Program, portfolio management (PPM) can be defined as identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work to achieve specific strategic business (Filippov et al., 2010). Provides holistic overview and approach to management, increase the visibility of the ongoing project. To ensure the right balance of suitable projects. Balance refers to the view of the portfolio as a whole. If the project is covering the business needs, balancing the project in terms of project risk, market coverage and products (Loch, and Payne, 2011). Also, PPM can help the organization coping with complexity in dynamic environments, as contingencies can be built in the overall portfolio. Flexibility concerning resource allocation, distribute them whenever it is needed at the right time (Sanwal, 2007).

Moreover, a holistic overview of the projects in an organization creates the opportunity to map out the projects, as a series of interconnected nodes will help highlight the weaknesses in the existing project management approach. For example, nodes are likely to have high degrees of autonomy will require some thought. PM's should ask themselves whether "local" operating norms or "way-of-doing" in a given node are likely to support or undermine the goals for the project (Ivory and Alderman, 2005). If the node is problematic, PM's should consider whether it should be managed by introducing, for example, linking roles such as the project sponsor or other forms of scrutiny. Second, mapping out the project as a series of nodes and by identity which nodes may be problematic (Ivory and Alderman, 2005) and locate the resource needs to

manage the situation can be flagged at an early stage. In this way, the true cost of managing the project, as it is designed at given point in time, can be estimated.

4.1.3 Project Management Office

At the organizational level, the project management office (PMO) is a practice that could help handling complexity in projects. The PMO reduce the complexity by implementing the right standards in portfolio, program and project management level (Müller, 2011). A PMO will help to develop and maintaining PM standards and practice. The standards should be detailed enough to provide guidance. They ensure governance through resource distribution behavior control, support (consulting and administrative support) and development of PM's and practitioners (Dai and Wells, 2004). Lastly, PMO supports the communication between the projects and organization. Not only assist the internal communication between the project team members and top management but also can be extended to external stakeholders and customers.

4.2 Passive PMS - Standardized Project Management

To deal with complexity the research institute and practitioners both need to respond positively. Combined a collective creativity from the organization and the practitioner is required to engage in complex system development (Cooke-Davies, 2011b). The system should be adaptable for the particular project, and the knowledge of the project practitioners and the processes should be adapted and adaptive to the project requirements. This section will look at what kind of passive collaboration that the organization and practitioners can engage, embrace and drive for positive influences in delivering strategies and face the complexity. The organization can facilitate a common ground, between the projects and organization. This is common ground could be standardization of procedures, like reporting, documentation, education, tools, measurements and other PM practices, this can be defined as standardized project management (SPM). Milosevic and Patanakul (2005) includes seven factors which have an effort in SPM; project management tools, processes, leadership, project organization, information management system, metrics, and culture. It is expected that such approach will carry significant potential for performing project performance (Milosevic and Patanakul, 2005). In their study, Milosevic and Patankul (2005), researched the importance of these factors at an operational level and all the seven factors were validated towards projects in dynamic environments. In their research, four of the seven factors had little or no impact statistically on project success from an operational perspective; Standardized project organizations; Standardized information management system; Standardized metrics; Standardized project

culture. The other three factors standardized leadership, processes, and tools, did show a significant factor for project success. One can adapt these factors for a standardized PMS interface, as they both are on the interface between project and organization.

The next section will discuss how leadership, tools, and processes can be standardized in a PMS system, and what they should include from the organizational perspective.

4.2.1 Leadership

This chapter highlights the differences between a manager and a leader and are trying to explain important factors and the importance of a good project manager. As for processes, it can also be mentioned that the PM needs to be adaptable to the situation and what's expected from the environment. Moreover, it is also highlighted that project practitioners also contribute with coping with complexity. The PM cannot be dependent on himself only, but also a competent project team.

Sometimes the project manager of a complex project has vague knowledge of dealing with complex projects. They learn from previous projects and perfects their knowledge over time. They develop tacit knowledge (Nonaka, 1994) with what that needs to be done and becomes proactive in their management. However, these skills are learned over time, and they need to acquire this knowledge through previous experience. Project work is not only conducted downward (towards the project group) but also upwards (through upper management and influential external groups). This implies that project management as a profession should have a stronger theoretical foundation for understanding why people behave as they do and how this can affect the project (Cooke-Davies, 2011). The task of managing complex projects combines both project management and leadership. Leaders inspire people to follow them, and managers get people to carry out work.

Leadership is an important factor in coping with complexity, developing practitioners with the appropriate method of project management is needed for successful projects. It is a distinctive difference between management and leadership and complementary systems of actions. Both are necessary for success in an increasingly volatile and complex environment. In complex environments, good management brings a degree of order and consistency and prevent merging of chaos. Moreover, leadership is the ability to cope with the change in the environment (Kotter, 2001). These two functions, coping with complexity and coping with change, are the key characteristics of management and leadership.

A manager is a problem solver, who looks for best ways to achieve a determined goal, makes sure that the project is operating efficiently, consistently and according to plan. In contrast, leaders create vision, motivation, inspiration, create meaning and develop new and fresh solutions to long-standing problems. "Leaders do the right things; managers do things right" (Kotter, 2001). A modern PM requires a balance between the attributes, of a leader, and of a manager. Simply, projects are sites where new ideas are performed into tangible outputs and where vision becomes a reality. The PM is responsible for two systems, vision and exaction and direction and the planning (Shenhar, 2004). They have overall responsibility for the execution of the project and make sure it meets its expectation at a higher level, and the project's output is aligned with the top management's expectation. They will have to revisit and deal with the business assumptions apprehended at higher levels, define the product and its market expectation and most important, identify and articulate a clear project strategy (Shenhar, 2004).

A standardized project management system can assist in selecting the right project manager towards the project's characteristics. Meaning that the project manager's knowledge and skill are aligned with the project context. By characterizing the projects from beforehand, it should be able to select the right project manager. A consequence of standardizing the PM's skillset and way of thinking can result in a linear way of performing project work. Which again, can hinder project success. Projects are per definition unique and may require different approaches towards the specific type.

Standardization of leadership in this interface is not to make the entire team of project managers act the same way, or to become similar. Moreover, standardization of leadership is to make sure that the PM is equipped with the right knowledge. Standardized leadership in a PMS is to focus on the project practitioner's skills, such as business skills, project skills, interpersonal skills, intrapersonal skills, technical expertise, leadership skills, management skills and so forth. Many of these attributes are required to manage a complex project successfully as mentioned in the chapter 4.1.2 and are connected to interpersonal abilities and emotional intelligence of the PM (ICCPM, 2012; Cooke-Davies, 2011; Collyer and Warren, 2009; Müller and Turner, 2007). This means other developments become necessary, for example, an increased understanding of cultural differences, to bring more insight in managing multicultural teams. Good leadership and an understanding of group dynamic could enhance a project group's performance (Johnson and Johnson, 1991).

To standardize project management towards leadership could be done through education of the project practitioners. Education could increase the awareness of the projects, complexity,

environment, purpose and other factors that affect the project. To gain the ability to reflect on the situations and adapt to the critical situations is essential, especially when handling complex projects. Another goal is to get PM's to both lead and manage (Shenhar, 2004). Managing provides functions of planning, organizing and controlling projects in the most beneficial manner. Leadership adds the development of project vision, communication the vision and motivate project participants. A sum of these will enhance the PM as a role (Shenhar. 2004). If a project deals with high levels of new material, then the PM's knowledge needs to be correspondingly high (Cioffi, 2006). Moreover, a mix of education and experience is required; after all, one would not trust a newly educated doctor to perform surgery without specialist experience or supervision, even though the knowledge needed is existing. Knowledge does not come overnight, and awareness is needed, so people's existing knowledge is not neglected. In addition, they create a shared language, which facilitates experience exchange and development of the methods.

Education will assist the project practitioners to reflect on what they do in project work, and increase their perspectives (processes, models, and management techniques), and will give them more valuable experience in the field. Education will create shared terminology and knowledge for project management which creates a professional environment.

4.2.2 Processes

A process is a series of actions taken to achieve a particular end. Each process is characterized by its inputs, the tools and techniques that can be applied and the resulting outputs. Processes will vary and differentiate on the different levels of project management. The Project Management Institute (PMI) have divided the project management processes within two main categories as shown in Table 4-1 (PMI, 2013).

Table 4-1 – Process Types (PMI, 2013)

Project management processes	Processes that ensure an effective flow throughout the project lifecycle. These processes comprehend tools and techniques involved in applying skills and capabilities described in the knowledge areas. These processes are general and can be used in different projects, disregarding the project type.
Product-orientated processes	These processes specify and create the project product. These are typically defined by the project lifecycle and varies by application areas. These processes are more on a technical-level and requires basic understanding on the specific product. If this is not present, the scope of the product will be hard to define. For example, a research project may require different procedures and tools that are determent by the environment, complexity and specifications of the project.

As the project management system is a project meta-level, this study will focus on the project management processes within the research institute. One of the pitfalls is that projects management tend to have a mechanistic thinking, where the majority of tools and processes are based on a hierarchy, division of work, linear cause-effect relationships and so forth. The traditional analyses of projects have been described as linear, suggesting an assumption of a strictly orderly project that progresses in distinct and predictable stages to completion (Rodrigues and Bowers, 1996). This includes an assumption that all the information is available at the start of the project, allowing the design of an optimal plan and the only concern of management is to keep the project on the specified track. The traditional techniques are based on a detailed breakdown of the project into work packages and activities; this permits the construction of equally detailed schedules and budgets for the control of the project and provides the basis for operational decisions such as resource allocation and time-cost trade-offs. The unconditional use of project management standards (e.g. processes directly adapted from the PMBOK®) are criticized, and a misfit between specific project characteristics and the chosen management approach is seen as a major source for project failure. The underlying hypothesis of this perspective is that project success is related to the choice of the "right" management approach related to specific project characteristic (Cooke-Davies, 2011; Müller and Turner, 2007).

Moreover, traditional methods should be used in a more responsive manner (Rodrigues and Bowers, 1996); it should be deployed within the dynamic environment of the classical control feedback loop; the original project plan is used to set targets, which are compared to the project progress, when it deviates, actions should be taken, and the project plan should be revised.

Project management needs to be more dynamic, responding to new information and adapting the plan to the new situation rather than keeping rigidly to the original. Since most projects can rarely be managed by applying standard methodologies that are designed to be used in different context. Remington and Pollack (2011) figured out that experienced PM's selects tools, techniques, and approaches dependent on the situation. If these tools, techniques, and approaches were non-existent, they were created to fit the purpose. Creating a map over available techniques, methods and models can aid the management of a complex project and simplify the processes. In addition, a correct response, recognition, and understanding of the feedback are required to make the proper migrating actions (Cooke-Davies, 2011). A proper system in place would help with the correct decision-making in the project, by having most information as possible.

This whole chapter is dedicated to the importance of adaptable project management processes towards the project type and specifications. Traditional methods can be a viable option as long they are used in a responsive matter, and that there is required a continuous feedback, between the project and the processes, so the project plans and procedures can be adapted to a possible dynamic environment. The PMS needs to address these issues and create contingency plans for the specified project type.

Toney and Powers (1997) argued that standardization of processes as approaches and procedures are organizational success factors. Standardized processes could be information sharing processes, communication processes, reporting processes, whereas all the PM's use the same standard interface. Standardized and structured repeatable processes that provide a good flow in the project sequences, as the end of phase stages, milestones, activities and major deliverables for each project. Flexible processes can be merged into a system that encourages and states how to adjust and adapt the standardized processes for different project types and needs. In the end, an integrated PM processes that link the project with the overall strategy to provide an integrated business perspective into the projects (Milosevic and Patanakul, 2005). This will create similarities and create predictability in the PMS system, which in the end will reduce the overall system complexity. Moreover, facilitate a common ground for the projects, which allows them to be compared on the same measures, at the same time improve the strategic alignment and enhanced value focus.

4.2.3 Tools Variety

Most standard PM methodologies carry an implicit assumption that a particular set of tools are defined in a certain order, and all the tools in the methodology will be applied. The term "tools"

comprises the practical tools and methods used in projects. Moreover, tools need to be integrated with the standardized processes, where each process deliverable is supported by specific and standardized project management tools. There should be a balance between simple and advanced tools, but they should be compatible with what is required in the project environment (Milosevic and Patanakul, 2005). As mentioned Tools are not completed without addressing organizational and individual capabilities. This brings us to the next step of this study, which entails creating a tool that can be used to ease the tensions between the organization and projects in a research institute.

4.3 Summary and Overview

PMS can ensure a proper and structured approach to the diverse range of projects that are conducted in a research institute. In this, case, structured implies the procedures and methodologies should open up the possibility to assess and select the correct approaches towards each project type. A PMS have different perspectives and need to address the needs from the organization and projects. Figure 4-2 the overview of the PMS. System theory is used while creating the system. This approach is selected because it creates a systematic and organized overview of the PMS. It creates a simpler illustration to describe the complex nature of a PMS and its aspects. It shows the relations between the active and passive and the input and output.
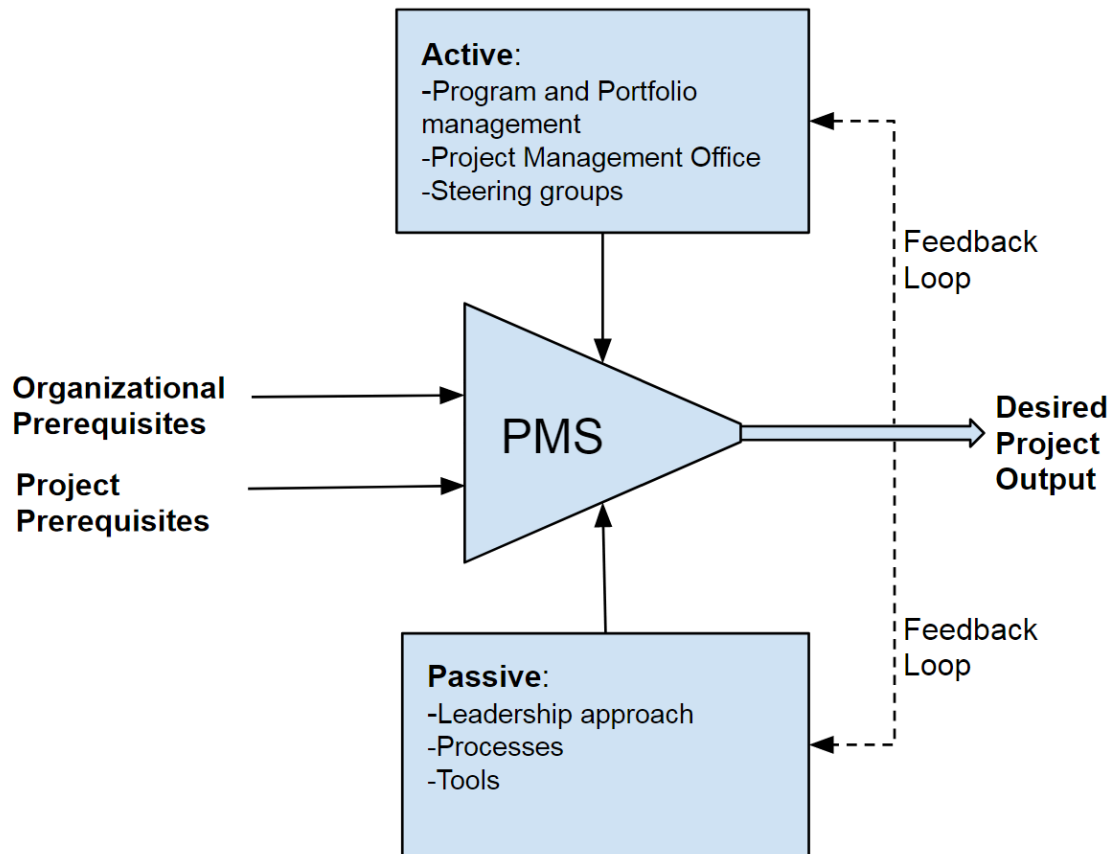
Figure 4-2 – PMS Specific Overview

The PMS is modeled in Figure 3, which has two inputs; these are organization and project perquisites. These are requirements and needs from the project and organizational environments. The PMS itself are merging these perquisites and are generating output. The output is in this case a suitable project management approach which is related to the context. The output is monitored with a passive and active feedback loop. The passive and active feedback loops have its foundation in the passive and active PMS elements. The purpose of the feedback loop is working as a control system, to adjust the system to maintain a correct project management approach. This enables the system to adjust its performance to meet the desired output response.

These are potential actions in order to create a PMS. Moreover, it is not clear in theory or research what factors which will result in the highest efficiency towards success in this interface. Moreover, recalling the overarching research question, one can start resonating an answer.

Can meta-level project management system (PMS) harmonize the interface between the organization and projects, in a research institute?

The immediate answer is that, yes, a PMS can harmonize the interface between the organization and project needs in a research institute. However, it needs to be the right PMS including the right factors such as project governance, steering groups, PMO and PPM. These active factors will be supporting the organization as a whole and will ensure governance through resource distribution, behavior control, support (consulting and administrative support) and development of project managers and practitioners (Dai and Wells, 2004). In addition, PPM, will assist identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work to achieve specific strategic business goals (Filippov et al., 2010). A successful research institute should be able to demonstrate its commitment to service excellence across all divisions. One way to accomplish that is to invest both time and money in standardizing project management training (Nicholas et al., 2002). However, implementing a PMS contain PPM, PMO, well functional steering groups, knowledge learning systems, PM development programs and so forth, will require a lot of resources and does not necessarily increase the efficiency and effectiveness in the organization. It is false to assume that a large PMS containing many actions will solve the 'friction'. There are a few reasons, more actions in the PMS will increase the complexity within the interface, and a potential overhead cost can ascend. Higher maintenance, operational and developing costs will occur on the PMS. To counteract this the PMS, should be adapted towards the context, and selection of the different aspects have to be a result of this context. Next aspect is the passive system, how can passive elements such as standardization enable a sustained PMS? This leads the study to the RQ 1.1 and 1.2.

1.1 How can SPM contribute to the PMS in a research institute?

1.2 What aspects of a SPM system is most advantageous to standardize?

One can argue that standardization is a passive measurement that do not require the same level of resources as the active measurements. This is one of the rationales for a standardization focus. There are several ways to develop a good PMS, but this thesis will continue to focus how standardization can be a tool to ease the tensions.

One way of ensuring project success is by selecting the right project management approach towards (Müller and Turner, 2007; Shenhar, 2004) the projects, meaning the right processes and leadership. One should select the project manager with correct knowledge and experience

to meet the perceived complexity in the project. The same goes for processes, a different value focus in a project could result in stricter or freer way of managing the project.

To develop a PMS that are contributing and harmonizing the interface one has to go one step further. The standardization system cannot be linear; it will have to be dynamic and flexible. A linear response to a nonlinear reality will not grasp the overall situation and various aspects of the situation. The standardized project management, need to be dynamic, so it is fit to the non-linear and dynamic reality. This can be done by selecting processes and leadership that fits with the project context. As argued, the project context is not static. The next step is to identify what aspects of a SPM that can be standardized. A SPM can be everything from reporting, procedures, routines, communication channels, information systems and so forth. To identify what aspects that can be standardized the study will investigate a live research institute. The study will explore the different aspects and needs from the PMS. This leads us to a flexible approach that is defined by the characteristics from the different projects that are conducted in the research institute.

Figure 4-3 is a model of how a SPM system can be illustrated. It can be presented as a funnel, which is creating a standard approach to the project reality. This approach should grasp the complexity in the organizational and project environment. The main purpose is to reduce the uncertainty by standardizing leadership in the organization, processes from the organizational and projects perspectives, and standardize the tools used in managing the project. These are all incentives to optimize the project output and effectiveness in the organization.
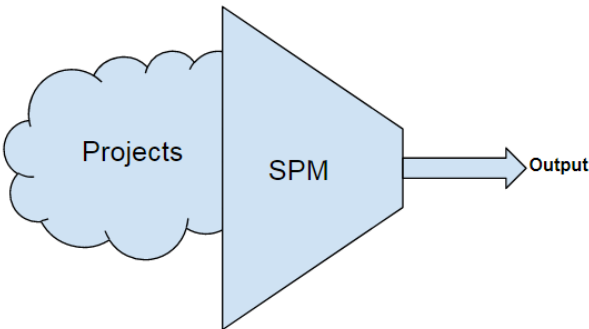
Figure 4-3 – SPM Overview

The projects are represented as cloud, see chapter 3.5. As it contains a lot of variety and complexity, combined the organization wants to measure this variety by having a standardized interface. to create a common ground.

As stated, the project is complex, and a linear response to a dynamic reality is not efficient. To create a flexible approach towards the projects and its variances the projects should be split up beforehand. This can be done through a categorization system. To create a project category system, one need to address the practical difficulties and complications in projects. In this case, projects in a research institute. One this is done, it becomes possible to create a practical PMS containing specific SPM procedures. This will be a merge between theoretical and practical findings.

5 Methodology

The overarching research question can have several answers depending on the perspective. To create a context, the general research question has been broken down to specify the answer. The selected perspective is standardization, and the context is a research institute. This makes this study an exploratory case study. Exploratory research is used when the topic or issue is new and when data is hard to collect. Exploratory research is flexible and can address research questions of all types (what, why, how). It is hard to conclude in an exploratory research, but it provides a better understanding of the problem (Saunders, et. al, 2016). In this study, a research institute is a focal point.

1.1   How can SPM contribute to the PMS in a research institute?

1.2   What aspects of a SPM system is most advantageous to standardize?

2.1   What identifies the current PMS in an active organization?

2.2   To what extent are the current PMS affecting the project practitioners in the organization?

The selected methodology will provide answers to research questions 2.1 and 2.2. Which again creates a foundation to answer research question 1.1 and 1.2. Combined the answers will give a specified to the overall research question. These answers will have a practical and theoretical foundation to the overarching question, of how a PMS can harmonize the interface. The PMS cannot be static, and cannot simply rely on a single data point; the research design will counteract this by extracting information from different project practitioners in a case company.

Previously, the research institute has been broken down to several perspectives, contextual, project, and organizational aspects. To study the PMS, the study focuses on the persons responsible for the project- and organizational interfaces within the organization, such as project managers, steering groups and project owners. The thought behind investigating these aspects is to get a deeper understanding of a PMS system and to explore the needs of the organization and from the projects. This will give information about what aspects that can be standardized and what that needs to be flexible.

Different theories and their aspects towards the potential issues towards research institute are investigated and explained. A challenge is that the theory is mainly not derived from 'projects in a research institute' studies, but from slightly different research that describes the different phenomena and subjects in a more general manner. This makes the study exploratory. It will

create concepts and discuss merits and demerits with a PMS interface and how standardization can be a tool to make this interface more efficient. Hence the choice of design and methodology. In addition, this is amplifying the importance of getting an insight of the specific needs and how a PMS can cope with the complex environment, combining theory, practice, and observations, in a research institute.

5.1 Research Design

Research designed can be described as the framework for generating the evidence that is suited the certain criteria's and to the research questions that the author is interested in (Bryman, 2016. It creates a foundation and structure for collecting and analysis of the data. There are several design types, such as cross-sectional design, longitudinal design and experimental/related designs and so forth (Bryman, 2016). Moreover, this study has its foundation from the case study design. One of the reasons this design is selected because it fits the specific criteria's such as timeframes, availability of resources, and the researcher's experience and knowledge. In addition, a case study fits the context of the thesis. The case study has the possibility to bind the theoretical concepts and embed it in a practical context.

PMS is a practical system, addressing how to manage the interface between an organization and projects. The more projects the organization have, the higher need for a PMS. Moreover, the case study is a good design to answer questions, which begin with "how" or "why" (Yin, 2011) as described in the research guide Table 5-1 at page 48. These questions are targeted to a limited number of events or conditions and their interrelationships in which is a good methodology to restrict and specify the information and RQ in this thesis. Yin (2011) continues with arguing that case study is a good approach to study the [1] meaning of people's life under real word conditions, [2] represent the views and perspectives of the people, [3] converting contextual conditions within which people live, [4] contributing insights into existing or emerging concepts that may help to explain human social behavior and lastly [5] striving to use multiple sources of evidence rather than relying on the single source alone. These factors are aligned with the purpose of the thesis and are evaluated to be a suitable design for the thesis. Moreover, it enables the researcher to create a theoretical foundation, containing factors that need to be considered in a PMS.

The nature of this study is to explore a PMS and the needs from the project practitioners at the different levels and departments within the organization. Project practitioners are in this thesis used as a term covering all human roles in each project, including, project members, managers,

owners and steering groups. Investigating the research institute and how it conducts project work will give a foundation to answer the RQs. In addition, it will make it possible to generalize a PMS for the research institute. To be able to generalize on an organizational level the research is conducted on project participants in different projects and department. This to obtain a holistic perspective of project reality in the organization. This can be considered as the unit of analysis, the project's specifics and organizational specifics are not in the main the focus, but is the interaction from a process perspective within the organization which is in focus.

5.2 Interview guide

To collect information and data from the project practitioner's semi-structured (Dalen, 2004) interviews was conducted. This approach was selected to access each project practitioner's individual interpretation and understanding of a PMS. This method will also provide answers of the person's perception and opinions about project work in the case company. Other qualitative methods could be used, such as a survey, but a survey would not have accesses the personal interpretations and feelings towards project work within the organization. A survey might increase the data foundation and numbers of data nodes, as it would enable more project participants to answer it. Moreover, this approach could be potential miss out relevant information that a semi-structured interview would catch up.

The interview guide was developed in two stages. The first stage was to construct open-ended and direct questions that could create a foundation to answer the RQ embedded in the thesis. Then add questions that were descriptive and open enough which enabled the project practitioners would provide sufficient information regarding the project, organization environment, and context. This interview guide was tested on two subjects in the case company to be confident that the response was at a satisfying level and quality. A short analysis of the answers was performed. This made it able to revise and review the interview guide so the answers could reflect the purpose of the study.

The questions were categorized by different topics, and subjects which combined provides an overview of the situation, options, and history of the specific participants. Categories and rationale are explained in Table 5-1 below. The full questionnaire is displayed in Norwegian in Appendix 1.

Table 5-1 – Questionnaire Categories

Category	Rationale
1. Formalities	To establish a relationship with the interviewee and to become aligned and familiar with each other. The interviewee was informed about the about the academic background, research design and process, and purpose of the study. At the same time informing the interviewee about confidentiality, anonymity, and recording during the interview. Another aspect of this process, is to create a relationship between the parties so it would become less intrusive and to create a friendly environment.
2. Introduction	Questions about interviewee's academic and formal background, work history and experience. In addition, questions about previous and current roles in the company and practical experience towards project work. These questions were asked to get familiar with the interviewee's history.
3. Project specific characteristics	Questions about a designated project. The questions concerned the project-specific characteristics and how it was controlled, followed and reported by the project practitioners. These questions gave a foundation of each individual's insight towards the project, and can potentially create contrasts between the selected projects. In addition, the answers would give a general perspective of the different projects and the special characteristics that can appear in a research institute.
4. General project characteristics	Questions about general project characteristics for all projects conducted by the research institute. This to explore the different perspectives and perceptions of the project practitioners towards project work within the organization.
5. General project management and governance	Questions regarding how the projects are controlled, example, towards time, cost, reporting, and quality. In addition, how the project practitioners perceive the difference between the projects. These questions were exploring the potential difference between the projects and at the same time has the potential to describe the autonomy of the project practitioners.
6. Official procedures and routines	Questions about the formal procedures and how they correlate with the project 'reality' at the research institute. These questions were designed to get an insight of the PMS of how the current standardized procedures are used and accepted by the project practitioners.

The order of the question categories is developed intentionally. The category order will first access the project practitioner's information opinions regarding a project he/she is familiar with before the more difficult questions are asked. The questions in section 2-3 are simple, direct questions that the interviewee can answer simply, as they are familiar and related to their workday. The questions in section 4-5 have no clear answer, which pushes the interviewee to think and resonate the answers. Analyzing these answers can reveal the project practitioner's perceptions, needs, and opinions towards project work in the research institute. Another

reasoning for this interview order is to set a good atmosphere and build trust, by gradually increasing the difficulty of the questions.

In addition, the project practitioners have different angles a PMS, the project owner and steering groups have a top-down perspective towards the PMS and the project managers have a bottom-up perspective. The questions were created to be fit to both perspectives. These specific perspectives become clear in the project specific category (3) and in the project management and governance questions (5).

Questions in category 6, was asked at the end of the interview, this to prevent priming (Meyer & Schvaneveldt, 1971). Simply put, Priming is an implicit memory effect where exposure to one stimulus influences the response to another stimulus. If questions about the "official procedures" were asked earlier in the interview. There would be a chance that these procedures would be referred to when the interviewee was answering the other questions. Priming is a potential issue that could arise in this type of study. To extract as much information about the current and ideal PMS without mentioned keywords, such as standardized procedures, which could guide the participant with answers that were 'correct' according to the formal procedures. To counteract potential priming during the interviews all the questions regarding the current PMS was asked in the end.

5.3 Data Collection

The process of selecting the samples can be defined as purposive sampling (Yin, 2011) as the samples are chosen to provide most relevant and significant data towards this study. The unit of analysis can be considered as the project practitioners belonging to different levels, projects and departments in the organization. The focus is not the project or organizational specific information. But how the persons in the organization and projects interact, and how this interaction is controlled and organized.

With the aspect of time in mind and cooperation, coordination, and dialogue with the company contact person. A broad and specific sample selection were selected. These samples existed of project practitioners mainly, project owners, project managers, department directors, and research directors from different departments, hierarchy level, projects and seniority in the research institute. This selection will provide a board perspective of what is expected of a possible PMS system. The project owner, steering group and project manager for each project were interviewed. This resulted in a sample size of 11.

Due to anonymity detailed description of each individual interview object will not be described. Instead, the subjects will be grouped into groups. Project owners, department directors, and research directors will go under the same term, department heads. The sample data are not presented individually e.g. in a table, as it could expose the individual's identity. The sample group is generalized and described as a collective group. See 5.5 chapter for more information about anonymity and sensitivity.

Project Mangers – Five project managers were interviewed, each of them had a seniority between 5-10 years within project management. These project managers managed small to large projects. They are also present at different departments in the organization and have different project contexts to give as a broad perspective of the project managers needs in the organization. Generally, the project managers, have a Ph.D. or similar within a special knowledge area, which is not connected to project management as a discipline.

Department Heads – All six of them have the role as project owner and participate as members in steering groups. The steering group usually consists of department heads and the project owner. They have a seniority varies from 20 -30 years within the organization and have extensive knowledge about the organization, both current and present. The department heads are also belonging to different departments, varying from the administration to the more functional departments. Several of the department heads are also members of the leadership group in the organization, which are considered as the highest hierarchy level in the organization.

The interviews were conducted during a span of two weeks, with mainly one interview per day. Prior to the interview, an information letter (Appendix 2) was sent out, with the purpose and reasoning behind the interview, this to get the interviewee on to date on why this research was conducted. In addition, this was a tool to save time in each interview.

All the interviews were conducted in a quiet one-on-one setting and in a sound isolated room to prevent external disturbance. Both participants were advised to turn the cell phones on silent mode to avoid external distraction. The interviews did not all take place in the same location, as the case company had offices in different geographical locations.

The 11 interviews were recorded and transcribed. The overall duration of each interview lasted from 30 to 40 minutes, where the average interview lasted for 34 minutes. The recording was a natural choice as a tool for this study, as a lot of different information would arise during the interviews. The recordings would allow an in-depth analysis of what actually said, permitted

repeated examinations, and lastly, help the encounter personal biases with examining of what is actually said (Bryman, 2016). During the interviews, jotted notes or scratch notes were written down; a few words or short sentences have been drafted down to help to recall something that was observed, something that was said or something that happened during the interview (Burgess, 1991). These notes were used to create a more in-depth understanding of the interview atmosphere.

Last note, due to anonymity, and sensitivity, all notes, transcriptions and recordings will be discarded at the end of the studies duration. This was one of the perquisites for cooperating with the research institute.

5.3.1 Observations and Interaction

The researcher was located at the case company for a total span of three weeks. This opened the availability to observe and get familiar with the project practitioners. This resulted in informal communication with the employees in the research institute. Resulting in increased understanding and insight with a broader perspective of how the project practitioners worked in the organization. This understanding made him aware of potential issues and problems, that enabled and encouraged him to discuss project problems with the different project practitioners. Another effect of this resulted in a 10-15-minute discussion after each interview. In this discussion, the various observations and jotted notes were discussed with the interviewee. This discussion was not recorded and became more informal and relaxed which enabled discussion of irregularities, observations and other issues that raised during the interview and other observations. This resulted in a faster and broader understanding of context of the case company. At the same time, it gave the interviewee a good perception of what the study wanted to address and investigate. To gather the data from these discussions, summary was written immediately down after the discussion ended.

5.3.2 Formal Documents

Data from organizational documents are used as a foundation when presenting the case company and its routines in chapter 6. These documents are not referred to in the text due anonymity. The formal documents consisted of annual reports, documents of the official procedures and the project handbook. The documents were collected from the company contact and the organization's formal web page.

5.3.3 Findings References

This chapter describes how the acquired data is presented. In addition, elaborate on the data foundations for the presentation of findings and case company description. There are two main data foundations; these are the [1] interviews and their transcriptions, and [2] the formal organizational documents. The observation also has a significant effect that backed up the findings when analyzing and coding the interviews. The observation assisted this study by bringing more clarity, behind the interview context. Table 5-2 below are describing where the background data is gathered.

Table 5-2 – Foundations for the Data Presentations

Chapter	Data Foundation
6 Introduction of the Case Company	Formal documents
6.1 Organization structure	Formal documents
6.2 Management and Hierarchy	Formal documents and observations
6.3 Current Project Management System	Formal documents
7 Empirical Findings	Interviews and observations

5.4 Thematic Analysis of Raw Data

Selecting the right approach when analyzing and coding interview data is essential. The analytical strategy will affect the discovery of patterns concepts and insights that are intriguing a relevant for the research question (Yin, 2014). Creating the right associations and relationship between the theoretical concepts, information, and themes of interests creates the infrastructure needed to evaluate and analyze the material. This study is using the concept of thematic analysis when analyzing the data from the interviews. Thematic analysis is an analysis of qualitative data that refers to the extraction of core themes that can be distinguished both between and within the transcription and creates identification of the main themes of the data (Bryman, 2016). A theme is a category identified by the available data and is related to the research focus and research questions. Moreover, the approach provides the researcher with the basis for a theoretical understanding other data and can contribute to the literature depending on the selected research focus. The analysis is based Braun and Clarke (2006) six stages of a thematic analysis;

1. Familiarize the data by reading the material and get aquitard with the material and its structure. This was done by transcribing the data into written form. And reviewing the original transcripts.

2. Generating the initial codes by systematic reviewing and organizing meaningful parts of the data and categorizing these into similar codes. Generate the initial codes by documenting where and how patterns occur. Coding of the interviews is defined as "the process of breaking down, examining, comparing and categorizing data" (Strauss & Corbin, 1990). Specific data was looked upon, such as repetitions, frequency, similarities and differences between the project practitioners and data related to project theory. The codes from the transcripts were aggregated and combined into an excel document. Each interview object got a number, and the number was added if the codes repeated itself. This created an overview of the most frequent themes and statements.

3. The codes were then extracted, combined and categorized into different themes. The themes were identified by investigating patterns, relationships and similarities of the data. The following themes were developed; [1] project specific related themes, [2] project manager Theme, [3] steering group theme and [4] official procedures theme. These themes were created with a foundation of the interview guide.

4. Reviewing, combining and merging similar themes into higher-order themes. The themes captured and proved an insight to the captured data. The correlation between the themes and how the data correlated with the themes was examined from a theoretical perspective. Generating themes that were more fit towards theory. This was done by grouping and clustering similar codes, and understand the underlying reasons for each code. Creating correlation between the codes specified the data. Sub-themes were generated in each main theme. Table 5-3 is an overview of the generated themes and subthemes. The result can be found in chapter 7.

Table 5-3 – Thematic Analysis Themes

Main Theme	Subtheme
Projects	• Ownership • Risk • Value • Difficulties and Challenges • Variations • Organizing
Project manager	• Role description • Expectations to department heads (Steering group, project owner, line manager) • Differences • Ideal
Department Heads	• Role description • Expectations to project manager • Differences • Ideal
Official procedures	• General • Project handbook • Reporting • Bureaucracy

5. Defining and refining existing themes that will be presented in the final analysis assists the researcher in analyzing the data within each theme. At this phase, identification of the themes essences relates to how each specific theme affects the entire picture of the data. The data were collected and extracted in a PMS, whereas the different aspects were categorized into the structure, which contains, PMS environment and context, active elements, passive elements and their interaction. The result of these steps is defined in chapter 8.

6. Constructing the report.

The specified themes used in this study was selected to fit the scope of the study. The themes are influenced by the PMS, SPM and the knowledge of developing ta project categorization system later in the study. This affected the coding, as it was a realization to find factors and data that corresponds well with a categorization system.

5.5 Ethical Concerns

On the grounds and nature of the thesis, all information from the interviews is handled with anonymity. The perspectives from the different levels and between the projects contain sensitive information. To obtain a greater trust and to get the interviews speak more freely it

was decided to anonymize and generalize the findings and their descriptions. Another reason is that the project practitioners do not have the same reality and understanding when it comes to project work, and there can potentially exist conflicts between the different hierarchy levels. One of the intentions of the thesis is to be informative and open up different perspectives and questions. Being able to identify the specific source is not important for this studys' results and findings, but the information extracted are. The information is then generalized to make the information untraceable to the specific project practitioners. Each project case descriptions and descriptions, in general, are generalized. An example is shown in Table 5-4.

Table 5-4 – Generalization of information

Specific	The organization is implementing an enterprise resource planning (ERP) system to get an improved process flow and optimize the resource distribution for the company.
Generalized	The organization is initiating an internal change project to increase the efficiency

(Note: these examples are not related to the case company)

The purpose of each description is still clear, and the descriptions still have enough information to be usable for this thesis.

However, this will not affect the findings, as the specific description of the individual project or project practitioner is not that important. For the reason that the PMS system should influence the interface between the organization and projects, and it is possible to cluster and categorize the project in types without mention project specifics. The same goes for the project practitioners; the general needs can be generalized by looking at the different project practitioners as an individual, collective groups, and clusters, such as project managers, project owners, and steering groups. Moreover, different needs will arise between the project practitioners and the projects; these changes will be addressed through the discussion.

As for ethical issues and conflict of interest, the case company has not participated in the work of the thesis. They have been involved in the process of collecting data and to select the scope of the thesis. The findings and study are developed by the author himself with mentoring and guidance from the NTNU supervisor.

5.6 Research Evaluation

This chapter will evaluate the study. The study will use Lincoln and Guba's (1985) trustworthiness as evaluation theory. This approach has been selected based on the nature of the study. As an exploratory case study, trustworthiness is essential. The study is identifying and creating a PMS outline for a research institute. This is making the evaluation of the method and process essential to gain trust and establishing a credible study.

Trustworthiness relates to the credibility, transferability, dependability, and conformability in the study (Lincoln and Guba, 1985). These factors or criteria's acre consisting of external and internal validity. According to Bryman (2016), internal validity is concerned with the soundness of findings that specify as a causal connection. External validity is relevant to set the findings in the qualitative results in different context and see if the findings can be generalized.

Credibility – Is addressing the confidence in the 'truth' of the findings. It is related to internal validity. There are several techniques for establishing credibility in qualitative research. Prolonged engagement (Lincoln and Guba, 1985) is selected as the main technique. Time was spent at the case company, to learn and understand the culture and social setting of interest. In addition, observing various aspects of setting, dialogue with a range of people and develop relationships with the employees. This constructed trust between the researcher and members. In addition, the PMS theory was developed before spending time at the case company, resulting in an understanding of a meta-framework. This also allowed theoretical discussion about the PMS with the project practitioners in the research institute. Another measure to increase credibility was to make sure there were several data points with a different background. This to produce an understanding based on several perspectives in the organization.

Transferability – Is related to showing that the findings have applicability in other contexts. Related to external validity. Thick description is a measure to address transferability in qualitative research (Lincoln and Guba, 1985). Thick description entails describing a phenomenon in detail, so one can evaluate the extent the drawn conclusions can be transferred to other times, settings, situations, and people. This is an exploratory study and to make this possible there are a few assumptions in this study which narrows down the scope. First, a PMS is developed and explained at a meta-level, then narrowed down to a research institute, then looked upon on a standardization and SPM perspective. This narrow scope and approach to a such a broad system, limits this study, making it difficult to apply the findings in different context. Moreover, the general answer and explanations of a PMS and SPM can be used in other

contexts. Since the overall logic of a PMS can be applicable to different project-based organizations. The rationale and purpose of a PMS would be the same, the details would, however, change with the context. The developed SPM and PMS are only applicable to a research institute.

Dependability – Addressing that the findings are consistent and could be repeated. PMS is a general framework, which can be applied in several contexts. The data is collected with a PMS in mind. Because of this generalizability, the findings are mostly depended on the organization type. The individual project practitioners are clustered together into representative groups, where one side are presenting the projects and the other organization. The overall concept of a PMS and SPM can be generalized into a different context. Furthermore, the specific findings such as the categorization system are solely dependent on a research institute context. Lastly, as an exploratory case study, the findings are related to the context and the case company.

Confirmability – Addresses the degree of neutrality or the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest. To some extent, this study is subjected to investigators bias. The researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for the purpose, the findings considered most appropriate, and the framing and communication of conclusions (Malterud, 2001, p. 484). The factors for the categorization system were outlined before the analysis to narrow the scope and to create a focal point in the study. To some extent, this was affecting the findings. Same goes for the PMS, it was broken down and elaborated with theory and measures that will make it effective. This made it easier to find conflicts when coding and thematizing the data. The conflict between ideal theory and findings from interview had an effect on the analysis. Lastly, the interview guide was created with correspondence with the company contact person and the NTNU supervisor, to counteract investigator bias. However, the main incentive to counteract these effects was frequent meetings with NTNU supervisor were also a measure to counteract these biases.

5.7 Limitations

The first limitation is based on the nature of the research methodology. Exploratory research is typically not generalizable to the population as a whole (Saunders, et. al, 2016). Meaning that the specified SPM system created will be difficult to apply in other settings. Moreover, the

results of the selected methodology are not useful for decision-making by themselves, but the findings can provide significant insight into the situation in the research institute. Although the results of qualitative research can give some indication as to the "why," "how" and "when" something occurs, but makes it difficult to reveal the frequency, «how often" or "how many" (Bryman, 2016).

As for the data collection, there was not a balance between the project manager and department heads in the organization. The cluster of department heads was more widespread, meaning that they represented the organization from more perspectives than the project managers. The majority of project managers belonged in two of six departments. This can indicate that the findings are more related to the specific instances in the research institute and limits the generalizability.

How this will affect the findings and development of the PMS and SPM systems are unclear, as the system are aimed to address the organization as a whole, and are trying to fit the various project context. One can assume the project context in the organization would not change with a more diverse range of project managers because the project context is a compilation with the perspectives from department heads and project managers. Making all the departments in the organization represented.

For data representation, all the interviews and transcriptions were in Norwegian; the transcriptions were translated while analyzing. Meaning that there is a possibility that the context might have been lost in translation. A counter mechanism to this was to make sure that the context was described in a suitable and in-depth manner.

Lastly, time limitation and duration of the thesis limited the number of interview objects and created a narrower scope in the study. More interview objects could enhance the findings and open different analysis and perspectives. However, chapter 10.7 suggest further work. Work that could have been performed if there was more time.

5.8 Personal Reflections

This is the only chapter where I, the author will use personal pronouns. During my years as a student, I have managed to distance myself from the usage of personal pronouns.

This thesis is a massive extension of an earlier specialization project. This project was related to a PMS system but was only investigating three different project types, which were separated in terms of complexity. This was the early development of a PMS. In this study, I have extended this PMS excessively and created a foundation with information from a project-based organization.

I would say the main characteristics of this master thesis is broadness; a PMS is a comprehensive system, that manages the interface between the organization and projects. This was one of my major challenges, and I used a lot of time to narrow down the scope of the thesis. There was little to no literature which has defined this interface before. This master thesis is an attempt to create a system and model it to visualize the system, at the same time illustrate its importance. The system is at the project meta level and is containing processes that address this level. It has been a challenge to perform a literature review with this perspective, especially for a research institute. Finding articles and literature dedicated to a research institute were not easy. To narrow myself and the study early on, the different challenges in a research institute was identified early; these factors were ownership, R&D, and risk. The theory was then built around these factors. The value factor was developed with my background from courses like strategic management and program and portfolio management. These factors assisted in narrowing down the focus and scope of the thesis. In addition, selecting a standardization perspective aided the scope of the thesis a lot.

The research question was influenced by the case company's expectations. The case company had a wish to use their project handbook as a point of departure. I have used the handbook as the focal point of the study. This is a reason why standardization and SPM were selected concepts. The communication with the case company was done through a contact person, who was involved in the study since the beginning. The contact person also aided me in contacting and identifying persons of interest within the company. This resulted in a broad range of relevant project practitioners.

For the empirical findings, results and their presentation, they may seem not so optimistic. I decided to focus on the problems that occur in the organization, for the system I am trying to develop, it becomes easier to address the problems and gaps in the research institute.

Last comment, I have an engineering background from micro- and nano-systems technology, this have made me used to qualitative studies and experimental research, which usually includes experiments, statistics, and detailed descriptions. This makes a qualitative study new for me, and to represent the findings and analysis became a challenge. I used a lot of effort in analyzing and transcribing data to create an empirical foundation.

6 Introduction of the Case Company

The purpose of this chapter will introduce the case company before presenting the empirical findings. This chapter has an objective nature and is based on facts from RESINC. The description entails the structure, management and the current standardized procedures. The descriptions are generalized and collected from formal company documents and observations. See table 5-2 in chapter 5.3.3 for more information.

The case company, hereby given a fictive name, and referred as RESINC, was founded around 60 years ago and today it has between 500-700 employees distributed over seven departments. The departments and administration are mainly located in the same geographical areas. Each department is specialized in their own area ranging based on their research fields. The annual turnover of the company is around 1 billion NOK. Their vision is to be international leaders, in their industries.

The projects conducted by RESINC are generally segregated to the separate specialist department, where few of the projects can be considered cross-sectional. This segregation also applies for the departments, whereas each department has their own culture, procedures, mentality, and frameworks towards project work, as further investigated in chapter 7.1.2. Detailed descriptions of the dissimilarities will be elaborated in the empirical findings chapter. The nature of RESINC is defined by highly regulated industries, this because of the high-reliability and complexity if the industries. These regulations are either international regulations. These are developed and created either by an international committee or by national laws. Simply put, the research institute needs to oblige these rules and regulations to be allowed to operate in the specific industry.

Moreover, RESINC is dependent on contractual projects and are functioned as a CRO. As mentioned in chapter 2.2, a CRO needs to have a 'service mind' to keep client contracts; this means that delivering on the right time with the right quality is essential.

6.1 Organization structure

RESINC is divided into several functional departments. That have a foundation in different scientific domains. Commonly, these domains are distinguished from one another, based on their natural characteristics and the natural markets. Moreover, each department is divided into several sub-departments, which are functioning as a matrix organization, illustrated in figure 6.1. The sub-departments vary from functional to specialized departments based on the research

fields. Simply put, each department works as a matrix organization, with its own department director, line managers, and project managers. Figure 6-1, is a conceptual illustration, briefly displaying the organization structure of the case company to give the reader a better insight of this study.
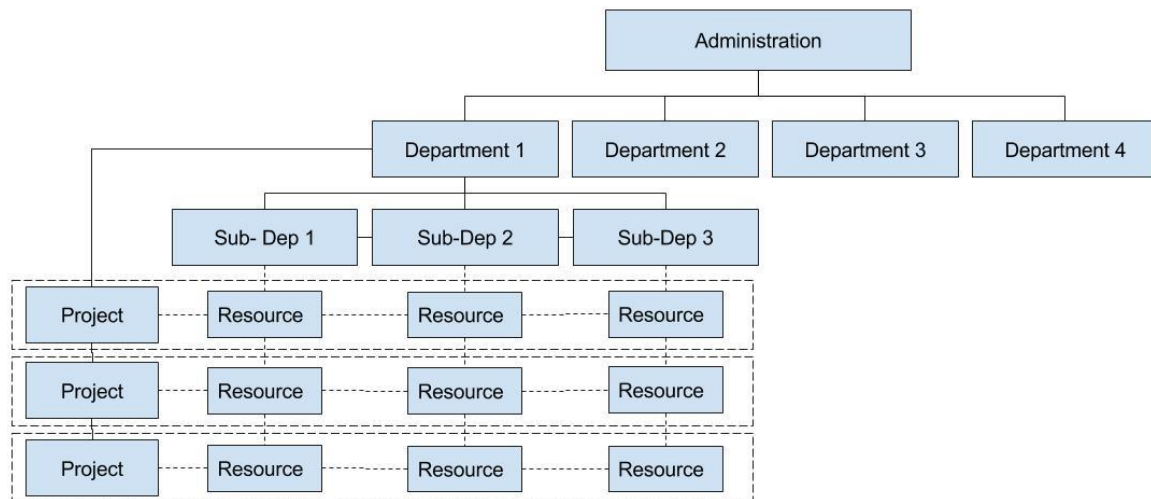
Figure 6-1 – Organizational Structure Case Company, RESINC

The departments are as mentioned, divided by their technology areas, and the sub-department are divided into specialized areas. This is further explained in chapter 7.1.

6.2 Management and Hierarchy

As mentioned chapter 2, a research institute is reliant on highly specific knowledge. This is also reflected in the RESINC. RESINC is a highly competent CRO with experts and researchers in its fields. Most of the researchers are highly educated within their knowledge domain.

RESINC has two main career ladders; one is as a researcher ranging from incremental sets from junior researcher to senior researcher. The other ladder is management, ranging from project manager to line manager. This opens up of different career trees for the employees within the organization.

As a matrix organization, there designated managers for each project, department, sup-departments and other functions such as HR, economy. These managers are interacting to distribute resources between each other. The specific interaction between these levels will be specified in future chapters. This study will look at the interaction between the organization and project. This is shown further in chapter 7.1.2

6.3   Current Project Management System

RESINC has a broad range of projects varying from internal change projects to international research projects. The projects are controlled by a designated project manager and steering group. The steering group has delegates from the involved line departments and sub-departments and central management.

In addition, RESINC has their own project handbook that is a tool for the project management. It is standardizing the organization's project methodology containing a board range of routines and activities. The purpose is to standardize the project management in the organization to achieve more control and increase project success by following developed routines.

The project handbook entails project control mechanisms during all stages of the projects, ranging from initiation, planning, execution and termination phases. These control mechanisms are usually documentation templates and routine and process flow systems. Table 6-1 below provides a detailed overview of the project handbook content. The data is extracted and rendered in most authentic manner. In addition, the organization has standardized the financial reporting function through a digital platform.

Table 6-1 – Project Handbook – Rendered Contents

Activity	Description
Project execution document	Contains the main activities throughout the different stages in the projects, and which of these are mandatory or not. In addition, defining the role that is responsible for that activity.
Template for project mandate	Describing the project formally. Including the project, start-end date, client project owner, and manager, resources, document handling, goals, frameworks, budget, mission, risk and future possibilities. The project mandate is created internally and in the initiation phase of the project.
Template for quality- and control plan	Describes the project from a quality perspective. Includes a checklist of factors and activities that should be evaluated to achieve a satisfied quality level. The quality concerns quality two aspects, the quality of delivery and project quality.
Template for project plan	Project plan containing guidelines for progress, billing, resource needs, internal/external reporting, risk handling and future possibilities. This plan should create for all projects and the project owner have to approve it. Project manager needs to review it throughout the project.
Template for internal status reporting	Template for reporting and evaluating project status internally. Concerning, project progress, project deliveries, availability of resources, risk, possibilities, HSE or other deviations from the plans. Each of these factors is evaluated in a high, medium and low system with predefined thresholds.
Template for external status reporting	Status reporting to the client, contains economic usage, project progress, and deviations. Also, contains a description of changes in the project plan.
Template for internal termination report	Divided into three parts: A. Achievement of fixed objectives and goals. Focusing a comparison of economic factors, actual vs planned cost, and achieved income. Also regarding project deliverables. Evaluation of actual and planned completion time. B. Objectives and goals, evaluation of planned and actual project goals and objectives. In addition, entailing, if there were any unexpected discoveries. C. Evaluation and learning. Contains actions and events that disrupted the project progress. Evaluation of the overall quality, answering questions if the project meets the quality criteria's. General evaluation of the project execution containing, internal/external communication, resource distribution, project planning, risk. Lastly, it assesses potential learning objectives and suggestions for continuous improvements.

The project handbook has detailed checklists and document templates that the project practitioners must follow, as it is one of the official procedures. The handbook will be analyzed further in chapter 8.3.1.

The projects usually have a steering group, which are following up the projects from the organization. The steering group usually consists of department heads and the project owner. Their main activities are to ensure that the project fits with the financial situation, organizational needs, and requirements. They are reviving reports and inquiries from the project managers, which they use as a foundation to make decisions and guidance towards the projects. They do not follow any specific formal procedures such as an agenda but are flexible enough to handle the potential issues that could arise during a project, such as resource problems and prioritization. Their goal is to have a holistic perspective and understand the interaction between all the projects.

Moreover, the project handbook is describing the different functions and responsibility areas in the projects, outlined in Table 6-2 below. This table explains how the various project practitioners should contribute towards the project work in the organization. It becomes clear that the different roles have different responsibilities towards the projects. This study will not analyze the specific roles and how they are perceived in reality. Moreover, the study will investigate the interaction between these roles.

Table 6-2 – Project Handbook – Role Definitions

Role	Description
Line manager	The line manager with budget and result responsibility are responsible for making description if a task or activity should be considered a project or not.
Project owner	Formal responsibility for the overall execution of the project. in addition: • Responsible for the overall economic and knowledge responsibility for the project. • Make sure that the project has the correct resources to achieve planned goals. • Appoint a project manager. • Approve project mandate, plans, and budget. Approve changes that will affect the project mandate and budget. • Approve the project proposal, communication, and delivery to customers. • Have an internal termination meeting in the project. The handbook also defines that the project owner is responsible for appointing a steering committee. Additionally, it is common that the project owner is also the leader of the steering group.
Project manger	• Have knowledge and economic responsibility with the foundation of the project mandate and upper held plans and frameworks. • Organize, plan, control, approve and report results, activities, and resources within the project context. • Develop project mandate, project, quality and control plans. • Responsible for archiving project documents and important information, and make sure that the documents are updated with the newest information. • Responsible for communication with customers. • Responsible for economic reporting and that it is registered correctly. Control and follow up bills and invoices.
Project worker	• Execute activities within their expertise and execute activities from the PM's instruction. • Report activity progress and risk to the PM. • Report problems, obstacles, and complexities that can affect the project.

This table is highlighted to get an overview and descriptive information about the different project practitioners and what their official standing is towards project work in the organization.

7 Empirical Findings

This chapter will contain the empirical findings from the interviews. The data will be presented systematically, and contain information extracted from the interview transcriptions and observations. The process is described in Chapter 5. The organizational and project findings will be presented first. Then the findings towards the interaction between the organization and projects will be presented. The findings of the current PMS and SPM will be presented. The figure 7-1 below describes the structure of this chapter. It is following the same structure as the PMS in chapter 4, and in the introduction chapter 1. It contains organizational and project perspective and the interface between them. This approach is selected to structure the findings into a structure fit to the study.
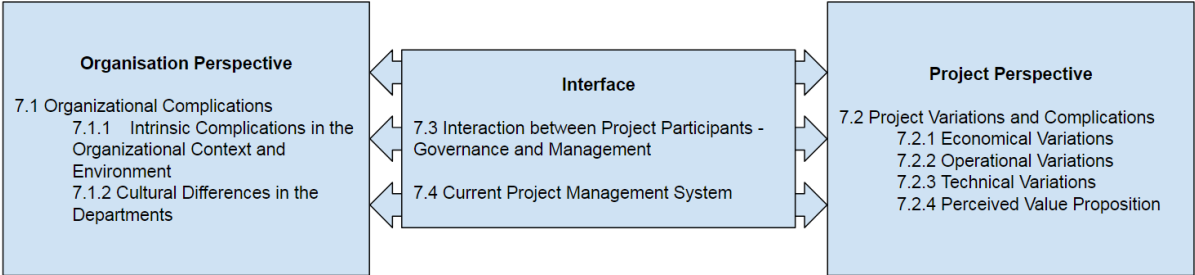
Figure 7-1 – Structure of the empirical findings

The reason for this structure is to introduce the complicated context of the research before presenting the findings in the interaction between the projects, organization, and PMS. This will create a more self-explanatory of why this interface is difficult to manage.

7.1 Organizational Complications

Multiple findings have its origins in the organizational aspects RESINC. Organizational aspects, in this case, is issues and complications that arise mainly from the organizational structures and the differences in the different departments in the RESINC. These findings are significant, as the PMS needs to address the various aspects.

The objective organizational structure can be considered as a matrix structure, as mentioned in chapter 6.1. which itself leads to some problems, such as a challenge in balancing resources, coordination issues and fuzzy leadership issues as the project member must respond to the department director and the project manager. Moreover, the following chapters will highlight other special issues that complicate the organizational context.

7.1.1 Intrinsic Complications in the Organizational Context and Environment

As highly reliant on generating 'cutting edge' knowledge, resources and facilities to maintain their competitive advantage, several issues can arise. These factors need to be handled by RESINC, which must have a structure that can support the organizational context. In the following chapter, the findings related to the organizational contexts is highlighted.

7.1.1.1 *National and International Laws and Regulations.*

RESINC must follow different international laws and regulations. This is more reflected into the various departments. Some of the departments have stricter regulations due to their high-reliability research field. Some departments also have more demands regarding quality assurance and documentation.

The complications here is that these relegations must be followed strictly and overrides internal procedures. This is a contributor to the project work culture in the different sub-departments as the employees follow different regulations and procedures. This creates differences in the way of working, whereas some departments have few regulations, others have to follow strict documentation regimes, and other departments have a different perception of risk. This is systematically adding more issues to handling when these actors are interacting with each other.

"Because one of the department special regulations, the system has to be customized to their specific needs" – Department Head

7.1.1.2 *Balance between Projects and Operational Factors*

RESINC has to constantly manage their resources and prioritize operational functions and projects at the same time. Operational functions and activities cannot be neglected. These are operational activities, logistics, maintenance, improvement, and safety issues. The challenge is that most of these activities are drawing resources from the same "pool" as the projects. Which significantly complicates the prioritization process between the two entities. The effect of this balance will have an impact on each other, and the consequences are not always easy to forecast.

7.1.2 Cultural Differences in the Departments

Laws and regulations are affecting how they work in the different departments; this is one contributor to the different culture regarding project work in RESINC.

Another factor has its foundation in the structure and how the different substructures are divided. All the departments have different substructures that are mainly divided into scientific knowledge areas. These 'knowledge' departments are based on specific knowledge areas that belong to the specific departments. This creates the interaction between the other sub-

departments different. In some instances, the resources from the sub-departments can be looked upon as a supplier for the project, where the sub-department only needs to finish their work package. Then they are finished with the project. This can be considered as a passive collaboration attitude towards the projects.

"Sometimes, the project members are acting like they are suppliers towards the project"
– Project Manager.

This statement came from a project manager in an internal research project; the project uses technology and resources from different departments. The project is an exploratory project, and collaboration is needed for project success. This supplier perspective makes the collaboration effort more difficult

Some other departments have structures based on functions instead of knowledge areas; these areas are based on the operational function. This creates different relationships in the project work, as the different resources should have a more symbiotic relationship towards project work.

This creates different attitudes to project work; this is also related to individual contributor and perception of project work. Generally and simplified, it can be looked upon as a reactive versus proactive attitude towards project work. This is another aspect, which makes it difficult to manage projects, especially cross-departmental projects.

7.2   Project Variations and Complications

RESINC has a comprehensive range of projects, the project can vary from a one-man, one-day research project, to projects involving several departments and millions of funds. The deliverables could be a research report, feasibility study or a commercial product to mention a few. Moreover, some characteristics can be derived from the projects, since there are significant differences between the projects itself. These differences are caused by the project's nature and context. These variations and differences can be summarized down the following subjects.

7.2.1 Economical Variations

The project funding varies with the type of project. External projects can vary between hourly charges to fixed price. One of the issues here is that the nature of the projects is hard to forecast in terms of resources. This unpredictability can reduce to reduced economic return. This especially true for research projects, as the output and project success is hard to predict.

RESINC is handling these issues by generating a formal contract between the involved parties. This contract addresses these uncertainties and addresses the consequences if the project becomes unsuccessful.

There is also variation in the contract; some clients have their own contracts RESINC must follow. These contracts are usually more extensive than RESINC normal contracts. The large clients also have a larger resource pool in terms of lawyers, which affects the negotiation of the contract economic terms. This will vary with the client size and expectations.

For internal projects, the perception of economy changes, it becomes a bit more informal. The findings suggest that the requirements and processes for financial reporting are not as strict as in an external project. There is a more ad-hoc focus, and the economy is not evaluated with the same precision as for external projects. A question here is which department are taking the economic risk, and how the economic funding is distributed throughout the organization. Some departments have a more stable economic flow than other departments, and the economic flow is balanced.

General perception from the steering group is that the economic capability and knowledge in the projects are not good enough, resulting in insufficient and undetailed economic reporting in the projects. This complicates their function as a steering group as its difficult to make decisions on a subjective foundation.

7.2.2 Operational Variations

One major contributor to the operational variation and its procedures are the client. RESINC has to adapt to the requirements of the client. The client could have routines and reporting functions in which the research institute have to follow themselves. This could affect the content of external reporting, frequency and the overall content of the reporting function.

"Some clients are maybe too interested and close to the project, this make the project more difficult to manage" – Project Manager

This is also affected by the client. Some clients are large and have the knowledge or internal specialists about the project and the scientific area. This affects the project practitioners as the requirements and specifications are becoming stricter which results in a different way of managing the project. Other clients do not have the same knowledge and are giving more power to RESINC and trust its findings and reporting. This power balance is varying between the clients and project types, especially towards client handling.

In some instances, the client has different suppliers, this will require more coordination and communication between all the involved companies in the project. RESINC also have to balance these projects with the current portfolio of projects.

The projects have to fit the organizational routines and client's specifications. The organizational routines are described in chapter 6.3 and should be followed. The relationship and project work becomes more complex in these instances.

Another aspect related to the operational project variance is the common perception that the organization's project maturity is relatively low. This means that the understanding of project as a discipline is lacking, which results in less efficient projects. This creates difficulties in managing projects, as the project team may be faithful to old routines and mentality.

"I feel my department are used to work on projects, I don't get the same impressions of the other departments" – Project Manager

In addition, routines that are not common on an organizational level. This will be elaborated further in Chapter 7.4.1.

7.2.3 Technical Variations

There will always be variations in the technicalities and technical complexity in the projects. Moreover, the understanding and specifications can change during the projects. Variations and uncertainty can arise in the interface between the project and the external client. In some instances, the client does not know what he/she wants. This creates additional uncertainties in the project, as the contract have to be understood by all project participants. In terms of understanding the actual needs, requirements and specification from the client. At the same time, deliver the project on the right time, quality and price.

7.2.4 Perceived Value Proposition

The different variances, economic, operational and technical, will also affect how value is perceived in the projects.

"Researchers do not like to do anything halfway… this can be a reason for over-deliveries" – Department Head.

An interesting finding is that the external projects are prioritized by RESINC because they are the main benefactor for economic income. At the same time, the major perception of project work is characterized by over-deliveries and delays. An over-delivery is when the work package or deliverables are completed with better quality and results than planned. This can be explained

by an over ambitious project team and the lack of understanding contractual terms. The project members are usually researchers, and when they are motivated towards a project, they want to perform and execute each work package with the highest perfection, excellence, and quality. Which sometimes results in over-delivery of the work package. The consequence is that the project member is using more time on one work package, which results in less time for other work packages. This is creating a chain reaction, which could be a reason for delays in other projects

The value proposition will also affect the prioritization and attention the project gets both from the researcher's point of view as elaborated above, and the organization.

Mentioning over-deliveries, it is natural to mention time delays in the projects. The delays in the projects will vary, but there is a common consensus from both project managers and department heads that the project nature makes it hard to make proper schedules and plans. This usually results in variations from the initial plan and in some instances delays. How this is perceived by the customer varies, some customers are willing to accept this delay other are not. Moreover, the project manager handles these situations by having a dialogue with the customer and the project owner. If there are too large delays, the issue is reported to the steering group to allocate the proper resources and response to the situation.

"There is usually a fight to get resources, internal project will have high priority if they are related to operations, the same goes for projects related towards safety, then comes external projects" – Project Manager

It is true, as the quote remarks, the critical operations, such as maintenance of high-reliability equipment have first priority. Then safety-preventing projects, then the external projects. Last in the prioritization list are the other internal projects, such as change and R&D projects. Another special instance is the perceived importance of the internal project. There is a tendency that internal projects, especially directed towards internal improvement are neglected, as the there are people in the organization do not see the importance of the project. This can also happen for an external project, where project members, do not perceive the project output as important and do not prioritize effort towards the project.

7.3 Interaction between Project Participants - Governance and Management

This chapter will present the findings of the project managers, and project governance system in RESINC. The project governance is, in this case, the steering group, project owners, and

department heads, which participate in the overall governance of the projects. There will first be a description of their role, and then expectations between them.

7.3.1 Project Owners and Steering Groups

Firstly, the steering group members are usually department heads, research directors and other people with a key position in the organization.

Their current interaction with the project managers is characterized by monthly reports, and status meetings two times a year. They are also available on an ad-hoc basis if some issues could occur during the project processes. The project owner is usually the steering group leaders.

The steering groups are expecting the project manager to do his job, create good reports, keep good communication streams internally and externally, and highlight cost and time overruns.

Some special findings are highlighted:

- The project owner and steering group are more relaxed when there is an experience project manager working with their project. This makes them leave more responsibility on the project manager and focuses their time on other activities.
- Steering group and project owners have a consensus that the organization can become better on project control and governance. Moreover, this is something they are working consciously towards.
- There is also a common realization that the project managers in RESINC are researchers and some of the project managers are being promoted too fast. They are aware of the assumption that good researchers are not synonym with a good manager.

Towards what is ideal, the steering group wishes in general that it were more knowledge towards business and management in the organization. This is also affecting the reporting, as there is a lack of risk and economy reports. It could be better routines and procedures for this.

Regarding the project meetings, the steering group wants to have the reports ahead of time so they could have a chance to be familiarized with the reports before the meetings. The same time some of the steering group members feel that there is not enough time to actually get familiar with the reports ahead of time.

7.3.2 Project Managers

The majority of project managers have a history of being researchers and project members; over time they have been promoted to project managers. Most of their skillset and knowledge in

project management are obtained over time and experience. The minority of the project managers have any formal education and training in project management. The project managers control and govern the project by using meetings and communicating via emails and face-to-face communication. Moreover, due to the complicated contexts (See chapter 7.1 and 7.2) the project managers have created an ad-hoc style of managing projects.

There is a common consensus among the project managers that there is an inadequate level formal procedures both towards processes but also in terms of reporting and guidance from the steering group and project owners.

There are few expectations and requests for information, plans, and reports. The project managers, plan for themselves to achieve personal control over the project. They make sure to follow routines and keep the expectation towards the client. Towards the organization, they report through a monthly report. Some of the project managers feel when they submit a report; they do not know what value the report generates in the organization.

"After I send it, I have no idea what's happening with them… I feel it will just be stored somewhere in a drawer" – Project Manager.

The project managers do not feel the commitment from the organization and feel that they are alone with the project responsibility. This is affecting the motivation of managing projects as they are working with high autonomy and wish there was more commitment from the organization and steering groups.

Another finding is that the project managers, have created their own procedures and own style of managing projects. To make their own projects more efficient and streamlined. This will be looked upon in chapter 7.4.1.

The project managers would prefer a straighter regime towards project management, where one of the expectations is the creation of more transparency and openness in the organization. They want to understand the value of their own work and make sure it has not just looked upon as unnecessary bureaucracy. Right now, the project managers feel that a meeting with the steering group is more like a presentation, where they present their work to a passive audience. They are not receiving the dialogue they need to make the optimal decisions to continue the project.

Towards the steering group and project owner, the PM would ideally expect a more proactive attitude and involvement towards the projects. Both regards the efficiency of the meetings and that the steering group has more demands towards the projects. In this regard, efficiency means

that the steering group already are familiar with the latest status report and are prepared before the meeting. Demands are meaning more formal requirements from the organization. As one of the project managers says:

"It is not natural for a project manager to make tactical and strategical decisions regarding finance, pricing, invoice and so on." – Project Manager.

7.4 Current Project Management System

The current PMS in RESINC is characterized by informal procedures and ad-hoc interaction between the project manager and the organization. There is a consensus between the organization and the project manager that the current PMS is to free, in terms of formalities, procedures, and reporting. There is a lot of variety created by client requirements that override the organization's procedures. There are formal procedures in the form of the monthly report and standardized economic reporting. Which the project managers generate one time per month and it is sent to the organization.

The general finding is that the current PMS is created from the top management and then delegated to the project managers. The PMS is not necessarily formed to fit all the different contexts, culture, and complications that exist in the various departments.

"There is a gap between what is developed at the organizational level and the reality at the department level. It not necessarily only for projects… I believe it's a good framework that's present, but we as an organization have a way to go towards communication and what message to deliver" - Department Head.

The gap is created by misalignment between the organizational and project needs in the organization. The routines created are not perceived as bad. Moreover, they are not followed by the project practitioners. The commitment towards these routines is lacking at all levels of the organization.

"Need to commit the meta-processes downwards, to create a common understanding." –Department Head.

Commitment towards the generated routines is needed in the whole organization. The widespread characteristics and different departments create organizational-subcultures which make it difficult to commit to routines from an organizational perspective.

"There are a culture and tradition in our research institute; the researchers are allowed to do what they want. There is a lot of individualists who have the "I have

Lastly, the differences embedded in the department contexts complicates a PMS system. Described in chapter 7.1.1and 7.1.2.

One of the departments has a different approach after a recent reorganization this department has established a local program and portfolio management unit. This unit only works with projects related to this department and is segregated from the other departments. This is a significant difference from the other departments. Moreover, this study will investigate a PMS for RESINC meaning that this finding will not affect the development and investigation of the PMS.

7.4.1 Perceptions of the Standardized Project Management System

The steering group, project owners, and department heads, perceive the project handbook as a useful tool towards the project work which aims to increase the effectiveness and transparency in the organization. The official guidelines in RESINC also state that the project handbook is the official standard of project work, and should be followed. Continuing, the general perception from the department heads is that the project handbook is actively used by the project managers. This creates a gap, as the perception of the project managers is different.

The project managers are in general familiar with the project handbook and its contents. In addition, the majority of them also says that it contains decent and proper procedures and processes. This makes the next finding interesting. None of the project managers interviewed are using the project handbook when they manage their projects. There are some reasons for this, and the main reason is the adaptability and relevance of the project handbook.

The PM says that the project handbook does not fit to the projects they are working with and are overcomplicated the procedures. The project handbook is perceived as a static and none-value adding tool towards project work. In addition, the project handbook is perceived as to detailed to be fit all the projects.

"The project handbook is too detailed to be a guide to all projects… It's so detailed that it becomes insufficient… It needs to be less detailed to become a good guide to all projects"
– Project Manager.

As mentioned, in chapter 7.3.2, the PM do not feel the organization is committed to the project handbook. There is no obligation in RESINC to follow the project handbook. There are no consequences of not following the project handbook. The project handbook is then not

prioritized which results that the PM's do as they want. The PM's are creating their own procedures and project templates that fit their managing style and project context better. These procedures could be action-lists, workflow systems, project plans, project mandates, and document handling programs and so on.

"I'm doing things my way. Till I'm told otherwise" – Project Manager.

Another reason for the neglecting of the project handbook is the culture. As mentioned in chapter 7.1.2, some of the departments are not used to work with project as a discipline. For the project managers, it is more difficult to manage, as the project members are not used in working in projects. This complicates the workday of the project managers, as the PM have to use more time in communicating and delegating than ideally. One of the project managers said:

"In my department, I have the feeling that I'm the only one using MS-project… At least, none in my project team are using it" – Project manager.

This is another example of the independence the project managers have in RESINC. This is also correlated with the finding. A project plan can be everything from to bullet points in Word, to Gantt chart in Excel to a full project plan created with aid from the project handbook.

7.5 Summary of the Findings

This chapter will present the findings with the foundation from the chapters above. These are showing in table 7-1. The majority of findings are related to the PMS interface. Which is was the focus of the questionnaire and research. These results will be used as foundation for the analysis in chapter 8 and the SPM system in chapter 9. The findings are presented in the same structure as the PMS figure in the introduction of this chapter.

Table 7-1 – Summary of Empirical Findings

Organization Perspective	Interface	Project Perspective
• International and national laws and regulation override organizational procedures. • Sub-departments have different contexts regarding laws and regulations. • The complicated balance between facility operations and projects. • Different cultures towards project work in the departments.	• Individualistic behavior affects project work • Different perceptions of value between the project practitioners. • People tend to do what they always have done • General understanding of project work and management is vague. • Lack of project and business understanding in the organization makes project management hard. • The consensus from project practitioners that the PMS needs to be improved. • Project manager's experience and competence affect the attitude of the steering group. • Project managers feel there is a lack of commitment and dedication from the organization. • Project managers create their own processes and routines to streamline their own project management skills. • PMS characterized by informal project management procedures. • A gap between the organization and project reality when it comes to processes. • Current standardized system is not fashionably used because it does not reflect project reality and are not considered as a tool to generate more value	• The clients are the main benefactor for differences in project variations in terms of project management processes. • Clients act differently, making all client relationships different. • RESINC are adapt themselves to the client's requirements

8 Analysis of Empirical Findings

This chapter will be answering research question 2.1 and 2.2 research questions directly connected to the case study. The research questions are redefined to RESINC.

2.1 What identifies the current PMS in RESINC?

2.2 To what extent are the current PMS affecting the project practitioners in RESINC?

These questions will be answered by a short analysis regarding the PMS context before analyzing the PMS specifics. This is done to create an increased understanding of the context, to build up a greater understanding of the current PMS. The analysis is based on the empirical findings and theory from the theory chapters. The data references will be cited during the analysis.

8.1 PMS Context and Environment

The environment and context for RESINC can be considered as complex and dynamic. The projects have different purpose, ownership, value propositions and draw resources from various parts of the organization. The projects have potential to utilize different aspects of the organizational capabilities in RESINC. These factors are contributing to the overall complexity, as the number of unknowns is increasing. The empirical findings illustrate that the context of a research institute varies, especially between the different departments. The aspects that are affecting the variation the most is the different ownership and the variations within these ownerships.

Ownership affects the projects and management in various ways. The ownership affects the processes, such as reporting of milestones, status. Not only the content of the reports but also the scope and frequency. In addition, the client can have different demands regarding formal procedures such as risk and economic reporting through the project phases. Considering these aspects, a standardized and static approach as the project handbook can be considered as insufficient, as the client's specification, scope and the projects requirements vary. For a CRO, the business aspects are important; the organization needs to be service minded to maintain a sustained client relationship (Nicholas et. Al., 2002). The fact that the research institute is adapting to the client's requirements is a sign that the organization values these clients.

Moreover, if all levels perceive this value this the same way is another question. One of the project managers says it gets harder to manage the project if the client is pursuing the project

and the processes closely. It requires more formalities and a consistent professional behavior from the project manager and his team.

Another finding, regarding the over-delivers in some project activities. Can suggest that the project practitioners are not committed or aware of proper client handling. Commitment, in this case, would be acting in the best interest of the organization, and not in self-interests, as some findings suggest.

However, how the client perceives RESINC is not investigated in this study and the analysis will not investigate this issue further. The analysis above is related to the organizational project understanding and gives an insight of how the current processes handle project stakeholders. Moreover, the section above states the importance of proper management of ownership and some consequences that can arise if not managed properly.

Stakeholder management and being 'service minded' could be related to the culture and history in the different department. The next section will analyze the different cultures within RESINC. The business aspects of this will be discussed in chapter 8.5.3.

The differences in culture in the departments affect the way of managing cross-departmental projects. Two main findings are the foundation and some of the causes of the different cultures. The characteristics of RESINC's industry are the highly regulation and restrictions in the markets, both during development but also during production as shown in the empirical findings and supported by Gad and Spainhour (2011) research. These laws and international regulations separate the departments. The legislation and regulations are affecting the way the department is working, and their attitude towards the project. Secondly, the departments have different organizational structures, to specialized discipline departments to functional departments. This affects the way of working in projects, varying from a matrix structure to a functional structure. This creates difference regarding project work and how the project practitioners participate in the extensive project range.

The potential conflicts that could occur in the interaction between a department following a functional structure and a department following a matrix structure will not be investigated further as it is not within the scope of this study. Moreover, the point is to highlight the intrinsic complications that can occur in RESINC. This is a reality that a PMS needs to address.

For the projects in RESINC, the variations in both output, duration, economy, and quality will vary. Moreover, the underlying context of the majority of the projects is the R&D nature. As

mentioned in chapter 0, innovation and R&D are difficult to manage as they cannot be looked upon as linear entities (Fagerberg, 2015). This is reflected in the way of managing the projects and how the projects are planned. All projects have some degree of dynamism. Since the projects are unique, it contains uncertainty in different levels that most likely contains non-linearity which makes it harder to plan. This is a challenge that is embedded in the nature of the research institute. The projects have an increased complexity compared to "standard projects". In addition, one of its most striking features is that the outcome might be very different from the initial specification but still valuable for the firm (Vicente-Oliva, et. al, 2015). Since the project outcome can vary, it increases the risk of selecting the projects. This complicates the prioritizing between the projects in RESINC. As the project abnormalities, it can result in knowledge spillovers (Jaffe, 1986), which may lead to new product development or innovation in which RESINC can use in different context. An obstacle is if there is a client involved. Then a question of intellectual property arises. If the unwanted discovery is happening in an external project, who owns it?

8.2 Active PMS in RESINC

Active PMS is a system put in place by the organization that should assist and simplifies the interaction between the project and the organization. RESINC have one active PMS incentive that is effective for the whole organization. This is the project steering groups.

8.2.1 Steering groups

Recalling Chapter 4.1.1, an effective steering group is important for project success (Lechler & Cohen, 2009). They should take an active role in steering, define initiated and control the execution of the project throughout the project lifecycle. The steering group are the main decision-making body and makes the significant decisions including approval of the project results and output (Zwikael, & Smyrk, 2011).

The description above is how the steering group should work ideally. All the expectations from the project managers (chapters, 7.3.2) can be compressed to the same description. In this case, the steering group is not working optimally. The project managers, feel that they need a more committed steering group that have a more proactive attitude towards the project. This is also reflected one of the findings, where the steering group has a common consensus that RESINC can become better on project control and governance. In addition, this is a goal they are working consciously towards.

Looking at the data and observing the context, one can argue that there are two main reasons for the issues in the steering group. These are a lack of formal procedures and lack of time and resources.

There a lack of formal routines in RESINC creates several challenges. Firstly, it will be difficult to compare the project with each other. Different reporting types and styles caused by the autonomy of the project manager will create different foundation regarding the availability of information for the steering group. This can create fuzziness in the decision-making process, as there is no guarantee that the needed information is available. Secondly, different information foundation will also complicate the prioritization of the projects. Let say; an experienced project manager creates a better status report than an inexperienced project manager. There may be that the steering group will prioritize the project with the best report, as it is easier to create a foundation for decision than the other project. This without necessarily know if this is the best decision to make from an organizational standpoint.

The other issue is time and resources. The steering group consists of members who already have parallel positions in the organization. This could complicate the dedication to be an active steering group member. The time issue is extracted from the finding that the project owner and steering group are more relaxed when there is an experienced project manager assigned to the project. This could be an indication that there is not enough time to follow up all project, as the steering group becomes more relaxed and can focus their time on other activities in RESINC.

If there are, a connection between these two issues can be argued. One can say that more formal procedures will create a better foundation to follow up and govern projects. Since it will increase the transparency and transferability between the projects by making all projects managers follow the same routines. This will simplify the project governance processes as all project have the same underlying structure or reporting processes.

Lastly, the steering group and organization is aware of the issues and the challenges regarding project work. They are continuously trying to improve their efforts with different incentives and changes.

8.3 Passive PMS in RESINC

A passive intensive towards a PMS is used to deal and counteract the complexity in the environment. Chapter 8.1 describes some of these complexities. In addition, create a common ground between the projects and organization. Ideally, the passive PMS incentives are created

collectively by the creativity from the organization and practitioner to engage a complex system development. The system should be applicable to the particular projects and knowledge between the professionals in the organization (Cooke-Davies, 2011). The processes should also be adapted and adaptive to the project requirements.

One of the department heads described the developed processes briefly; by saying, it's a gap between what's developed at the organizational level and the reality at the department level. Automatically this will create a misfit between what has created an organizational level and what is actually needed at the project level in the organization. This is also a supportive argument of why the project handbook is not used excessively by the project practitioners.

Moreover, some passive incentives are used by all the project practitioners; this is the organizational financial reporting system. A question here, is why this system is used and not the project handbook? This will be analyzed further in chapter 8.3.1.

Recalling, the passive PMS chapter 4.2, Project Leadership is a crucial factor towards project success. Leadership adds the development of project vision, communication the vision and motivate project participants. A sum of these will enhance the PM as a role (Shenhar. 2004). If a project deals with high levels of new material, then the PM's knowledge needs to be correspondingly high (Cioffi, 2006). Developing the project managers skills such as business skills, project skills, interpersonal skills, intrapersonal skills, technical skills, leadership skills and general management are required to manage complex projects successfully (ICCPM, 2012, Cooke-Davies, 2011, Collyer & Warren, 2009, Müller & Turner, 2007).

RESINC has so far, no formal procedures for 'project management as a discipline' training, development programs or project management as a career path. Now the project manager is considered as a single step on the management career path (Chapter 6.2). This is a contrast to what is needed in RESINC context (ICCPM, 2012; Piachaud, B, 2002). The research institute is dependent on knowledge, project management skills and business skills to be optimal in the complex and high knowledge environment (Lam, 2001). This makes the project management decline at the borderline between both of the existing career paths. In some departments, project management discipline is perceived as a 'bureaucracy position,' where no value is generated. These findings can indicate that the project management as a discipline maturity is low in RESINC. This can also be reflected in the effectiveness of the steering group, see chapter 8.2.1.

8.3.1 Project Handbook

As mentioned in chapter 7.4.1 the content of the project handbook is considered as good. Nevertheless, there is a common consensus that the project handbook is to checklist based and to specific to be able to fit all projects. The most common saying in the findings, is that the project handbook is perceived as a useful tool but does not fit 'my' department. Meaning that the project managers do not use it. There can be several reasons for this.

Firstly, the content of the project handbook can be misaligned to the project reality. The projects conducted by the research institute is complex. In terms of the vast array of technologies, departments, procedures, laws, regulations, output, contract, and ownership. There are few similarities between the projects making it challenging and complicated to make one procedure that will fit all projects. The project handbook is preserved as detailed. If it is too detailed it will make a conflict between the projects and the procedures, as Shenhar (2004) states, "one size do not fit all". Meaning that there is not one optimal way of managing projects. Following a detailed scheme of procedures and routines when the overall project duration is a few days may seem as unpredictable and inefficient. If the project duration is years, following a detailed scheme of procedures may be more beneficial to make sure the project is planned well enough since the beginning. Making the project handbook less detailed and more general, so it becomes more flexible may enhance the utility of it. Making it a tool that can fit the comprehensive range of projects, instead of being a considered a linear tool.

Secondly, it could be the format of the project handbook. A handbook is an analog tool containing items and procedures that the PM should follow. If this is followed, where should the documents be stored? The analog format could be an influence for not following the project handbook consequently. If the handbook were digital, or in a more interactive system, maybe it would be easier to follow. In addition, if the handbook were digital, it would increase the access to information and make it simpler to compare the projects with regards to quality. It would be possible to compare successful projects with the unsuccessful project and analyze if this has something to do with the formal procedures or not.

Thirdly, who is the project handbook created for? There is not enough certainty and knowledge of the value in following the handbook and where this value is added to the organization. Example, if the PM follows the 'Template for quality- and control plan,' and completes this operation to the highest perfection. Who in the organization is requesting it? Did the PM do it for themselves or for the steering group? Currently, this is creating confusion. In addition, did

this quality and control plan add value towards the project, or does the international laws and regulation capture this inactively.

Lastly, previously a gap between the organization and project reality is analyzed. How is this affecting the utility of the project handbook? To answer this question; the principal-agent theorem (Chapter 3.3) can be used. The principal-agent problem develops when a principal creates an environment in which an agent's incentives do not align with its own. In this case, the principal (organization) wants to enhance comparability, transferability, and effectiveness in the organization by creating a standard project methodology, the project handbook. The agent (project manager) wants to perform the project in the efficient, effective and smart way. Resulting in creating his own procedures and streamlined processes. The perception of the project handbook is not understood the same way between the parties. This could be an example of the *moral hazard problem* (Moe, 1990). The project manager acts in his own interest and is performing what that is best for them. This is not necessarily aligned with the organization's interest. The citation below is backing up this problem.

"I'm doing things my way. Till I'm told otherwise" – Project Manager.

In addition, the parties have a different understanding of the project environment, as the project manager have a more detailed overview of the project than the steering group, creating asymmetry in the knowledge relations. This asymmetry in information can complicate the information flow between the parties, and make it difficult to make the best decisions.

8.3.2 Project Tools

An interesting finding in Chapter 7.4.1, states that the project managers selects and creates their own tools based on the situation and project context. In some instances, the project managers are using different project plans, different workflow systems and so on. Since most projects can rarely be managed by applying standard methodologies that are designed to be used in different context. This is aligned with the finding of Remington and Pollak (2011) that figured out that experienced project managers select tools, techniques, and approaches dependent on the situation. If these tools, technologies and approaches were non-existent, they were created to fit the purpose. This illustrates that the project managers are proactive in their work and they are creative and experienced enough to be able to select their own procedures. If this is valid for all the project managers, is not certain. However, it is possible to assume that most of the solutions to the problems in the organization most likely exist in the organization.

8.4   Interaction within the Projects

The principal-agent theory is used to describe why the project managers are not committed to the project handbook. Moreover, this theory also describes other problems within RESINC.

The project managers have a stated that the project members are not always committed and motivated towards project work. One of the reasons could be the lack of understanding of the importance of project work. This could also be a different scenario of the principle agent theorem. The principle (project manager) and the agent (project member) are not aligned and acting with the same interest. As mentioned in chapter, 7.2 there is a problem with over-deliveries, the project members are executing the project activity with better quality than planned, at the same time using more time. This could be both the adverse selection problem and moral hazard problem (Moe, 1990).

Adverse selection problem, the project member has more information about the project activity. This in-depth knowledge about the project activity may make the project member understand that a few more actions will increase the output of the specific drastically. The principal does not know why the agent is acting the way he is. This creates a conflict.

 This can lead to the **moral hazard problem** as well. The agent has a personal interest in the specific project activity and is acting in their own interest. Let say, the specific project activity can result in groundbreaking research, and the project member wants publicity and creds for this research. The agent is then acting in his own interest, which makes it a moral hazard problem.

8.5   Summary and Special Remarks

The answers for RQ 2.1 and 2.2 are embedded in the chapters above; moreover, this chapter will present a short overview of the answers for each of the questions, before continuing with the other research questions.

2.1 What identifies the current PMS in RESINC?

It is established that the project and organizational context for RESINC are complex. Widespread knowledge is needed from the project practitioners, in different knowledge areas. At the same time, a framework of active and passive PMS elements is required to create the PMS manageable. The PMS in RESINC is currently characterized with informalities with some attempts to make this interface manageable. The current systems do not match the complexity

in the project environment and are resulting in less effective projects. The maturity towards project and project management as a discipline is not optimal. Lastly, the PMS is created top-down, meaning that the procedures are created from the organization then delegated to the project practitioners.

It is also stated that some of the reason for a not optimal steering group are the lack of formalities, time and resources available for the steering group. For the other PMS aspects, the project handbook and the current standardized procedures have compatibility issues with the project reality. There could be several reasons for this, but the foundation can be in organizational growth, and balance of exploration and exploitation of internal resources. This will be discussed in chapter 8.5.1. A different aspect is where this responsibility should be in the organization, should it be generated by the management team, or should the project managers have control of their won procedures. This will be discussed in Chapter 8.5.2

2.2 To what extent are the current PMS affecting the project practitioners in RESINC?

A different aspect is the effects of the principal-agent theorems. The problems that arise in this interface creates misalignment between the project manager and organization, and project manager and the project team. This misalignment is resulting in excess uncertainty in the project deliverables, processes, budget, quality, requirements and control mechanisms. A lack of understanding of, e.g., the requirements or project context can prevent the project manager from understanding the overall strategic or business objective of the project, which can prevent them from full collaboration with the project owner, because of the difference in knowledge (Turhan, 2005). A consequence of the current PMS is the at the project managers are creating their own methodologies and tools. If this effect is desired or not is unclear, but the project managers are organizing themselves independently and creating their own project management style. Resulting in more differences when managing projects, which again complicates the project control aspects. This leadership role is discussed in chapter 8.5.3.

Lastly, the business aspects are elaborated, chapter 8.5.4. Some findings are related to the business understanding in the organization. The aspect of project business case is therefore essential to investigate more.

8.5.1 Organizational Growth

As stated in chapter 9 and 10, the current PMS is characterized as informal. Some of the reasons why has already been explained, however, one other aspect has not been investigated. This is related to organizational growth. Historically, RESINC has grown, and new departments and

sub-departments have been formed. This has been natural steps in the evolution of the firm as they are responding to the needs of the market, at the same time exploiting their organizational capabilities (Turner, 1999). This can be considered as organic growth.

Moreover, the project management as a discipline has not been following the same growth. This is creating an organizational lag, where the internal procedures have not been following the development of project management as a discipline.

There is an indication that the attitude towards project work has not been following the growth of the organization. This is especially highlighted in the project management understanding between the departments. The youngest departments in terms of age are one of the few departments which have structured as a matrix orientated project organization. Project managers in this department are used to work with project management as a discipline and are responsible for several cross-departmental projects. The department director in this department is also aware of the department's knowledge towards project management and relaxes more when the project has a skilled project manager. In addition, another department has also created their own internal PPM - function, that will assist the project and project managers internally in this department. The growth of RESINC has been affecting the evolvement of project procedures and routines, as it seems there has little grounding from the organization. Another argument this is related to the lack of business perspective inherent in the organization. In addition, the problem with researchers is driven by self-interest in project work, which is complicating the cooperation in project work. These findings are related to the project maturity in projects which varies between the departments and the unique knowledge of the employees in the organization.

There is also an indication that organic growth in the organization has created sub-cultures with different attitudes and mentality towards project work in the organization. Making changes and implementation of new project management as a discipline more difficult. Particularly for RESINC as a whole.

Why this happened is a different discussion, it could be the organization and management were occupied in concealing new market opportunities promote more economic growth and value creation in the organization. RESINC is operating in a challenging market, which is affected by many external and internal factors and obstacles, as international frameworks, lawmaking, operations and so on. Generating economic growth for RESINC could, therefore, be a challenge. Focusing the energy and organizational capabilities on growth may shadow the needs

to create a proper PMS system in the organization, as it is a matter of priorities. It is a question of ceasing new opportunities in the market or focus the same resources on internal optimization. It is almost a paradox, focus on improving internal capabilities or concentrate on generating new value. One can easily argue that both is needed to achieve a competitive advantage. Efficient and optimized internal capabilities, such as project management would result in a more efficient way of working which can free up resources and in the end lead to more economic income and value generation.

For an effective PMS, this will require more effort from the organizational perspective, such as top management, steering group, department heads, as it is easier to commit and get a smaller group of people aligned before distributing and pushing the new project culture down to the rest of the organization. Creating a sustainable fundament towards project management as a discipline, in the top management will show the rest of the project participants that the organization is committed to the new era of project management. The era where project management is perceived as a necessary discipline to achieve success and efficient work in the organization.

8.5.2 Authority Perspectives – Centralization or Decentralization

Another aspect that can be used to describe the current PMS is related to the authority autonomy in RESINC. In this regard centralized or decentralized perspectives in the organization. This is related to what aspects of the organization which has responsibility and control. This could be control over procedures, standards, routines, and other functions related to project work. The next question is which organ should have this autonomy, responsibility, and authority? Should it be centralized in management, such as in the steering groups, or decentralized at the project managers? What is most beneficial for the organization, having a project manager with a broad understanding and freedom? Alternatively, having specialized scientific project managers, and have the other aspects at a different level in RESINC?

- **Centralized** - Centralized resources such as department heads or management team consist of a smaller group and it easier to develop and formalize project methodologies, procedures and routines. In addition, obtaining a holistic perspective of the project, and how it is aligned with the rest of the organization is simpler, as they, in theory, have a better overview of all the projects in the organization. As they are a central group, they have more power to influence and construct organizational mechanisms that ensure that the business policies are developed and followed by the project practitioners. With centralized resources, towards the business case of the projects, it is also easier to

achieve finical control, well-developed project business case and policies. A centralized group can ease the complexity, as there is centralized and combined knowledge towards the project methodology and generated business cases, which will result in better-developed business cases, which will lead to more efficient and responsive project business strategies.

Disadvantages of having a centralized authority are to get the project practitioner aligned with what is developed at this level. Distributing and delegating the authority down to the project practitioner will become a challenge. In addition, it will undermine local knowledge about the project, and the steering group must be made more involved in the project to understand what business case which would be optimal for the organization. This can cause an overload for the steering groups.

- **Decentralized** – This approach is more reliant on the project managers, resulting in a more specific project methodologies, procedures, and routines towards the specific projects. This requires a better insight and understanding from the project managers, that can be achieved by education and training. Moreover, it will create local responsiveness and potential to create a better customer satisfaction.

  This approach would give more responsibility to the project managers, and the organization needs to ensure that the project managers understand the overall strategy of the organization, to ensure that the projects become aligned with the overall strategy. In addition, to the extra responsibility, the project managers achieve more power in the organization, as they also have more autonomy toward project decision making.

RESINC have a mix between both centralized and decentralized perspectives. The official procedures are created centralized, but they do not match the project nature. Which makes the project manager selecting a decentralized approach, as a response to the project context. If this is done purposely by RESINC, is not safe to say. The reasoning behind both perspectives is viable. Both project managers, management, and department heads are using different incentives to control the complexity in the organization/project and to achieve more control of what is going on in the organization/project. The only difference is the formality between them.

8.5.3 Project Leadership

The steering group and project owner are more relaxed when there is an experienced project manager involved in the project, is an interesting finding. The next question will be if there are any coordination and communication between the project managers in RESINC. Are the project managers learning and advising each other if project management problem occurs? The study has not investigated these issues. Moreover, this finding can indicate that the project management as a formal discipline, may be low.

Generally, the effects of the informal PMS create an ad-hoc style when managing and working in projects. The ad-hoc solutions generate more flexibility when managing projects, flexibility can be good, as the freedom of the project manager creates solutions and tools when it is needed. Since it creates a custom response based on the project's nature and requirements. This response is based and dependent on the project managers, insight, experience and knowledge. The effectiveness of this is dependent on the project manager's experience and understanding of the situation. The flexibility can result in response, which has a better fit with the project context.

The disadvantage is that it will be hard to get an overview of everything that's happening. In addition, creating asymmetry in the information between the project owner and manager. Formalities can create transparency, which increases the availability of information which can balance the information between the project practitioners.

Currently, there are no standards towards project leadership in the organization. Standards in this regard are standards which aim to increase the project managers skillset and knowledge towards project management as a discipline. Standardize project leadership on a meta level could be beneficial for the organization, as higher understanding and knowledge of how to perform projects effectively and efficiently could help RESINC in optimizing their resources. Developing project practitioners, and increase the understanding of project management and project work will enhance the efficiency (Cooke-Davies, 2011). This can be done either by having mandatory education systems for the project managers, or project related workshops for the project practitioners.

Formalizing project management as a discipline and as an efficient way of organizing research may be essential for the organization. It is important that the project practitioners get the right knowledge, this would also include innovation and R&D management and proper methodologies towards the project type. This can be done by creating a project management

discipline as a career ladder in RESINC, where the project managers area ranked on their ability to address complexity.

Because of the comprehensive range of project, a single approach towards project management can be considered unsatisfactory, as all projects are unique and have different needs in term of managing them. Developing project managers to expand their knowledge horizon will generate a more holistic approach when managing project.

8.5.4   Project Business Case

In chapter 3.3 it stated that the project owner has the business case (Morris, 1998). A finding in RESINC is that that the business case aspects are vague. What is most beneficial for RESINC will be discussed in this chapter. In a complex environment, such in a research institute the project managers also require insight in the scientific area to understand the overall complexity (Cioffi, 2006), risk, and complication in the projects. The project managers in RESINC have a strong academic and scientific background within their particular research fields. Moreover, the business aspect of a project manager is not at the same level. If this is, a prerequisite can be argued. The business aspects in RESINC are currently not optimal. Creating project strategy and project business case can be essential to optimize resources and generate optimal revenue and use of resources. Can the business case procedures be standardized?

One can argue that this can be grounded to the nature of RESINC, as it functions as a CRO. If one organ in the organization handles the business case of the project, such as strategizing, value proposition, visioning and aligning the projects with the overall strategy, it could be beneficial for the whole organization. Should it be centralized in management, such as in the steering groups, or decentralized at the project managers?

What is most beneficial for the organization, having a project manager with a broad understanding of technicalities and a project business case? Alternatively, having specialized project managers, and business case at a different level in the organization. Should it be centralized or decentralized project business case? It becomes clear that there are some merits and demerits of both approaches. There is no clear answer to what is the best for RESINC. Moreover, the study suggests that a centralized system may be more efficient and suitable for a research institute. The project managers already have a lot of responsibility in the complex project environment, delegating more responsibility might become a challenge as the project managers have to use more personal resources towards the generation of the project business case. In addition, the organization must ensure that the project managers are equipped with this

knowledge and skill set, to optimize this potential value. Other structures can be mentioned from a business case perspective, but centralization and decentralization are the simplest illustrations of the problem.

9 Development of a SPM System

From the analysis, some aspects have become clear. In RESINC interaction between the projects and organization is not optimal. The project handbook is an attempt to make enhance this interface, but as revealed, it is rarely used, and the common statement from the PM is that the handbook does not fit their kind of projects. The procedures and routines that are described in the handbook are themselves not bad. So, they can still be used. However, they can be used in a more beneficial matter.

This chapter will answer RQ 1.1 and 1.2:

1.1 How can SPM contribute to the PMS in a research institute?

1.2 What aspects of a SPM system is most advantageous to standardize?

The current SPM system is characterized with the project handbook and some other incentives that the project should follow. In reality, all these systems have to be followed for all projects. The current formal SPM can be considered as linear, handling all projects with the same systems and procedures. This is contradicting to the finding, that illustrates that the common consensus and perception from the department heads and project managers are that the projects are varying hand are not similar. Earlier, in the theory chapters, it states that a linear response to a non-linear environment is unbeneficial.

The current SPM in RESINC is attempting to reduce the complexity by streamline processes and maintain control by assuring that each essential aspect of the project is evaluated in a beneficial manner. The output of the projects can then be visualized as linear from a process perspective, as all projects are currently assessed by the same official processes.

Moreover, in complex and dynamic environments, traditional methods should be used in a more traditional manner (Rodrigues & Bowers, 1996). Project management needs to be more dynamic and responsive to the new information and adapting to the new situation rather than keeping to the initial plan.

Toney and Powers (1997) states that standardization of processes as approaches and procedures are organizational success factors. Standardized processes could be information sharing processes, communication processes, reporting processes, whereas all the PM's use the same standard interface. Standardized and structured repeatable processes that provide a good flow in the project sequences, as the end of phase stages, milestones, activities and major deliverables for each project. Flexible processes can be merged into a SPM system that encourages and states

how to adjust and adapt the standardized processes for different project types and needs. In the end, an integrated PM processes that link the project with the overall strategy to provide an integrated business perspective into the projects (Milosevic and Patanakul, 2005).

One can create a more flexible system by creating standards fit to the project nature. The project has different characteristics. Highlighting the differences between the projects can aid in selecting the correct approach towards the project. Separating the project based on the unique features can be done through a categorization system.

A linear response to a dynamic environment is not beneficial (Chapter 8.3) as shown the project reality is complex by nature. The SPM needs to address this. By characterizing the processes in the SPM system into the needs and reality of the organization and projects could be beneficial. This is illustrated in figure 9-1. Some SPM processes are based on the organizational needs, while other SPM processes are dependent on the project characteristics. This is resulting in different outputs which are a response to the characteristics of the project environment.
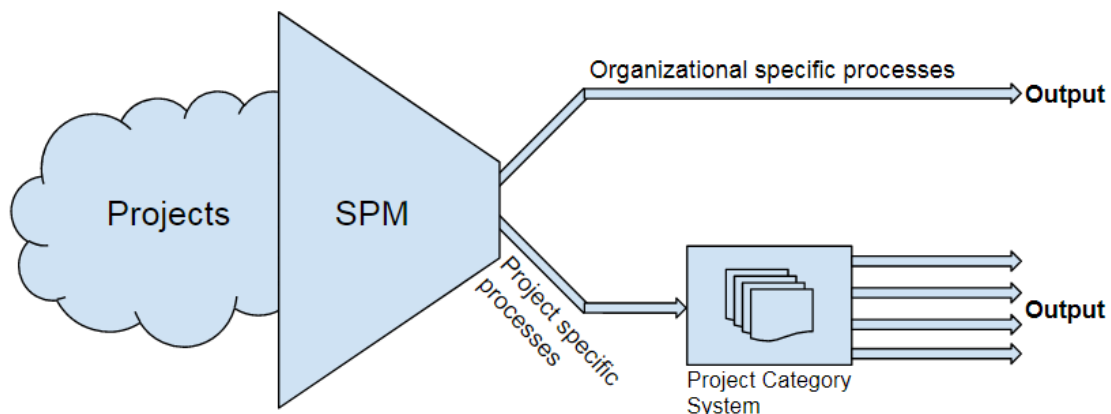
Figure 9-1 – SPM Flexible Concept

This system has more diversity in terms of outputs. The main difference is that the output is more relatable to the input, which can lead to increased efficiency. How this system can be created will be elaborated in the continuing chapters.

SPM with an appropriate categorization system has the possibility to become a useful tool for a systematic reviewing of each project independently, and recommending the best practices of the project, from an early stage. Hopefully, to aid the management early on, and make sure that the most important factors are reviewed early, and counteract possible early warning signs. In addition, early categorization and distinguishing of the different projects can make it feasible to establish a more holistic overview over the various projects (Ivory and Alderman, 2005)

conducted by the research institute, which again can enhance control. This control could lead to a simpler portfolio and balance over the specific projects that are carried through the organization.

9.1   Aspects of Categorization

A flexible approach is needed towards the projects as the projects cannot be looked upon as singular and identical entities. To create a flexible system is prominent to identify the current projects and access the uniqueness characteristics between them. Identifying the projects and separate them from the different needs can be valuable in selecting the correct approach and leadership towards the project. Categorize the projects based on the characteristics could, therefore, be useful.

The study will use Jacob (1991) definition of categorization, which refers to "*the processes of dividing the world of experience into groups- or categories- whose members bear some perceived relation of similarity to each other... The process of categorization entails neither membership within a category is determined by the apprehension of a set of definitive characteristics nor that inclusions within one category prohibits membership within another category.*" (Jacob 1991, p 78, emphasis added)

Bowker and Star (2000) suggests that categorization and organization is an innate part of nature. Few elements of our world are not categories, and that human's categories unconsciously as a part of our thought process. Essentially, categorization is a way of making things more manageable. The same reasoning can be applied in this context. This model will categorize the projects conducted in the research institute based on its fundamental characteristics. The objective is to simplify the selection process for project related processes. Moreover, it is then essential that the model is trying to visualize the project context in a simplistic and useful way.

One of the arguments to have a model to categorize projects is to allocate the correct process practices toward the project type. Generally, project practitioners will throughout time, gain experience and competence and build up a skillset in project management. This skillset will be combined with various processes, tools, methods, models, and techniques of project management. However, it is inappropriate to assume that this specific skillset can be adapted for managing various projects with varying needs and attributes. Example. A too simplistic model of assessing project risk management could fail to recognize the significant systematic risk. Which again affects the decision-making in the project (Cooke-Davies, 2011). Another example, applying traditional methods unfit for the project type, and incompatible with the

actual system, could result in unsuccessful, inferior and challenging projects. Wrong use of project methodology that is not adapted to the project type could also increase the complexity. As they, they fail to address the right problems and details. The next chapter will develop a model for SPM based on the findings, analysis, and theory.

9.2 An Aggregated SPM System

Several aspects should be considered when creating a model for SPM. It needs to be fit with the organizational context and project nature and realities to be useful. As seen in the analysis, there are few procedures and routines that all projects follow, such as economic reporting. On the other hand, there are some flexible routines, that the PM selects and creates based on the projects contexts. This can be used to create a two-part system.

Part 1, Organizational specific standards, which processes that all projects must follow. Part 2, Project specific standardization, such as a categorization model, which enables process selection based on the characteristics of the individual project. The specifics for each part is aggregated from the analysis chapter. Processes, in this case, can be processes for selecting and managing the project. This model is a project-meta-level model, which in theory can assist the PMS and create a better systematic overview of the projects. It can be considered as a tool to select the right approach towards each project.

9.2.1 Organizational Specific Standardization

In the analyses, it is showed that there are already some standards, economy reporting, generation of project mandate and steering group meeting. This can create a foundation for general standards that all project needs to follow. The organization requires some level of control, and by making, all projects e.g. follow the same economic reporting system, the organization can achieve more control. In addition, standardize the project prioritization routines to an organizational level may increase the efficiency of the organization. An effective resource distribution system will also be beneficial to standardize from the organizational standpoint.

As mentioned in chapter 4, some processes and standards need to be in place for the organization to obtain a certainty level of control and visibility of the conducted activities. This standardization will create 'global' variables, which makes it possible for the organization to keep the desired level of comparability between the organization's project. This comparability will make it easier to keep track and control over the projects. Organizational specific factors as economy and purchasing processes, resource distribution, customer relation management

processes, formalities and reporting procedures. The idea of having a standardized set of global variables is that it will create a foundation of the project work and simplify these processes. In an organization, the economy system and control are essential to control the cash flow within the organization. Same with resource distribution, as stated earlier, the case company function as a matrix organization and the ability to regulate and distribute the correct resources to the right project is important. Lastly, communication, formalities and reporting procedures, is defined as procedures such as paperwork as project mandate, contracting, reporting channels that need to be in place for the project to be initiated.

Standardizing in from this perspective would be processes that direct all the projects with the same organizational interface. The following paragraphs will look at the different aspects for part 1 SPM.

Economic and purchasing function. Standardize the economic interface in the organization to ensure that all purchases are reviewed and have the same quality. A good economic reporting system can create transparency in the projects, and it will become easier to compare the projects with each other.

As a project based organization with a matrix structure, resource distribution will always be a challenge. Moreover, the fact that RESINC has to balance operational activities and project does not make the PMS simpler. **A resource distribution system**, such as enterprise resource planning (ERP) systems. That optimize the resource distribution between the departments and between the projects.

RESINC must provide value and deliver outstanding service; this will help the organization creating long-term relations and providing their clients with improved solutions. The clients count on RESINC to generate information, then assemble, analyze, and return the information to them in an easily understood format, quickly and consistently; this needs to be reflected in the project manager role and discipline. An organizational project **leadership** system can be essential. It refers to project management selection, training, and education related to project practices, strategy, and methodologies that can be used to manage and analyze project interactions and activities throughout the project lifecycle. The goal is to improve and select the correct project manager to the project. This system can be a valuable incentive to increase performance in the widespread project nature in a research institute.

For the other systems to work, some minimum requirements are needed for the projects. **Formalities and reporting procedures**, as appointing a project manager, reviewing the project

scope, selecting steering group, goals, start/end date and so forth. These aspects can be considered as minimum requirements for any given projects.

9.2.2 Project Categorization Framework

Part 2 of the PMS is related to the project specific attributes. The projects have different needs. A next step in creating the foundation for SPM; is to accept that projects are unique and have differences inherent in their nature. This difference can be highlighted by evaluating and separating the project based on their unique attributes.

Creating standards towards something dynamic such as a project would be insufficient if there is an assumption that projects are singular and monotone. Illustrating this difference and separate, the projects from one another can be done by evaluating the different projects using a project categorization framework. With a foundation of the categorization framework processes, procedures and standards can be developed towards each category. The categorization system can provide recommended procedures and routines based on the project characteristics. The categorization framework can be used as a tool for further selection of correct project practices.

To create a project category system one need to define the factors. The analysis and empirical findings have so far identified some aspects that are contributing drastically towards the project complexity. The factor that influences the project the most is the **ownership** factor. Another factor that influences the projects are the is the **organizational complexity**, which is inherent in RESINC. This entails the organizational complexity factors as a number of departments/organization, locations, nationalities, languages, cultures and time zones involved.

The project purpose and deliverables also have a contributing and impact. The research institute has a comprehensive range of project, varying from internal change project, safety projects, R&D projects, assessment projects, innovation projects and so forth. Previously it is argued that innovation and R&D projects are complex as they are non-linear in terms of the process. The next factor in the categorization system is **risk**. Describing a project in terms of risk can cover the widespread range of projects.

As argued and highlighted in chapter 3.2 **value and focus** can be a guideline when managing projects. Having a clear focus and good understanding of the generated value of the projects can assist the project manager in prioritizing the decisions within the projects.

These factors will give a holistic overview of the project early on. Each of these factors are predictable at an early stage in the project; [1] either if it is an external or internal project, [2] The value intention, [3] an overview of types of resources used to execute the project and [4] a brief overview of risk factors, as uncertainties embedded in the project.

This study will not go in-depth and indicate what practical processes, which can be used for the different factors. However, will briefly highlight and create an overview of possible procedures which can be employed. The evaluation criteria of each factor are not assessed. The argument and rationale are that these four factors are contributing to the overall complexity of the projects that are conducted in a research institute.

9.2.2.1 Ownership

As a research institute, RESINC, is subjected to three different types of ownership, internally, externally and mixed. Between these types, the level of control would vary between autonomous and heteronomous. In addition, the project ownership will affect the overall complexity and increase the uncertainties. Of course, this could vary, a client could initiate a project with unknown specifications, but it would require more communication between the project client and the research institute to meet these specifications and to prevent scope creep. In addition, the communication should be more formal, in terms of formal communication channels, specified and good reporting between the parties. Lastly, the quality assurance should have a higher quality; a bad quality project has the possibility to reflect RESINC overall performance and reduce the RESINC reputation in the market.

The ownership variable has three different aspects:

- **Infernal** – The organization itself owns the project.
- **External** – Client owns the project, usually through a contract.
- **Mixed** – Project could be a part of a research cluster or consortium. This collaboration could affect the project in different ways.

Proper processes for client handling, such as collaboration and formal communication channels should be utilized to create an effective and sustained client relationship. In addition, formalities such as contracts are essential in order to actual control this relationship in a formal way. The contract will also affect the project deliverables and its requirements.

For RESINC, the business aspect is important, and the degree of ownership will affect this. It is therefore important that the project manager and organization are working together to achieve best business effort towards the client.

One can assume that an internal project does not require the same procedures as an external project. In an external project, the client's requirements must be understood, and the project should reflect these. In addition, RESINC has to adapt to the client's requirements, which complicates the management. In internal project, the organization is free to manage the project, as they want. At the same time have more flexibility towards it, as they are in control of the scope, duration, resources, and prioritization themselves. It becomes clear that the different projects require different procedures. Coordination, communication and control, are three aspects that will vary with the ownership. Coordination in terms of resources, when it is an external owner, the research institute have a higher pressure at delivering the project at the right time. Communication between the project owner and project manager to understand the requirements. Internal projects might require a more informal assessment of the requirements, then, an external project that requires more detailed requirements and understanding of the needs to meet the client's expectations. Lastly, control, the control in external projects will be affected by the client's requirements, and the research institute has to act more professional towards the client to keep a professional relationship. Moreover, to make sure that they have the right information available if the client requests it. The contract requirements between the research institute and client is a formality that will distress the project control.

Special process areas contributing to the categorization system: Flexible control, Coordination of internal resources, External Communication.

9.2.2.2 *Organizational Complexity*

As a finding from the analysis, the complexity inside the organization itself is a benefactor to the overall complexity of RESINC. Assessing the needs of the organization towards the project can be valuable to select the optimal project management approach. The organizational complexity entails the number of people and relationships within and outside the departments, the number of locations, nationalities, languages, cultures and time zones involved. There could potentially be different and conflicting interests, loyalty, cultures, and relationships among the project practitioners that will influence the project and its decision-making, as elaborated in Chapter 8.4, which indicates the effects of the principal-agent theorem.

Knowing about these aspects early on will affect the project manager's approach towards the projects. Setting the project standard and create a foundation for the project team early on will be beneficial. If the project is a cross-departmental project, more collaboration and coordination is needed to counteract the cultural difference embedded in the organization. An increased effort from the project manager to establish good cross-sectional teams and get the team aligned early one will be essential. Counteracting the potential principal-agent conflicts that can arise tin such an environment. Setting the standard and identify and establish a suited working environment early on will be beneficial. Getting the project team aligned, shared focus, motivation, and contribution towards the project are crucial.

Managing a project drawing resources from single or multiple departments will require different coordination and management because of the different cultures and frameworks of each department. The cross-departmental projects will need more effort in coordinating and aligning the project team, in order to facilitate a well functional project team. The different cultures in the departments will be an obstacle that needs to be overcome to enhance the efficiency of the project team. The end goal is to establish a collaborative project team, that works together towards a common goal. The processes should reflect this.

Special process areas contributing to the categorization system: Coordination and alignment of the project team. Enhance team collaboration.

9.2.2.3   Risk

Assessing the risk factors early on can aid the selection of project processes and methodologies in the project. The rationale behind this factor is a quick assessment through soft information gathering techniques as brainstorming, expert opinions or learning from similar projects (history) etc. can create a foundation for further risk handling. Which can be used to select the correct activities for detailed project risk identification, analysis, mitigation strategies, control and documentation.

Based on the findings, these risk sub- criteria's can be beneficial to evaluate when assessing the risk factor.

Financial Risk – Investment required to make the project happen. For internal projects, the organization may accept potential challenges with project financing. For the external project, the organization should assess the impact and consequences of potential overruns.

Technical Risk – Related to the deliverables of the project. Example. High technical risk can make it harder to plan. Technical risk also affects the resources and how the project team should tackle the problem.

Operational Risk – How the project fits with the current resources in the organization. In addition, how the project will affect other projects or facilities in the organization. Example, if there is a delay in the project or a specific project activity takes more time than planned. How will this affect the other projects. Risk after the project is handed over. Example, knowing early on that a project may affect the operations of the organization. It can plan for and result in more control in those instances when the project may be an obstacle to the operations.

Some project in a research institute can be distinguished from the other projects by looking at the risk. Example on can assume that innovation projects contra an internal change project has a significantly higher level of technical risk implanted in the project. Whit this in mind, it could be challenging to differentiate innovation projects solely on this factor alone.

Special process areas contributing to the categorization system: Communicate risk, coordinate to create contingency plans.

9.2.2.4 *Value*

There are several reasons for RESINC to initiate projects; to create revenue, new product development, create knowledge, optimize routines and so forth. One special factor for a research institute is that their main source of income is specialized knowledge. Therefore, when thinking about value in this context, it exists of both intangible and tangible assets where they are both important for the organization's survival. This makes it fuzzy to predict the project outcome, since knowledge is hard to measure, but in the initiation of a project, there is still a chance to ballpark the overall value outcome. Therefore, this factor is not only dependent on economic variables such as the return of investment but also expected a generation of knowledge and innovation. For this particular reason, it is suggested that the value factor consists of two sub-factors.

Economy – Potential economic generation for the organization. Also, entails projects where the focus is to optimize current procedures and operations, where the result of the project is to make the organization more efficient and effective.

Knowledge – Knowledge generation in the project, Generation of know how. Increasing the organizational and technical capabilities in the organization. Can result in increased reputation and position in the market.

Clarifying value focus early on can be a key action to optimize and create a project strategy. At the same time, be used as a factor which makes it easier to prioritize the organizational capabilities within the organization.

Processes related to this should address the value and its focus. If the value focus is to generate new knowledge, collaboration and project learning should be highlighted. The information should be shared in the organization to optimize its value. Anyhow, communication and aligning the organization with the right value focus can be essential. The project should be considered as an extension of the organizational strategy.

Special process areas contributing to the categorization system: Communicate and alignment value focus internally. Collaboration and alignment of project team.

9.3 The SPM System

These two perspectives, creates the foundation to develop the SPM system. If used, it creates a foundation of standardizing procedures in the organization. Instead of creating a linear standardization system such as the project handbook, this model opens up for a more dynamic approach. The model can be looked upon as a tool, to achieve the right control of the project conducted by the research institute. Combined these can enhance the comparability between the projects. If the project has the same foundation of variables, they can be compared with each other, and potentially used to keep track and aid the prioritization processes between project and resources. The underlying hypothesis of this perspective is that project success is related to the choice of the "right" management approach related to specific project characteristic (Cooke-Davies, 2011, Müller & Turner, 2007). The further benefits are elaborated in Chapter 9.3.1.
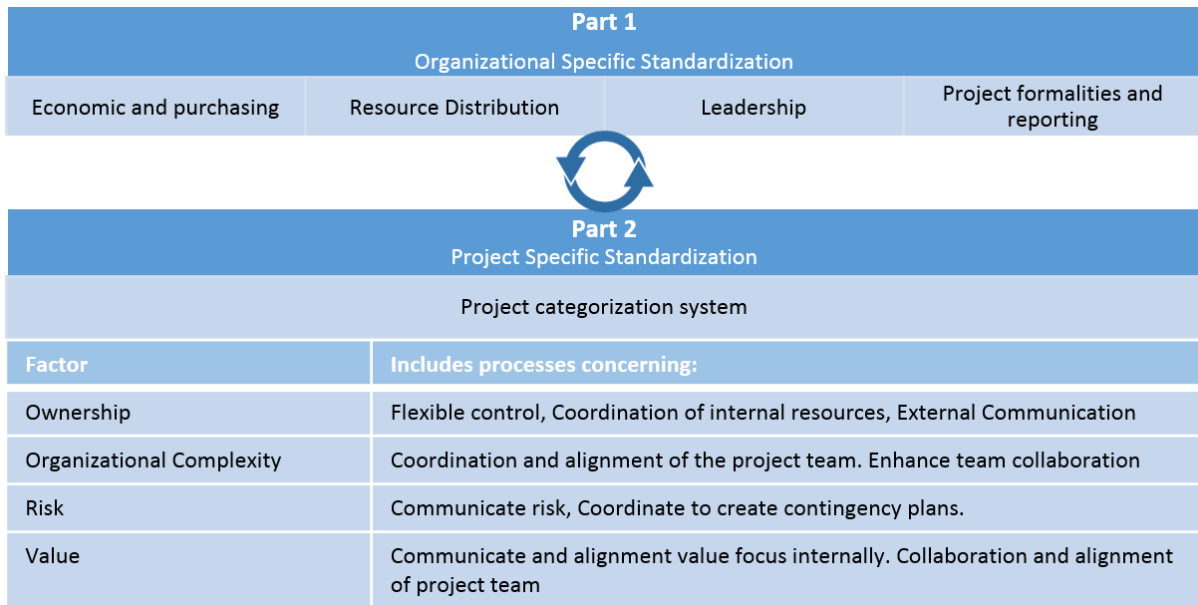
Part 1			
Organizational Specific Standardization			
Economic and purchasing	Resource Distribution	Leadership	Project formalities and reporting

Part 2	
Project Specific Standardization	
Project categorization system	
Factor	Includes processes concerning:
Ownership	Flexible control, Coordination of internal resources, External Communication
Organizational Complexity	Coordination and alignment of the project team. Enhance team collaboration
Risk	Communicate risk, Coordinate to create contingency plans.
Value	Communicate and alignment value focus internally. Collaboration and alignment of project team

Figure 9-2 – SPM System for a Research Institute

The figure 9-2 above is the illustrating the SPM system, from a process perspective. The factors are extracted from their representative chapters. The processes associated with the factors are concerning the special subjects that should be reflected in the process. These are based on the theory and empirical findings in the previous chapters. The illustration is also illustrating the relationship between part 1 and 2. The processes in these parts codependent, meaning that they should interact with each other in an optimal way to be effective.

Part 1 of the system is related to the organizational specific standardization and are based on minimum requirements from the organization, and is standardized to obtain a certain level of control. The processes in this part can be looked upon as a seedbed for the rest of the projects in the organization these types of processes are also present in all departments in the organization, hence the standardized approach.

As for **part 2**, the categorization framework should be used as early in the project initiation phase as possible. The goal is to select the right approach towards the project as early as possible. The project should be assessed by evaluating the factors, risk, ownership, organizational complexity and value. The factors should be evaluated using intuition and rationality to make the process fast and efficient. Once the project is categorized, different processes and project management approach should be assessed towards it. The processes should be aligned with the different factors.

The idea behind the categorization framework is to insert the variables into a four-dimensional radar chart. Where each factor has a separate axis, which is mutually independent of each other.

When the project is plotted, the result will have a diamond shape. Moreover, the output of this model can create a simple overview of the project reality and assist the research institute in selecting the right approach to the right projects. The output of the categorization framework is illustrated in figure 9-3 below.
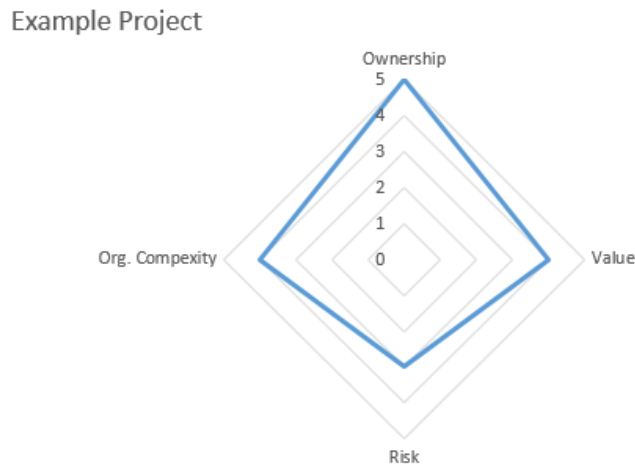
Example Project

Figure 9-3 – Example of Project Management Categorization Framework

The framework is not static and will vary with the project type; the special processes should be developed and address the different variances each factor can have. The rating of each factor indicates what processes which should be selected. Example, high ownership score can indicate that the project has an external client and the organization should select processes and procedures fit with client's requirements. How this is done is practice, are not a scope of this study. This way of illustrating the differences in projects will also become a visual tool for the project practitioners. Which again, can lead to a more effective selection of the right project procedures.

The study will not investigate the specific evaluation criteria's thoroughly since the main thought behind it is to highlight the differences and important aspects when managing projects in a research institute. In addition, explore the reality of how SPM can be used in a PMS. This will be explained in chapter 9.3.1.

Next step will investigate the methodology to evaluate these factors. The main thought behind evaluating this categorization framework, it that it should be simplistic enough to not add more complexity in the PMS interface. The categorization framework should be executed using holistic reasoning instead of a data based analytical reasoning (De Wit & Meyer, 2014). The holistic reasoning is based on creative interpretation of the project, whereas the strategist will have to intuitively judge and envision the future that has the best chance of representing the

project reality. The analytic reasoning perspective is based on logic and data that is gathered and processed to pinpoint the project characteristics. The main different between these two perspectives is time, and the categorization system is a tool that should be used as an early assessment of the project. For this to work in practice, the categorization and evaluation criteria's need to be clear enough, so this become possible. If it is hard to differentiate the evaluation criteria's the model can become harder to use.

9.3.1 Potential Benefits

Appling a categorization system and create a proper SPM system can aid the PMS interface in the organization. This chapter will discuss some of the possible benefits of applying such a system.

A SPM system especially the categorization system can be a tool which enables evaluations all projects with the same factors will result in increased comparability between the projects This can create a foundation for management to prioritize between the various range of project. An early evaluation of the projects can also result in a simpler strategy alignment process. Whereas the project characteristics are identified and create an increased information foundation for strategic decisions.

If used correctly and a SPM system can increase the transparency in the projects. Since all projects undergoing the same management processes and have the possibility to create familiarity between the projects. This familiarity can be identified at different levels in the organization, and can potentially lead to more commitment at all levels. If the projects are mapped out early on and illustrated in the categorization framework (chapter 9.2.3), the project practitioners can relate to what kind of projects, they have worked on before, and understand the differences in the current project. This understanding can result in more flexibility in the organization as project participants understand the variances between the projects. The categorization framework will be illustrating the differences in the project, so the project practitioners can relate to it in implicit understanding. Meaning they will have an understanding of the project, based on their previous experience.

An underlying understanding of project work. As the SPM have the possibility to create, can potentially reduce the gap between the organization and project practitioners. If projects are mapped out, and the differences and characteristics are identified, it has the potential to increase the project practitioners understanding of why the special management method, process, and structure is fashioned instead of another.

As mentioned above, SPM can create alignment. In addition, if followed by the whole organization, it can enhance the project working culture. A similar approach towards the projects on an organizational level will create a common understanding of project work.

9.3.2 Beneficial for whom?

An essential question which is derived from RQ2.2 is advantageous for whom? The potential benefits are already enlisted in the previous chapter. However, who is it advantageous for, the project managers, project owners, project members or the organization?

Once again, there is no clear answers; the following discussion will investigate the different advantages for SPM with the various people in mind.

Organization – A SPM system will align the projects with the organizational requirements, making it easier to compare, prioritize and control clusters of projects. Aligning the projects with the proper strategy will be a result of a proper SPM system. In addition, a SPM will create a minimum quality assurance regarding the projects, as all projects are going through the same regimes. More information and increased comparability can make it possible to estimate different risks, and difficulties which can be avoided by redundancies.

Project Owners – More efficient managing toward the project. Early distinction of the project will make it easier for the project owner, to obtain control over the project at a meta-perspective. Meaning that the project owner can obtain an insight of the project without knowing all the specific. In addition, making all projects following all projects can enhance the transparency, which makes it possible to compare projects with each other. This comparison can make the project owner more familiar with the projects. Lastly, reviewing important factors early in the project can aid the project owner in steering the project towards the end goal.

Project Managers – Firstly, a SPM will create more certainty for the project manager, as there will be predefined processes and routines which change with the project. A SPM has the opportunities to create more safety for the project manager. Safety in this case creates more certainties, and if the organization is committed to the SPM, the PM will receive more support from the organization.

Project Members – Will have continuity towards project work. Have the possibility to understand why the project manager acts the way he does. Easier for the project member to understand the whole picture.

9.4 Challenges with a SPM system

There are some demerits with a standardized approach, as increased dynamism in the project management is considered more successful. Standardization, in this case, is to ensure that the organization provides the correct measurements that are required for successful projects. Knowledge through educating PM's and project practitioners is a viable approach when dealing with complex and for a project orientated organization. Awareness of projects, nature, purpose and how to deal with complexity will create a good foundation for successful projects (Milosevic & Patanakul, 2005). Moreover, a contingency approach is essential in standardizing PM activities. Standardization at meta-level may enhance success, but it needs to be customized to reach the strategic purpose of the company. It is wrong to assume that standardizing alone will automatically enhance project success. The convergence of innovation and project management research over the last decades emphasizes the importance of an adaptive model (Dodgson, Gann, and Phillips, 2013, p.639).

Bowker and Star (2000, p, 231) implies some challenges in developing a categorization system in a work setting. The categorization scheme must try to enhance comparability between the projects. To do this, it needs to be some standardization of language used to describe work activities. This will aid the communication channels and increasing understanding between the users. In addition, a standardized language can also imply that moving between projects in the organization would be easier. Moreover, comparability makes it possible for project practitioner to learn from similar projects, which again facilitates knowledge management and increasing the likelihood of success (Crawford, Hobbs, and Turner, 2004). Lastly, increased standardization and compatibility can ensure that the entire range of project experience could be examined and analyzed, and giving the organization a more holistic overview. However, the challenges of standardization are that it reduces the variety and complexity of the reality to a set of categories, that requires a degree of simplification. Models are an implication to perceive a reality constructed by the participates. It's a human interface based on the individual's perception. This can potential lead to unforeseen systematic effects towards the project work whereas decision making and assumptions can be too simplistic and create a more complex situation.

10 Discussion and Conclusion

As in the nature of an exploratory study, it is difficult to conclude (Saunders, et. al, 2016), and the study has come up with a thorough investigation of both PMS and SPM systems, and how they correlate and how they can contribute and support each other. This has resulted in a better insight of these systems and their practical implications.

These facts are reflected in the structure of this chapter. Firstly, the important answers for the first and second research questions are summed up in chapter 10.1 and 10.2. After this, the overall PMS (chapter 10.3) is introduced, which includes and combines the various aspects, concepts, and models that have been introduced in this study. This is the answer to the overarching research question. The PMS system can be considered as a holistic model, which are addressing the complications and difficulties in a research institute. These difficulties include the project nature, organizational context, organizational capabilities and how they correlate and can be addressed by a PMS.

10.1 Standardized project management

Recalling research question 1.2 "*What aspects of a SPM system is most advantageous to standardize?*"

This thesis has studied literature and a case company for standardized project management activities SPM is a part of a PMS system. Meaning it consists of project and organizational perspectives. There is an underlying theoretical assumption that standardized project meta-level procedures can be used to as an incentive from the organization to create a controlled and flexible approach towards project management (Chapter 4.2). The developed SPM system is created with a research institute as a focal point. The SPM consist of global procedures, which are initiated from the organizational level in the organization and consists of processes and routines that have the intention to enhance project management in the organization. In chapter 9.2.1 these processes and routines are identified, these are, processes concerning economic and purchasing functions, processes for resource distribution, processes and routines for project management (Leadership) training and development, and lastly, minimum formalities towards projects, such as project mandate and reporting.

To create flexibility a project categorization framework is created in chapter 9.2.2, which evaluates the projects based on ownership, organizational complexity, value focus, and risk. This system aims to specify the correct processes which can be used to address the different

complexities that arise in a research institute. The categorization framework will also illustrate the project specifics, which enables a mutual project comparison between all the projects in the organization. This can also simplify the strategic process in the project, and increase the strategic alignment. In addition, identity and reviewing project factors early on, can also make the selection of the proper project management function early on.

The answers for research question 1.1 "*How can SPM contribute to the PMS in a research institute*?". The in-depth answers for this question are in chapter 9.3.1 and 9.3.2. The highlight is that a sustained SPM system can provide more organizational control. The importance is that the system is not static and are able to address the various challenges that can arise in a research institute.

10.2 PMS in a research institute

The PMS in a case company, hereby referred as RESINC, is elaborated, analyzed and discussed in chapter 8. Moreover, the highlights of the research questions will be concluded in this chapter.

For research question "*2.1 What identifies the current PMS in RESINC?*" The current PMS contains two major components, the active PMS (chapter 4.1), steering group and the passive (chapter 4.2), the project handbook. There is otherwise a lack of formal routines. The steering group has little formal procedures towards projects, except the frequency of meetings. They are providing project governance to the project managers, and are evaluating the projects based on organizational needs. The project handbook is the official project guideline in the organization and should be used in all projects. There is a common consensus towards both incentives, which are not working optimally. The steering group are affected by informal processes and are perceived as uncommitted by the project managers. There could be several reasons for this, as investigated in chapter 8.2.1. The project handbook is perceived to detailed, so it does not fit the complex nature in RESINC.

For research question 2.2. "*To what extent are the current PMS affecting the project practitioners in the organization?*" One can say it creates an ad-hoc PMS in the organization. Meaning that the steering group is handling issues as they arise. The project managers are creating their own management approach depending on the project type. To summarize, these findings are creating more work and repetitiveness towards project management in the organization. If the PMS became more formalized, it could assist both the steering group and

the project managers in the organization. This could potentially increase the efficiency of the organization, as the project practitioners would save more time.

10.3 Conceptual PMS

This chapter is dedicated to provide an answer to the overarching research question, which asks; "*Can meta-level project management system (PMS) harmonize the interface between the organization and projects, in a research institute?*". Before this question is answered, a holistic PMS will be created and illustrated. It will contain aspects and contents which were generated throughout the study. Table 10-1, is showing the references and theories which are used as a foundation for the PMS model.

Table 10-1 – Detailed PMS Content Description

Name	Chapter	Page
Organization	2 - Organizational Context for a Research Institute 6 - Introduction of the Case Company 7.1 - Organizational Complications	9 61 67
Projects	3 - Special Project Factors 7.2 - Project Variations and Complications	15 69
PMS	4 - Project Management System 8.4 - Interaction within the Projects	29 86
Active	4.1 - Active PMS 8.2 - Active PMS in RESINC	31 81
Passive	4.2 - Passive PMS - Standardized Project Management 8.3 - Passive PMS in RESINC	34 82
SPM – Part 1	9.2.1 - Organizational Specific Standardization	98
SPM – Part 2	9.2.2 - Project Categorization Framework	100

Table 10-1 illustrates that the whole study is used to create the PMS which is designated towards a PMS and SPM system in a research institute.

Organization, requirements, and characteristics are used to specify what is needed from the organization. In chapter 2, it is established that a research institute operates in a demanding environment. It needs to address and be adaptable towards the laws and regulations (chapter 7.1), maintain a business case (chapter 2.2), explore the "frontier of research" (chapter 2.2), maintain competitive all this while balancing organizational capabilities (chapter 2.1). The organization needs to ensure that they are meeting and maintaining the external requirements, and internal requirements. Lastly, the importance of generating a proper strategy, which is delegated throughout the organization.

Projects in a research institute are widespread. Meaning they have a lot of variations regarding technicalities, economic and operational factors (Chapter 7.2). There are also variations between the project type, such as R&D and external projects (chapter 3). This indicates the importance of having an adaptable and flexible project management approach.

PMS, combines the different requirements, and characteristics in the research institute. By balancing the **passive** and **active** aspects, it provides a process output that should be aligned with the organizational and project needs. The active and passive measurements can vary, but as shown in the analysis (chapter 8.2 and 8.3) a formalized approach is required and dedication from all levels in the organization.

SPM combined two parts. Part 1 is connected to the organizational specific needs and requirements. These are global processes which make sure that all projects are aligned and meeting the minimum requirements of the organization. Entails, financial and purchasing processes, leadership processes, and resource distribution processes. Part 2, is dedicated to the complex project nature and creates a categorization framework based on the project characteristics.

Figure 10-1 illustrates the correlation between the different aspects in a PMS. The PMS is influenced and created using systems theory. These theories supported the complex structure of a PMS. As PMS contains dynamic, static, active, passive, outputs, inputs and elements. Systems theory then became a valid theory to use when developing a PMS. The perspective in the developed PMS is a process perspective, meaning that the PMS is adjusting the desired project output by adjusting the project management processes within the organization.

The illustration is a conceptual model, of how the different aspects are correlated. The projects are visualized as a cloud as they are diverse complex, unique, and as per definition have unique properties. The cloud represents uncertainty and chaos that the PMS needs to address. The passive and active entities are created and maintained by the organization.
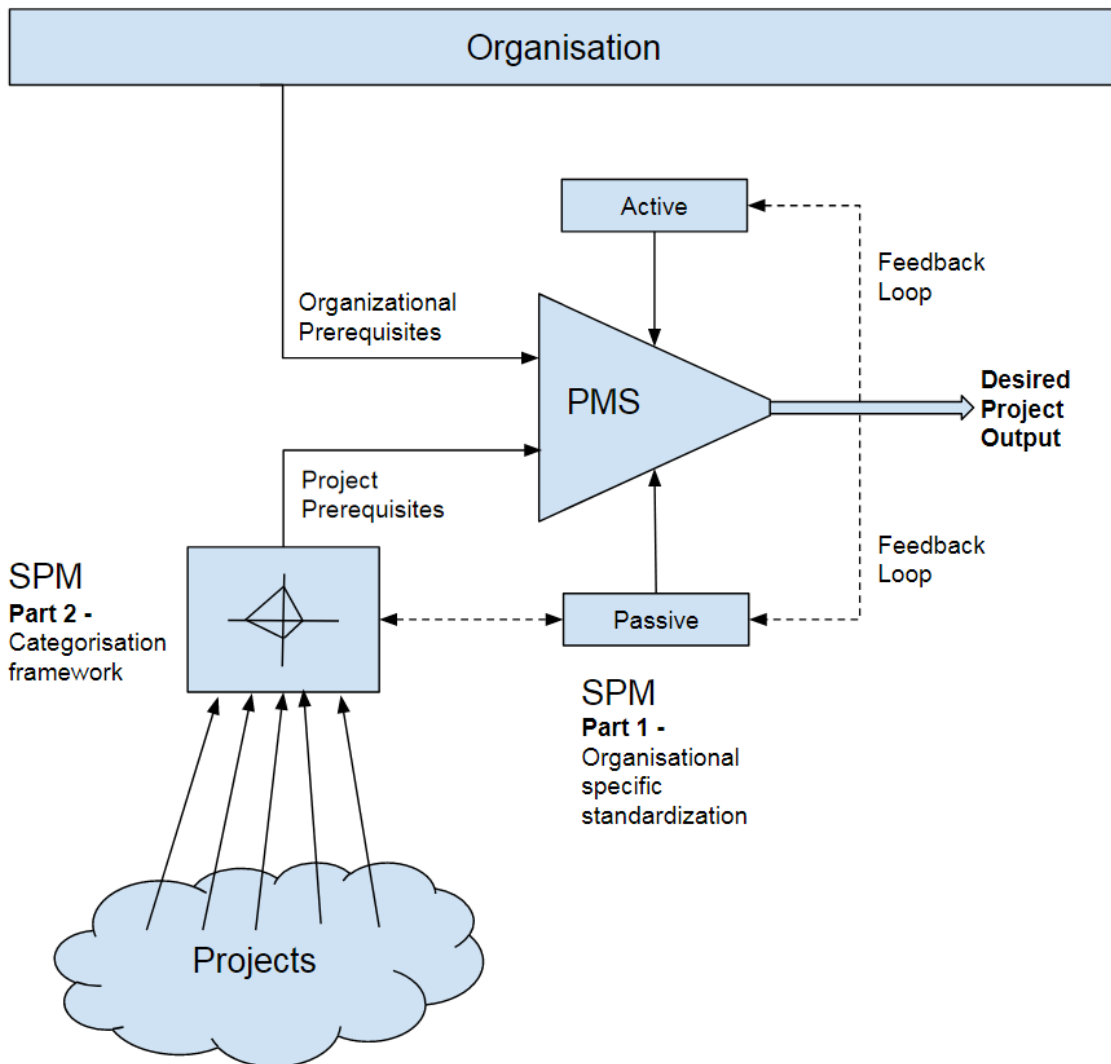
Figure 10-1 – Holistic PMS, with Organizational, Project and SPM Aspects.

The PMS have two main inputs, the organizational and project prerequisites. Prerequisites include the requirement and conditions for the PMS system to operate. It is based on the specific needs of the organization and projects. The PMS needs to address and satisfy both organizational and project aspects in the most beneficial manner. Before the diverse and complex variations of the project are sent to the PMS it is passing by a categorization system (chapter 9.2.2), which categorizes the project based on ownership, value, organizational complexity, and risk. One can say the categorization system works as a filter, which is highlighting the significant differences in each project. This categorization system defines the overall complexity of the projects, and make the input to the PMS more indefinable. The PMS system is controlled by two entities, the passive and active aspects. Both the entities are monitoring the project output and provide a response to the PMS. This feedback loop is

adjusting the PMS to achieve the desired output. The passive system is also operating and adjusting the categorization system.

The model is an extraction and combination of earlier figures and models. Table 10-2 bellow is explaining what aspects of the models that are used to create figure 10-1. This table is created to illustrate that the different aspects of this study are employed in a combined effort to make a PMS system.

Table 10-2 – Aspect Extracted from Other Models

Model	Short description	Extracted aspects
1.1 – Project Management System Concept	Overview of the overall PMS concept, organization and projects are illustrated as generic.	Correlation between organization and projects at a meta-level.
4-1 – PMS General Overview	Enhanced PMS overview included active and passive elements. The projects are modeled as a cloud to fit the complex project reality of a research institute.	Correlation between the passive and active PMS aspects. Modeling of the complex project reality.
4-2 – PMS Specific Overview	PMS Illustrated using systems theory. Shows the control mechanisms and feedback loops, which affects the PMS system.	PMS from a systems theory aspects, also feedback loop correlation between the active, passive and PMS aspects.
4-3 – SPM General Overview	Generic purpose of a SPM system from a process perspective. Shows how standardization can be used related to project management.	The concept of how a SPM system can reduce the complexity by streamlining processes and making sure that all projects are following the same procedures.
9-1 – SPM Flexible Overview	Applied SPM, described towards the research institutes context, from a process perspective. The output from the SPM contains more outputs that are connected to the organizational and project specific processes.	How SPM can be used as a flexible approach, and how a categorization system can be to create proper procedures towards a complex project reality.
9-2 –SPM System for a Research Institute	Process overview of key processes that can be standardized in a SPM, and which level these processes should be standardized.	What aspects and processes that belong to the different aspects of the organization.
9-3 - Example of Project Management Categorization Framework	Part two of figure 9-2, contains factors that illustrate a project categorization framework. Also, illustrates how this framework can be used in practice.	How a project management framework can be used to create controlled outputs via, categorize the projects.

116

10.4 Concluding remarks

The PMS is created in the interaction between the permanent and the temporary. The interface is created by the project practitioners. The purpose of a PMS is simply put, to control the interface to obtain a satisfied level of efficiency and effectiveness. The variations of a PMS will be dependent on organizational fit and project needs, perquisites and requirements. To achieve optimal efficiency and effectiveness the system needs have the right level of control and formalities. Hence the discussion and paradox regarding chaos and control, in the introduction chapter. A balance will create flexibility in the interface which may be suitable for the research institute.

Moreover, there is a flaw the overarching research question; the question should have a 'how' nature instead of a 'can' nature. The 'can' question can be answered easily, because of the broad definition of a PMS. A 'how' question would have a more in-depth answer and may open up for a different discussion. A PMS have the ability to formalize the interface between projects and organization in a research institute.

In a project-based organization such as a research institute, the PMS will be existent and managed consciously or sub-consciously. The study, has shown that the project managers are creating their own tools and processes if they are non-existing. This is a supportive argument to the statement that the project practitioners tend to self-organize when it is necessary. This is an example of subconscious management of the PMS interface. This can be related to the human aspects, as humans tends to self-organize to be more efficient (Ashby, 1947). Once these actions are formalized and defined, it becomes a conscious act. Consciously by organizational requirements, procedures, and actions or sub-consciously by the project practitioners itself, where they act coordination with the organization. The level of consciousness can have a correlation with the awareness in the organization. The awareness addresses the understanding of the interface between organization and project. This is connected to the project maturity in the organization. This study is addressing essential subjects which both affects and creates a foundation towards a PMS. With special empathizes on SPM. As SPM is a passive incentive towards a PMS. The study can potentially increase this awareness, by highlighting the issues in the organization and how a PMS and SPM systems can make project work more formalized and simplistic.

Currently, the research institute has mixed approach in the PMS interface, it has one major active element, steering group, and one major passive system, Project Handbook. These are two

elements that combined are addressing the complexity and variations in the project work in the organization. If these elements did not exist the interface between the organization and projects would be less effective. The current PMS in the research institute is aiding the PMS.

There are several ways of managing the PMS; it can be various active elements, such as PMO and PPM, and passive elements. Moreover, the importance is to select the elements that are fit with the organization, context, and environment. A too excessive system can create an overly managed interface which can result in a waste of resources. In addition, one can argue that there is no correlation between the size of the PMS system and its efficiency. A too big system can result in a higher overhead and operational cost in the organization. A small PMS may lead to inefficient projects. With this in mind, one can argue that a PMS should be fit with the availability of resources in the organization.

Furthermore, the proposed SPM is an extension or an add-on, which can contribute to the PMS. The proposed system is categorizing the projects as a part of the selection of the correct processes and leadership. The aim is to match the processes and leadership with the project characteristics to achieve optimal projects. As it is a passive system, it can be suitable for the current PMS in RESINC. It is assumed that, a passive system does not require the same level of control and maintenance as an active system.

PMS controls the level of formalities. One can use reasoning to explain that excessive use of passive elements, such as procedures, standards and so forth, will restrict the project managers freedom, it will create more control. Restriction in terms of creativity and select the methodology and procedures that fit with the project manager's style and experience. In addition, formalities and passive elements need to be followed. The organization than having to utilize resources to make sure that the project practitioners are committed to the formal procedures of the organization.

Moreover, a too excessive framework can fail to recognize special situations and projects. There is a possibility that a too detailed system will fail to address all the variations that can arise in these systems and interactions. A system that is less detailed can, therefore, be more efficient, but requires more knowledge and intuition from the project managers, to recognize these issues.

The closing statement towards PMS, is that a PMS is an essential system in this interface. A well-managed PMS will result in higher efficiency and effectiveness. Moreover, PMS needs to be fit with the organizational capabilities, such as intellectual capital and resources.

10.5 Practical Implications

The study has developed a PMS using systems theory. The system explains the correlation between the aspects of a PMS. The system is also grouping together different project governance concepts, such as PMO and PPM, in a holistic context. The important aspect of a PMS is to develop a system which is suitable for the organization and its needs. It is assumed that a too complex PMS, containing a lot of active and passive elements do not necessarily result in a more effective project management. The size of the PMS is not synonym with the effectiveness.

Other practical implication is the project categorization framework, and its possible benefits. A simple tool for evaluating projects on four factors can create flexibility when creating a standardized approach.

Moreover, the special context that makes a research institute unique is investigated. One important practical aspect is the fact that a research institute should be focused on being service-minded to maintain sustained customer relationships. This is reflected in the developed SPM system that addresses this from a project and organizational level. Indicating that selection of the proper processes is essential to maintaining healthy client relationships.

The study has not presented a lot of new theories and theoretical findings. It has compiled and aggregated existing project management theories and methods and developed a PMS and SPM system.

Towards a SPM system, the proposed benefits are elaborated in chapter 9.3.1 and 9.3.2.

10.6 Theoretical Implications

The study has developed two main theoretical contributions. First is the conceptual PMS in Chapter 10.3 Which is created with different theories regarding project management and empirical research related to a research institute. Combined it creates a meta-level system including the various aspects in the project − organization interface. This system is an illustration of the aspects and their correlation, which is needed to obtain a certain level of control. The concepts and rationale behind a PMS can be used in different project-based organizations.

The second contribution is the SPM system in chapter 9. This SPM system is specified and developed towards a research institute. Compared to the PMS, the SPM is more specific to the

needs of a research institute. Meaning the generalizability of the SPM is difficult to adapt to other contexts.

To create these contributions, PMS and SPM, the study is combining existing concepts within project management and management literature. Such as paradox chaos vs control (De Wit and Meyer, 2014), systems theory (Flood and Carson, 1993), project leadership (Cooke-Davies, 2011; Kotter, 2001; Shenhar, 2004), project processes(PMI, 2013; Rodrigues and Bowers, 1996; Müller and Turner, 2007), project tools (Milosevic and Patanakul, 2005), project governance (Müller,2009, 2011; Crawford et al., 2008; Gareis, 2000 Sanwal, 2007; Dai and Wells, 2004; Jeng, and Huang,2015) and project standardization (Milosevic and Patanakul, 2005; Cooke-Davies, 2011b; Nicholas et al., 2002).

Another theoretical contribution towards project management is that a linear and static management and standardization approach to a dynamic environment is unbeneficial. Indicating that a too detailed standardized approach is unbeneficial when creating SPM. Meaning flexibility and adaptability are essential in a complex world.

As for gaps in the literature, there are few gaps. Most of the empirical findings and problems in the organization support general project management theories. Which can be solved with effective collaboration, communication and a correct and adaptable project support systems (Lechler and Cohen, 2009; Crawford et al., 2008; Müller, 2004, 2009; Müller and Turner, 2005, 2007; Shenhar, 2001, 2004; Morris, 1998; De Wit and Meyer, 2014; Bourgault and Daoudi, 2014; Brady and Hobday, 2011).

The closest finding which can be considered a theoretical gap is that the principal-agent theory can be used in all the levels in the organization. Project owner and project manager, project owner and client and project manager and project member.

10.7 Suggestions for Further Work

The row work chapter will be divided up in the following sections. Further work regarding the main contribution, the PMS and SPM systems and the other theoretical and practical aspects.

The PMS can be further developed and fitted to the RESINC's needs. This will include an in-depth analysis and research of the special needs of the project practitioners in the organization, to expand the passive and active aspects of the system. In addition, investigate, and test out the benefits of the PMS. In this study, the PMS is investigated from system theory and process standardization perspective. More research is needed towards PMS to make it a sustained system. These perspectives could be, knowledge, learning, management, change and degree of flexibility, to mention a few.

More research is also required in the SPM system to refine the processes further. Currently, the processes are defined from a meta perspective, meaning that they are defined based on category. These processes can be identified and investigated from a theoretical perspective. These processes can also be identified by researching and analyzing RESINC further.

Regarding the SPM system, the evaluation criteria for the framework needs to be investigated further. Selection criteria's can be identified by investigating theory or by analyzing RESINC. As stated (Chapter 9.3) the criteria's needs to be intuitive and when inserted in the categorization framework, create a visible overview of the project. The relevance and usefulness of a project categorization system should also be investigated.

PMS and SPM can be efficient tools regarding development and execution of organizational strategy. How this can be used in practice needs to be investigated further. One of the assumptions for a PMS and SPM system is to create the project and organizational interface simpler and more manageable.

Other theoretical and practical aspects that can be researched further is suggested to be:

The question and impacts of ownership in a research institute have barely been touch upon in a project in a research institute setting. The range of ownership in this context affects the project and project practitioners in several ways. This could vary from the chosen project control mechanisms, client handling to the motivation in the project. A more in-depth study of these phenomena would be beneficial. How can this affect the PMS and SPM systems, and how can the organization address the challenges when having varying degrees of ownership?

What level in a research institute should own and develop the business case? Should it be centralized by a dedicated team in the organization, or should it be at project management level? It is not certain that it is most beneficial to train the project managers in business and strategy to enhance the projects, this aspect can be controlled centrally. This research could be interesting as it has the possibility to be valuable knowledge, to balance the centralization – decentralization paradox. This will also be entailing how project management as a discipline can be developed and made useful in a research institute:

Investigate the ownership and motivation relationship in a research institute. Will the researchers work more efficient and with higher motivation if they are feeling ownership to the projects?

Knowledge and technical spillovers (chapter, 3.1) is something that can occur in innovation and R&D, how a PMS can address this need to be investigated.

11 References

Ashby, W.R., 1947. Principles of the self-organizing dynamic system. The Journal of general psychology, 37(2), pp.125-128.

Baccarini, D., 1996. The concept of project complexity—a review. International Journal of Project Management, 14(4), pp.201-204.

Bierly, P.E., Damanpour, F. and Santoro, M.D., 2009. The application of external knowledge: organizational conditions for exploration and exploitation. Journal of Management Studies, 46(3), pp.481-509.

Bourgault, M. and Daoudi, J., 2014. Innovation projects conducted by distributed teams: the impact of key team characteristics on collaboration. Journal of Innovation Economics & Management, (1), pp.37-72.

Brady, T and Hobday, M., 2011. Projects and Innovation. In: Morris, P., Pinto, J. and Søderlund, J. The Oxford Handbook of Project Management. Oxford: Oxford University Press. pp. 273-294.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. Qualitative research in psychology, 3(2), pp.77-101.

Brown, S.L. and Eisenhardt, K.M., 1998. Competing on the edge: Strategy as structured chaos. Harvard Business Press.

Buck-Lew, M., 1992. To outsource or not?. International Journal of Information Management, 12(1), pp.3-20.

Burgess, RG., 1991. "Keeping field notes" (pp. 191-194). In RG Burgess (Ed.) Field Research: A sourcebook and Field Manual. London: Routledge.

Burns, T.E. and Stalker, G.M., 1961. The management of innovation. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Caudy, D.W., 2001. Using R&D outsourcing as a competitive tool. MEDICAL DEVICE AND DIAGNOSTIC INDUSTRY, 23(3), pp.115-126.

Ceric, A., 2014. The Nemesis of Project Management: The Gaping Non-contractual Gap. Procedia-Social and Behavioral Sciences, 119, pp.931-938.

Cioffi, D.F., 2006. Subject expertise, management effectiveness, and the newness of a project: The creation of the Oxford English Dictionary. In Project Management Institute Research Conference, Montreal, Project Management Institute.

Collyer, S. and Warren, C.M., 2009. Project management approaches for dynamic environments. International Journal of Project Management, 27(4), pp.355-364.

Cooke-Davies, T., 2011. Complexity in Project Management and the Management of Complex Projects. In: Cooke-Davies Aspects of Complexity: Managing Projects In a Complex World. PMI. pp 1-14

Cooke-Davies, T., 2011b. Towards Project Management 2.0 In: Cooke-Davies Aspects of Complexity: Managing Projects In a Complex World. PMI. pp 179-188.

Crawford, L., Cooke-Davies, T., Hobbs, B., Labuschagne, L., Remington, K. and Chen, P., 2008. Governance and support in the sponsoring of projects and programs. Project Management Journal, 39(S1), pp.S43-S55.

Crawford, L., Hobbs, J.B. and Turner, J.R., 2004. Project categorization systems and their use in organizations. In Proceedings of the PMI Research Conference.

Dai, C.X. and Wells, W.G., 2004. An exploration of project management office features and their relationship to project performance. International Journal of Project Management, 22(7), pp.523-532.

Dalen, M., 2004. Intervju som forskningsmetode: en kvalitativ tilnærming. Oslo, Universitetsforlaget.

Davies A, and Frederiksen, L., 2010. Project based innovation: the world after Woodward, In: Technology and Organisation: Essays in Honour and of Joan Woodward. Research in the Sociology of Organisation Series.

Davies, A., Brady, T. and Hobday, M., 2006. Charting a path toward integrated solutions. MIT Sloan Management Review, 47(3), p.39.

De Wit, B., Meyer, R., 2014. Strategy an International Perspective. 5th ed. Andover: Cengage Learning EMEA. pp 201-216

den Hertog, P., van der Aa, W. and de Jong, M.W., 2010. Capabilities for managing service innovation: towards a conceptual framework. Journal of Service Management, 21(4), pp.490-514.

Dinsmore, P.C. and Cabaniswin, J., 2006. The AMA handbook of project management. AMACOM Div American Mgmt Assn.

Dodgson, M., Gann, D.M. and Phillips, N. eds., 2013. The Oxford handbook of innovation management. OUP Oxford.

Dvir, A. and Shenhar, A.J., 2007. Reinventing Project Management. Harvard Business School Publishing Corporation.

Eisenhardt, K.M., 1989. Making fast strategic decisions in high-velocity environments. Academy of Management journal, 32(3), pp.543-576.

Eisenhardt, K.M., 1999. Strategy as strategic decision making. MIT Sloan Management Review, 40(3), p.65.

Engwall, M., 2003. No project is an island: linking projects to history and context. Research policy, 32(5), pp.789-808.

Fagerberg, J., 2015. Innovation–a New Guide. Working Paper, University of Oslo, Centre for Technology, Innovation and Culture (available online at: http://www. sv. uio. no/tik/InnoWP/tik_working_ paper_20131119. pdf), accessed February 23.

Filippov, S., Mooi, H., Aalders, F. and van der Weg, R., 2010. Managing Innovation Project Portfolio: The Case of Philips Research. In Proceedings of the 7th International Conference on Innovation and Management, pp. 819-830

Flood, R.L. and Carson, E., 1993. Dealing with Complexity: An Introduction to the Theory and Application of Systems Science. Springer Science & Business Media.

Gad, S.C. and Spainhour, C.B., 2011. Contract research and development organizations: their role in global product development. Springer Science & Business Media.

Gareis, R., 2000. Program management and project portfolio management: New competences of project-oriented companies. Proceedings of IRNOP IV, International Research Network for Organizing by Projects.

Gareis, R., 2004. Management of the project-oriented company. The Wiley guide to managing projects, pp.123-143.

Harpum, P., 2007, Project Control. In: Morris P, and Pinto, J. A Wiley Guide to Project Control: John Wiley & Sons INC

Hayes, S. and Bennett D., 2011. Managing Projects With High Complexity. In: Cooke-Davies Aspects of Complexity: Managing Projects In a Complex World. PMI. pp 17-27

https://www.merriam-webster.com/dictionary/tangible

ICCPM (International center for complex project management), 2012. Complex Project Manager Competency Standards. 4th ed. Australia.

Ivory, C. and Alderman, N., 2005. Can project management learn anything from studies of failure in complex systems?. Project Management Journal, 36(3), p.5.

Jaffe, A.B., 1986. Technological opportunity and spillovers of R&D: evidence from firms' patents, profits and market value.

Jeng, D.J.F. and Huang, K.H., 2015. Strategic project portfolio selection for national research institutes. Journal of Business Research, 68(11), pp.2305-2311.

Johnson, D.W. and Johnson, F.P., 1991. Joining together: Group theory and group skills . Prentice-Hall, Inc.

Kline, S.J. and Rosenberg, N. 1986 "An Overview of Innovation", in Landau, R. and Rosenberg, N. (eds.) The Positive Sum Strategy: Harnessing Technology for Economic Growth, Washington D.C.: National Academy Press, p. 275-304

Knight, G.A. and Cavusgil, S.T., 2004. Innovation, organizational capabilities, and the born-global firm. Journal of international business studies, 35(2), pp.124-141.

Kotter, J.P., 2001. What leaders really do (pp. 85-96). Harvard Business School Publishing Corporation.

Kreiner, K., 1995. In search of relevance: project management in drifting environments. Scandinavian Journal of management, 11(4), pp.335-346.

Kutila, M. Jokela, M., Fruttaldo, S., and Pallaro, N., 2014. Advanced study of project ownership challenges in research organisation. WSEAS Transactions on Business and Economics 11(1). pp 562-570

Lam, J., 2001. The CRO is here to stay. Risk Management, 48(4), p.16.

Lechler, T.G. and Cohen, M., 2009. Exploring the role of steering committees in realizing value from project management. Project management journal, 40(1), pp.42-54.

Leifer, R., 2000. Radical innovation: How mature companies can outsmart upstarts. Harvard Business Press.

Leiponen, A., 2005. Skills and innovation. International Journal of Industrial Organization, 23(5), pp.303-323.

Lim, K., 2004. The relationship between research and innovation in the semiconductor and pharmaceutical industries (1981–1997). Research policy, 33(2), pp.287-321.

Lincoln, Y.S. and Guba, E.G., 1985. Naturalistic inquiry (Vol. 75). Sage.

Loch, C. & Payne, F. C., 2011. Strategic Management: Developing Policies and Strategies. In: Cooke-Davies Aspects of Complexity: Managing Projects In a Complex World. PMI. pp 41-57.

Malterud, K., 2001. Qualitative research: standards, challenges, and guidelines. The lancet, 358(9280), pp.483-488.

Marshall, A.W. and Meckling, W.H., 1962. Predictability of the costs, time, and success of development. In The rate and direction of inventive activity: Economic and social factors (pp. 461-476). Princeton University Press.

Maylor, H. 2003. Project management (3rd ed.). Harlow, UK: FT Prentice Hall.

Merriam-Webster Dictionary, 2016, Innovation – Merriam-Webster [ONLINE] Available at: https://www.merriam-webster.com/dictionary/innovation [Accessed 08 December 2016]

Meyer, D.E. and Schvaneveldt, R.W., 1971. Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of experimental psychology, 90(2), p.227.

Milosevic, D. and Patanakul, P., 2005. Standardized project management may increase development projects success. International Journal of Project Management, 23(3), pp.181-192.

Moe, T., 1990. The Politics of Structural Choice: Toward a Theory of Public Bureaucracy. Organization Theory. Ed. O. Williamson. New York: Oxford University Press, p.116.

Morris, P.W. and Hough, G.H., 1987. The anatomy of major projects: A study of the reality of project management.

Morris, P.W., 1998. Why project management doesn't always make business sense. Project management, 4(1), pp.12-16.

Müller, R,. 2009. Objectives and Institutions In: Müller Project Governance. Gower Publishing; pp 15-27

Müller, R. and Turner, J.R., 2005. The impact of principal–agent relationship and contract type on communication between project owner and manager. International Journal of Project Management, 23(5), pp.398-403.

Müller, R. and Turner, J.R., 2007. Matching the project manager's leadership style to project type. International journal of project management, 25(1), pp.21-32.

Müller, R., 2003. Communication of information technology project sponsors and managers in buyer-seller relationships. Universal-Publishers.

Müller, R., 2011, Project Governance. In: Morris, P., Pinto, J. and Söderlund, J. The Oxford Handbook of Project Management, Oxford University Press. pp. 297-320

Müller, R., 2012. Project governance. Gower Publishing, Ltd..

Nicholas, J.A., Squires, D.J. and Lennox, I., 2002. Three Challenges to CRO Success. Pharmaceutical Executive, 22(6), pp.96-100.

Nolan, A., 2011. A new OECD project New sources of growth: intangible assets. [online] Available at: https://www.oecd.org/sti/inno/46349020.pdf [Accessed 21 Apr. 2017].

Nonaka, I., 1994. A dynamic theory of organizational knowledge creation. Organization science, 5(1), pp.14-37.

OECD, 2002, Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264199040-en

OECD. 2011. Skills for Innovation and Research - OECD. [ONLINE] Available at: http://www.oecd.org/sti/inno/skillsforinnovationandresearch.htm. [Accessed 07 December 2016].

OECD/Eurostat, 2005, Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264013100-en

Olsson, N.O. and Berg-Johansen, G., 2016. Aspects of project ownership in theory and practice. Procedia Computer Science, 100, pp.790-795.

Olsson, N.O., Johansen, A., Alexander Langlo, J. and Torp, O., 2008. Project ownership: implications on success measurement. Measuring business excellence, 12(1), pp.39-46.

Patanakul, P. and Shenhar, A.J., 2012. What project strategy really is: The fundamental building block in strategic project management. Project Management Journal, 43(1), pp.4-20.

Perrow, C., 1984. Normal accidents: Living with high risk systems.

Piachaud, B.S., 2002. Outsourcing in the pharmaceutical manufacturing process: an examination of the CRO experience. Technovation, 22(2), pp.81-90.

Pinto, J.K., 2007. Project management: achieving competitive advantage. Upper Saddle River, NJ, USA: Pearson/Prentice Hall.

PMI (Project Management Institute), 2016. Complexity | Project Management Institute. [ONLINE] Available at: https://www.pmi.org/learning/featured-topics/complexity. [Accessed 27 November 2016].

PMI, 2013. A Guide to the Project Management Body of Knowledge: PMBOK (®) Guide. Project Management Institute. Fifth Edition

Porter, M.E., 1980. Competitive strategy: techniques for analyzing industries and competitors.

Porter, M.E., 1985. Technology and competitive advantage. Journal of business strategy, 5(3), pp.60-78.

Remington, K. and Pollack, J.. 2011. Tools for Complex Projects. In: Cooke-Davies Aspects of Complexity: Managing Projects In a Complex World. PMI. pp. 29-40.

Rodrigues, A. and Bowers, J., 1996. The role of system dynamics in project management. International Journal of Project Management, 14(4), pp.213-220.

Sanwal, A., 2007. Optimizing corporate portfolio management: aligning investment proposals with organizational strategy. John Wiley & Sons.

Saunders, M.N., Thornhill, A. and Lewis, P., 2016. Research Methods for Business Students. 6th edition, Pearson Education Limited

Shenhar, A.J., 2001. One size does not fit all projects: Exploring classical contingency domains. Management Science, 47(3), pp.394-414.

Shenhar, A, J., 2004. Strategic Project Leadership® Toward a strategic approach to project management. R&D Management, [Online]. Volume 34, Issue 5, pp 569–578.

Shenhar, A.J. and Dvir, D., 2007. Project management research-the challenge and opportunity. Project management journal, 38(2), p.93.

Shields, P.M. and Rangarajan, N., 2013. A playbook for research methods: Integrating conceptual frameworks and project management. New Forums Press.

Sobek II, D.K. and Liker, J.K., 1998. Another look at how Toyota integrates product development. Harvard business review, 76(4), pp.36-47.

Stacey, R.D., 2001. Complex responsive processes in organizations: Learning and knowledge creation. Psychology Press.

Stewart, T.A., 1997. Intellectual capital: the new wealth of organizations.

Sydow, J., Lindkvist, L. and DeFillippi, R., 2004. Project-based organizations, embeddedness and repositories of knowledge: Editorial.

Toney, F. and Powers, R., 1997. Best practices of project management groups in large functional organizations. Project Management Inst.

Turhan, A., 2005. Does the nature of ownership matter? Lessons from theory and evidence.

Turner, J. R. 1999. The Handbook of Project-Based Management: Improving the Processes For Achieving Strategic Objectives, McGraw-Hill.

Turner, J.R. and Simister, S.J. eds., 2000. Handbook of project management. Gower Publishing Limited.

Urli, B. and Terrien, F., 2010. Project portfolio selection model, a realistic approach. International Transactions in Operational Research, 17(6), pp.809-826.

Urueña, A., Hidalgo, A. and Arenas, Á.E., 2016. Identifying capabilities in innovation projects: Evidences from eHealth. Journal of Business Research, 69(11), pp.4843-4848.

Vicente-Oliva, S., Martínez-Sánchez, Á. and Berges-Muro, L., 2015. Research and development project management best practices and absorptive capacity: Empirical evidence from Spanish firms. International Journal of Project Management, 33(8), pp.1704-1716.

Whitty, S.J. and Maylor, H., 2007. And then came complex project management. In 21st IPMA World Congress on Project Management (pp. 1-7).

Wood, M., 2002. Mind the gap? A processual reconsideration of organizational knowledge. Organization, 9(1), pp.151-171.

Wozniak, T.M., 1993. Significance vs. capability:" Fit for use" project controls. AACE International Transactions, pp.A-2.

Xia, W., and Lee, G. 2004. Grasping the complexity of IS development projects. Communications of the ACM, 47(5), 69–74.

Yin, R. K. 2009. Case study research: Design and methods. Thousand Oaks, CA: Sage.

Zwikael, O. and Smyrk, J., 2011. The Project Environment. In Project Management for the Creation of Organisational Value (pp. 85-133). Springer London.

Appendix 1 – Interview guide

Note: the real company name has been replaced with "RESINC"

Formelt	Minne om lydopptak, anonymitet, sitat må bekreftes Raskt om min bakgrunn
Introduksjon	Navn: Stilling: Utdannelse: Kan du fortelle kort om din arbeidshistorikk og tidligere erfaring med prosjektarbeid? Hvilken rolle har du hatt i tidligere prosjekter. Eks i en annen jobb... ? Hvilke prosjekter deltar du i akkurat nå? Beskriv dine roller i nåværende prosjekter hos RESINC?
Prosjekt Spesifikt	Ta utgangspunkt i et spesifikt prosjekt Kan du kort fortelle hva dette prosjektet omhandler? - Prosjekteier - Formål og verdiskapning - Risiko, teknisk, økonomisk, tid. - Grad av samarbeid og omorganisering for å få prosjektet gjennomført. Hva er din rolle i dette prosjektet? Hvem er styringsgruppe/referansegruppe (eller prosjektleder)? Hvilke forventninger har du til dem/de? Hva rapporterer du til dem? Hvilke prosesser har dere for dette? Hvordan følger du opp i dette prosjektet? Hva ville vært ideelt, med tanke på oppfølging og rapportering? Skjer det noen ganger at konflikter oppstår. Hvis det skjer, kunne du forklart kort hva den omhandler og hvorfor du mener den oppsto?

Prosjektkjennetegn hos organisasjonen (Generelt)	Dette er litt mer generelle spørsmål om kjennetegn i RESINCs prosjektarbeid. Hva kjennetegner prosjektene hos RESINC? • I hvilken grad opplever du reparativt arbeid, fra et prosess perspektiv? • Til hvilken grad preges prosjektene av usikkerhet? • Hvordan opplever du kundens posisjon og deltakelse i prosjektene? Opplever du variasjon mellom prosjektene du kjenner til her på RESINC? I hvilken grad opplever du en forskjell i prosjektstyringen mellom prosjektene? • Forskjell på prosjektlederne? • Noen andre forskjeller du vil påpeke?
Prosjektstyring hos organisasjonens (Generelt)	Hva mener du kjennetegner RESINCs prosjektstyrings struktur? • I forhold til tidsplaning? • I forhold til arbeidsfordeling, resursfordeling? • I forhold til kvalitetskontroll? • I forhold til rapportering og byråkrati? Hvordan varierer dette mellom prosjektene du har deltatt i? Hvordan opplever du disse prosjektstyrings prosessene? I hvilken grad kan du påvirke prosjektstyrings prosessene? I hvilken grad opplever du byråkrati og dokumentasjon i prosjektarbeid? • Hvordan påvirker dette dine arbeidsoppgaver?
Offisielle Prosedyrer	I hvilken grad er du kjent med RESINCs prosjekthåndbok? Hvordan samsvarer den med din erfaring om RESINCs Prosjektvirksomhet? Ta utgangspunkt i et prosjekt du har jobbet med, i hvilken grad mener du denne prosjekthåndboken boken ble brukt? • Prosjektmandat • Som hjelpemiddel som prosessveiledning? • Kvalitet og kontroll (KK-plan) verktøy? • Statusrapportering (internt og eksternt)? • Utarbeidelse av prosjektplan?

Appendix 2 – Information letter

Bakgrunn

Prosjektarbeid er en arbeidsform som per definisjon er unik og temporær, og som gjøres for å oppnå et definert mål innenfor en planlagt tids- og ressursramme. I denne masteroppgaven med foreløpig tittel "Project Management System at a Research Institute" ser jeg på standardiserte prosjektprosesser mellom «organisasjon» og prosjekt, og hvilke fordeler og ulemper som kan oppstå ved å standardisere prosjektprosesser. Ideelt sett skal disse prosessene fremme effektivitet og gjøre prosjektarbeidet enklere. Men per definisjon er alle prosjekter ulike, så hvordan kan dette gjøres i praksis?

I min masteroppgave utvikler jeg en organisasjonsrettet kategoriseringsmodell som er tilrettelagt for IFE. Denne modellen vil kategorisere prosjektene ut i fra prosjektets kontekst som eierskap, verdifokus, organisatorisk omstilling og risiko. For eksempel, et internt prosjekt vil kreve andre ressurser og ulik grad av kontroll sammenlignet med et eksternt prosjekt. Systemet vil bestå av to forskjellige nivåer. Organisatorisk nivå som er et av nivåene, er felles for alle prosjekter. Eksempel på dette nivået er styring av kommunikasjonskanaler, økonomi, datasystem osv. Det andre nivået er prosjektrettet, og skal være fleksibelt etter prosjekttype.

Videre skal jeg i min masteroppgave analysere prosjekthåndboken og samkjøre denne med kategorisystemet jeg har utviklet. Dette blir grunnlaget for sammenligning av hvordan standardiseringen av prosjektrutiner fungerer i praksis, og hvordan den er tilrettelagt hvert enkelt prosjekt.

Hensikt med intervjuene

Prosjektleder, nivået over prosjektleder (prosjekteier/prosjektansvarlig) og styringsgrupper/ referansegrupper vil bli intervjuet for å få et innblikk i hvordan prosjektarbeidet utføres samt hvordan interaksjonen mellom nivåene kan relateres mot det prosjektspesifikke. Jeg kommer til å spørre generelt om prosjektarbeid hos IFE. Dette for å få et innblikk i hvordan prosjektene styres, hvilke formelle rutiner som finnes og hva som kjennetegner prosjekter hos IFE. Jeg er også interessert i å forstå hva de forskjellige leddene krever av informasjon og rutiner. Dette for å få identifisert eventuelle ulike behov mellom nivåene.

Intervjuene vil dokumenteres ved at det gjøres lydopptak. Lydopptakene vil analyseres, og relevant informasjon trekkes ut. Etter at studien er ferdig vil lydopptakene slettes. Ingen sitater

vil bli med i oppgaven uten godkjenning. Alle intervjuobjekter vil anonymiseres, men rollen (prosjektleder, prosjektansvarlig osv) vil framkomme.

Du kan når som helst avbryte intervjuet, men jeg håper at du tar deg tid til å fullføre. Intervjuet vil vare ca. 1,5 time.

Om meg

For tiden avslutter jeg en master (MSc) i Internasjonal Prosjektledelse ved NTNU og vil være ferdig med min masteroppgave våren 2017. Tidligere har jeg en BSc. i elektronikk med spesialisering innenfor mikro- og nanosystemteknologi. Samlet gir disse to et godt tverrfaglig fundament til å forstå ulike teknologier og helheten i komplekse systemer. Jeg har stor faglig og praktisk interesse for samspillet mellom teknologi og menneske, og hvordan teknologiske løsninger kan støtte opp under menneskelig samhandling og kreativitet.

På forhånd takk!

Jeg ser frem til å møte deg.

Med vennlig hilsen

Jonas Forsber