

## Project Portfolio Management in New Product Development Organizations

Application of accepted PPM theories in practice

*Master of Science Thesis in the Master's Program International Project Management*

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Department of Civil and Environmental Engineering  
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CHALMERS UNIVERSITY OF TECHNOLOGY  
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## ABSTRACT

Project Portfolio Management (PPM) is a relatively new area within project management which deals with, among other things, selecting and maintaining the right project portfolio within the organization. Many organizations have shifted the way they work and have become project based organizations (PBOs) during recent years. That has increased the need for PPM and the benefits that it brings to the organization. Publications of PPM materials have increased significantly over the last several years and PPM theories have been established as a vital part of the popular theories of project management. This thesis focuses on PPM within new product development (NPD) organizations both from the academic and practical perspective. The academic perspective was provided by a literature review and a case study research provided the practical perspective. The case study research analyzed how the theory presented in the literature review is applied in two relatively large NPD organizations. The case study results showed that the PPM theory is solid and can easily be applied to most NPD organizations. But there are some aspects of the theory that seems to have more importance than others according to the case study research findings. Selection models and stage-gate project life-cycle models seem to be the most important PPM tools for NPD organizations while Earned value analysis on the other hand is not as important for these kinds of organizations. Another important finding from the case study, which contradicts to a certain degree with the literature, is that the PPM practices should be adapted to the organizational structure and culture, but not vice versa. Recommendations about how the organizations that participated in the case study research could improve their PPM practices were provided based on the literature and the case study findings.

Key words: Project Portfolio Management (PPM), Project Management, Project Selection, NPD organizations, Case Study Research.



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## Preface

This master's thesis is constructed as a part of a two year master program called International Project Management at Chalmers University of Technology. The author had worked prior to these studies in project management within several organizations in different industries. PPM was introduced in one of the first courses in the master's program and the author found it especially interesting due to the fact that he realized that many of the most common problems he had seen in the industries could be dealt with more efficiently with PPM. The author looked more into PPM and decided to define a master's thesis that focuses on the PPM theory and how it can be applied efficiently within organizations. The thesis work was carried out from December 2011 to May 2012.

It was vital for the thesis to get a practical perspective of how PPM theory is applied in organizations. A case study research was defined and two of the largest NPD companies in Iceland were contacted and invited to participate in the thesis. They were both interested in the topic and assigned company contacts that both played a vital role in the case study research. The collaboration with the companies was very successful and I would like to thank Ásgeir Ásgeirsson from Marel and Ylfa Thordarson from Össur for their contribution.

Inger Bergman from Chalmers University of Technology was the supervisor for this thesis and participated in the thesis from the idea phase and all the way to the end. She is vastly experience within the field of project and portfolio management and was able to provide many valuable advices that enhanced the final result of this thesis. I would also like to thank Inger for her contributions.

Göteborg May 2012

Ingvar Steinn Birgisson

## List of Abbreviations

|     |                                  |
|-----|----------------------------------|
| ECV | Expected Commercial Value        |
| EVA | Earned Value Analysis            |
| I2M | Innovation to Market (Marel)     |
| IPG | Integrated Product Group (Marel) |
| IT  | Information Technology           |
| NPD | New Product Development          |
| NPV | Net Present Value                |
| PBO | Project Based Organization       |
| PM  | Project Management               |
| PMG | Product Market Group (Marel)     |
| PMI | Project Management Institute     |
| PMO | Project Management Office        |
| POR | Program of Requirements (Marel)  |
| PPM | Project Portfolio Management     |
| R&D | Research and Development         |
| ROI | Return of Investment             |

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# 1 Introduction

Project Portfolio management (PPM) is an area within project management which has become more and more popular among organizations and academics during the last decade. This thesis will analyze PPM both from a practical and academic perspective and present how PPM theory is applied in organizations. PPM can be especially beneficial for NPD organizations, due to the fact that these organizations depend on the projects selected to day to become the product winners tomorrow. This thesis will focus on these kinds of organizations and present what aspects of the PPM theory are the most important for them. This thesis should contain everything needed for NPD organization to illustrate how they should implement PPM and what aspects of the theory they should focus on.

## 1.1 Purpose and research questions

The purpose of this master's thesis is first of all to analyze the presented PPM theory and summarize why and how PPM should be implemented within organizations dealing with multiple projects. This is done by reviewing published articles, textbooks and standards and structuring a literature review that can be used as guidelines for organizations to realize what benefits can be gained from implementing PPM and what tools and methods can be used in order to reach these benefits. Secondly, the purpose is to perform a case study within two organizations and analyze how they apply PPM theories in practice. Lastly, the purpose is also to provide the two organizations with recommendations of how they can improve their practices in order to become more efficient in selecting, maintaining and coordinating the projects within their project portfolios. The purpose can be summarized in the following research questions for this thesis:

- How are the project portfolio management practices within the organizations applied compared to the theories presented in the PPM literature?
  - What are the most important aspects of the PPM theory for NPD organizations?
  - How can the organizations improve their practices based on the theories presented in the literature?
  - Why should the organizations implement the suggested improvements, how can they benefit from these improvements?

The main objective of the case study is not to evaluate or grade the PPM practices within the two organizations, but rather to analyze them in order to be able to compare them with the literature and individually. By doing so an insight can be established how the PPM theories are applied in practice and also some recommendations can be provided to the companies how they could improve their operations and why they should do so.

The popularity of PPM theory has increased significantly during the last decade (Chapter 3.2.2) and a lot of theory has been published. The problem that this thesis is intended to solve is that it can be time consuming for companies to analyze this huge collection of articles, books and so forth in order to find the relevant theory that they can use to support implementation or improvements of their PPM practices. The

author of this thesis conducted a comprehensive search for a critical review of PPM literature from the NPD perspective without success. This thesis will contain such a review.

A literature review is presented and a case study research constructed to give a practical view of how PPM theory is applied in practice. This case study is then compared to the literature review and conclusions are drawn about what aspects of the theory are the most important ones for NPD organization. This report can be used by other NPD organizations as guidelines of how they can implement or improve their PPM practices. Killen et al. (2007) stated that the empirical research within the field of PPM was very limited and although several empirical research have published since then, the author of this thesis thinks that more attention needs to be given to this research area. This thesis is an honest contribution.

## **1.2 Limitations**

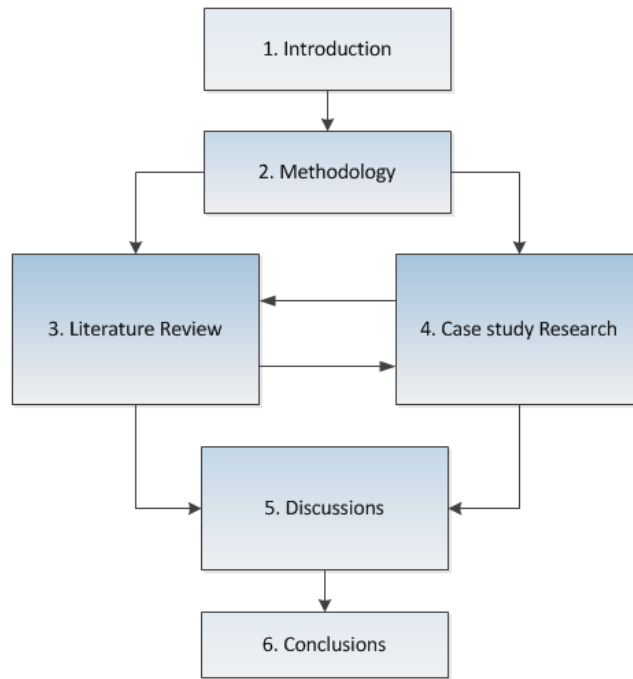
The biggest limitations of this research are time constraints and resources. This thesis is constructed by a single student which limits the case study to only two organizations. It would have been better to expand the case study to several more organizations to have more data to be able to generalize how the PPM theories are applied in practice.

Because of the author's background and interest, this thesis is written from a project management perspective rather than product development perspective. A more product development orientated approach on similar topics can be found a master's thesis from Chalmers by Svennung and Söderström (2008) or the doctor dissertation from Chalmers by Dawidson (2006).

Although this thesis is written from a project management perspective, it will focus mainly on PPM within R&D and NPD organizations. PPM can be used in any industry sectors but it can be especially beneficial within the fields of R&D and NPD.

## **1.3 Thesis structure overview**

This master's thesis report consists of six chapters. The first chapter introduces the thesis and presents the purpose, research questions and limitations. The second chapter introduces the methodology that will be used in order to draw conclusions about the research questions. The third chapter presents a detailed literature review of the PPM theory and the fourth chapter presents a case study research that was constructed within two NPD organizations. The fifth chapter compares the literature review to the results from the case study and presents a discussion around the research questions. Recommendations for how the organizations can improve their operations are also presented in chapter 5. Chapter 6 concludes the report by highlighting the main findings of this report and presenting the author's recommendations for future research. The thesis structure overview is presented in Figure 1.



*Figure 1: Thesis structure overview*

## **2 Methodology**

### **2.1 Research method**

There are several different research methods available, but initially the case study method was considered to be the most suitable option for the study that will be carried out in this thesis. Yin's (2009) book presents a simple framework for how to select the research methodology and it supported the initial idea that the case study method was the appropriate one. According to Yin (2009) the case study method should be used, firstly, when the research questions are "how" or "why" questions, which is the case for this thesis research questions. Secondly, the case study method is relevant when the investigator has no control over events being studied and thirdly when the focus is on contemporary phenomenon, current events rather than historical events. According to these criteria the case study method is the most appropriate one for the research that was done in this thesis (Yin, 2009).

The case study method allows the investigator to get the holistic and meaningful characteristics of a real-life event, such as managerial processes that this thesis focused on. The contemporary phenomenon is investigated in depth within its real-life context, but the boundaries between the phenomenon and the context are often not clear (Yin, 2009). The phenomenon in this thesis was the Project Portfolio Management and the context was the two focal organizations.

### **2.2 Research design**

Before the actual data collection was executed, it was important to develop a solid theory of the things that would be studied. The development of theory is an essential part of all case studies and it is often done through review of relevant literatures. The theory provides guidance of what data to collect and what strategies will be chosen to collect it (Yin, 2009). The literature review is especially important in this thesis, because the research questions and the purpose of the thesis are closely related to the established PPM theory. An extensive literature review for PPM is presented in Chapter 3.

One of the biggest problems with case studies is that it can be hard to generalize from a single case study, which is often the way case studies are designed. Also the multi case studies require more resources, so it can be hard to design the research in order for it to be legitimate but still within the boundaries of resources (Yin, 2009). For the study that is presented in this report, a two-case study was chosen, where the same study was performed in two organizations. By having more than one case study, the evidences are generally considered more compelling and the overall study more robust. The chances of doing a good case study are better with a two case study compared to a single case study, which often tend to be vulnerable (Yin, 2009).

An important study proposition in this thesis is that due to the fact that the PPM theories are quite young, there would certainly be differences between the theories and two cases. These cases were also likely to have vast differences in their practices although they work in a similar environment. The goal was to try to exploit these differences in order for the discussions and recommendations to become more fruitful and useful for the two organizations.



## 2.3 Data collection

Yin (2009) presents several ways of collecting data in case study research. The research that was done in this thesis focused on three main data sources, documents, interviews and direct observations. One of the principals of data collection is to have multiple sources, and this is especially important for case study research. The case study is said to be more convincing and accurate if it is based on multiple data sources (Yin, 2009).

First of all some initial data was collected from the two organizations through documents that they provided, such as organizational structure, department description, annual reports etc. These documents were intended to support and possibly complement other data that would be collected later in the process. These documents gave a brief insight into the phenomenon and its context and there by supported the research design.

Next, three interviews were performed in each organization, using an in-depth interview tactic (Yin, 2009). In in-depth interviews the respondent takes a role of an informant and provides the case study investigator with an insight into the matter through open-ended and informal conversation. The informant might provide facts of the matter as well as his or her opinion about events. The respondents in these interviews were managers working closely with project selection and coordination within the two organizations. An interview guide with open-ended question was constructed with a similar structure as the literature review. The interview guide is presented in Appendix, Chapter 8.1. These interviews were intended to provide the author of this thesis with a deep understanding of the practices within the organizations, make him able to compare their current situations to the PPM theories and make recommendations for improvements. The three interviews that were done in each company are:

1. Phone-interview with the key informant
2. Interview with one of the key informants' colleague
3. Summary interview with the key informant

Lastly, some direct observations were made about the PPM practices during the visit at the companies. These direct observations involved illustrations of the tools and methods used in the PPM process and so forth.

## 2.4 Data analysis

Yin (2009) presents four general strategies for analyzing the data from case studies. The most preferred strategy and most relevant for this thesis focuses on the theoretical propositions during the analysis. In this case, the whole case study is heavily dependent on the theoretical data and the case study design is highly affected by the literature review presented in Chapter 3. As the research questions demonstrate, the purpose of this study was to compare the practices within the two organizations with the literature review and also with each other. By following the structure of the literature review, the case study data was analyzed in a logical sequence that resulted in discussions where the research questions were answered.

## **3 Project Portfolio Management literature review**

### **3.1 Definitions**

#### **3.1.1 Project management**

Nowadays, projects have become fundamental element to the way many organizations operate. Whole sectors of industries are dominated by project-based organizations (PBOs), including engineering, construction, IT and product development (Maylor, 2010). There are many different definitions for projects, for example:

*“A project refers to a value creation undertaking based on a specific mission, which is completed in a given or agreed timeframe and under constraints, including resources and external circumstances”* (Ohara, 2005, p. 15)

To separate projects from other operations within organizations, project considered to be unique, temporary in nature and focused on specific goals and outcomes. Project management is a wide spread and popular concept that can be defined as the following:

*“Project management is the professional capability to deliver, with due diligence, a project product that fulfills a given mission, by organizing a dedicated project team, effectively combining the most appropriate technical and managerial methods and techniques and devising the most efficient and effective work breakdown and implementation routes.”* (Ohara, 2005, p. 16)

With these two definitions clear, it is possible to move to the main topic of this thesis, Project Portfolio Management.

#### **3.1.2 Project portfolio management**

In the last several years, the area of Project Portfolio management (PPM) has become increasingly popular. This area is becoming a vital part of Project management theory and according to Levine (2005), PPM is generally considered as the greatest improvement in the project management field since total project management methods were developed in the 1950's. Many definitions for PPM have been developed and one of the most cited one was presented by Cooper et al. (2001a, Chapter 1):

*“Portfolio management for new products is a dynamic decision process wherein the list of active new products and R&D projects is constantly revised. In this process, new projects may be evaluated, selected and prioritized. Existing projects may be accelerated, killed, or deprioritized and resources are allocated and reallocated to the active projects”*

This definition emphasizes on PPM within R&D and NPD which is the field that will be focused on in this thesis. PPM has especially gained much popularity within R&D and NPD as the decisions to select the right projects are extremely important for the organizations in this area.

Levine (2005) presented a definition that the author of this thesis thinks describes PPM in the best way. His definition is closely related to the main goals of PPM that will be presented later in this thesis:

*“PPM is a set of processes, supported by people and tools, to guide the enterprise in selecting the right projects and the right number of projects, and maintaining a portfolio of projects that will maximize the enterprise’s strategic goals, efficient use of resources, stakeholder satisfaction, and the bottom line.” (Levine 2005, p. 70)*

PPM is not just another project management technique, PPM is above and beyond project management because it spans all the way from the vision of the senior management, through project management, to the realization of benefits and competitive positioning. It is also worth mentioning that PPM is not fundamentally management of multiple projects, but rather practices that make sure that the right decisions are made regarding selection of projects in order to maximize the organizational benefits (Levine, 2005). In other words, PPM should ensure that the right work is being done, but not that the work are done right.

### **3.1.3 Related concepts**

In project management literatures there are other concepts presented that serve a similar role as project portfolio management. Multi-project management and program management are widely used terms that are closely related to PPM. But although they are similar to PPM, there are important differences that need to be clarified.

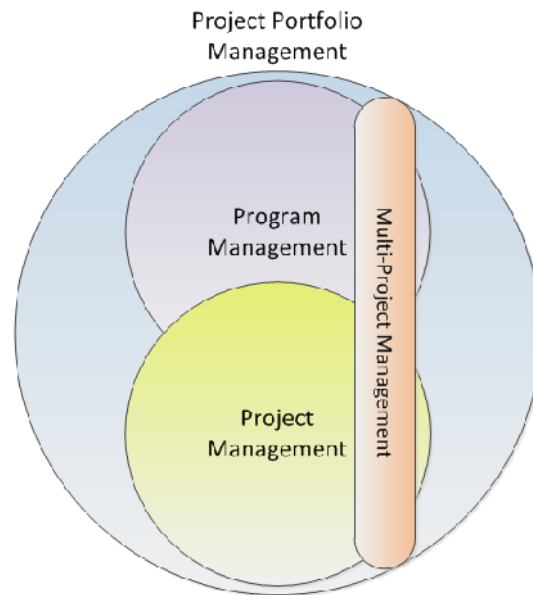
Multi-project management’s main responsibility is to allocate resources among concurrent projects within organizations executing a substantial share of the operations as projects. This is certainly also a part of PPM but other roles and responsibilities, such as project evaluation, selections, prioritization, deprioritization and termination is not seen as part of Multi-project management (Engwall and Jerbrant, 2003).

One could say that Multi-project management is a part of PPM, as PPM is a wider and more complex process that includes tools and methods for the various roles that PPM has. Multi-project management can be implemented as a part of strategy, but often Multi-project management emerges without it to be a part of a particular implementation strategy (Engwall and Jerbrant, 2003).

Program management is a term that is used for various practices and roles in the project management literature and often mixed with PPM. Program management is defined in the PMBOK Guide as following:

*“A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside the scope of the discrete projects in the program.” (PMI, 2008b, p. 434)*

So the main difference between program and portfolio management is that the projects in the program are working towards the same final objective, meanwhile a portfolio is the whole collection of projects and possibly programs within an organization or a business unit (Maylor, 2010). Big road construction is a good example of a program that contains few projects that all work towards the same end objective.



*Figure 2: PPM and related concepts*

Figure 2 demonstrates the connections between these related concepts. Multi-Project Management can be seen as a part of PPM which is concerned with resource allocation between several projects. Program management is the management of few projects that have the same end objective, but this program along with other projects and programs construct the project portfolio. By definition, projects and programs are temporary but portfolios are not, because new projects and programs are constantly being brought into the portfolio when other ones shut down (Maylor, 2010).

## **3.2 Historical background to project portfolio management**

### **3.2.1 Theoretical development**

From the start of civilization operations and other activities have been executed in projects. Some kind of project management has been used in battles, wars, construction etc. for hundreds or thousands of years, but Project management was not accepted as a special management discipline until in the second part of the 20<sup>th</sup> century. Tools such as Gantt charts, PERT and CPM were developed at the time of the World War II and slowly adapted by industries (Maylor, 2010). In the latter part of the 20<sup>th</sup> century development of tools and methods commenced to evaluate and select projects within organizations. For the last 50 years, hundreds of studies have been published describing these tools and methods (Henriksen and Traynor, 1999) and this can be seen as the beginning of project portfolio management as we know it today.

In the end of the last millennia theoreticians and practitioners recognized a strong need for a way to coordinate the project portfolio, set strategic priorities across the projects and find a balance between the projects (Madic et al., 2011). As this need arose, companies started to borrow tools and methods from established portfolio management theories for financial management of stocks, bonds and mutual funds. These theories were developed from the first book written on portfolio selection by the Nobel Prize winning economist, Harry Markowitz. There he described that a portfolio of investments is more likely to raise returns and reduce risks than single

investments (Solomon, 2002; Madic et al., 2011). Managers also started to ask the question, which projects should be started and how the projects should be prioritized with the limited resources in mind (McGrath, 2004). These types of questions pushed the development and analysis of project portfolio management further and now researchers and professionals see it as one of the fastest developing and improving concepts within the field of project management (Madic et al., 2011).

### 3.2.2 Publishing trends

The increased popularity of project portfolio management during the last decade has led to a firm establishment of PPM theory as a discipline within the research field of Project Management (PMI, 2008a). There has been an increased rate of published articles focusing on PPM in the last decade and in one major journal database the citations rose from two in 2000-2001 to thirty-five in 2004-2005 (Killen et al., 2007).

A brief study was made during the construction of this thesis where the database Science Direct was used to find the number of articles that mentioned “Portfolio Management” in the International Journal of Project Management published each year. The results are presented in Figure 3.

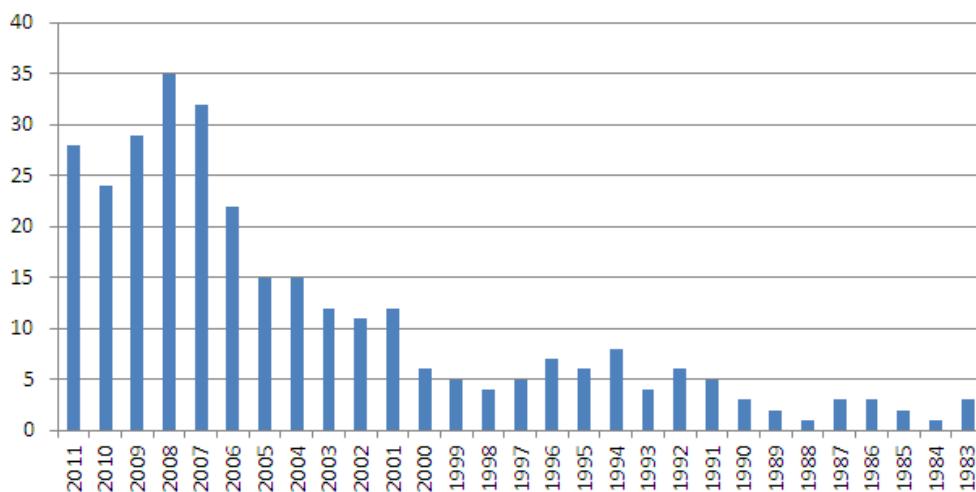


Figure 3: Number of PM articles mentioning "Portfolio Management"

Figure 3 shows that there has been a significant increase especially during the last few years. The reason for the increased interest is the increased importance of technological innovation and that successful innovation is highly dependent on the effective management and selection of new product developments (Killen et al., 2007).

The authors of most project management textbooks have added chapters about portfolio management in their latest edition. Standards for portfolio management have been developed by the Project Management Institute, the first edition was published in 2006 but a new edition was released in 2008 with changes that were made after reviewing hundreds of recommendations for improvements from various individuals (PMI, 2008a).

### 3.3 The importance of PPM

There has been a significant shift in how organizations operate during the last two decades and PBOs are becoming dominant in many industries. The project management tools and methods have enjoyed great success and managers have realized that increased efficiency in operations can be achieved by moving operations more and more to the form of projects. Nowadays, in fact 1/5 of the world's gross domestic product (GPD) or 12 trillion US dollars is being spent on project (PMI, 2012). Organizations have usually multiple concurrent projects and that has raised the importance of coordinated management in the form of PPM (Killen et al., 2007). Effective project management of a single project is no longer sufficient, nowadays the management of the whole project portfolio has become a vital factor for achieving long-term success and competitive advantage (Heising, 2012).

PPM within the fields of R&D and NPD has grown especially in importance in the world of global competition where the survival of organizations is increasingly dependent on a steady stream of successful new products. The outcome of the innovation project portfolios needs to be maximized because innovation is now understood to be the main driver of economic growth in the developed countries (Killen et al., 2008).

Studies have shown that top performing companies within R&D and NPD tend to emphasize more on PPM than companies with lower performance levels (Cooper et al., 2001b). Cooper and Edgett (2008) presented that the reason is that the top performing companies realize that new successful products are the fundamental aspects for business success. The companies that have the best ability to select the today's projects will become the tomorrow's product winners. Also, new product development is the manifestation of the business strategy and PPM supports the organization to choose the right projects that will eventually lead to the appropriate products. Lastly, by having efficient resource allocation the organizations are able to do more with the same resource pool and also do the right things, by focusing on high-prioritized projects (Cooper and Edgett, 2008).

To demonstrate the importance of PPM, Killen et al. (2007) presented the results of a study of 84 universities and industry experts. It stated that strategic planning, the link between the technology and corporate strategy, and the new product project selection were rated the most important problems within management of technology. The results highlight the importance of PPM activities as these problems are the central aspects of PPM's main goals (Killen et al., 2007).

Many organizations use project management maturity models to assess their project management practices and as a structure for improving the practices in few steps. A common model is the Berkeley PM maturity model presented in Figure 4. The model presents five levels of project management maturity and provides guidelines of how to reach from one level to the other (Kwak and Ibbs, 1997). By analyzing this model we see that if organizations want to reach the fourth and fifth level of the model they have to have some sort of PPM practices to have integrated multi-project planning and control. This emphasizes the importance of PPM and demonstrates that to reach high levels of project management maturity, organizations have to implement PPM practices.

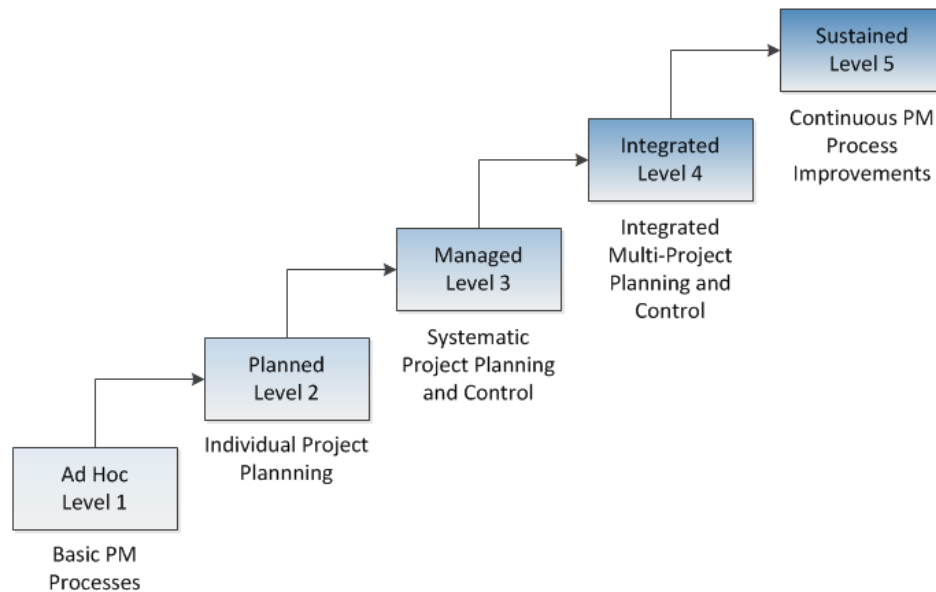


Figure 4: Berkeley PM maturity model (Kwak and Ibbs, 1997)

There is a significant pressure on the managers of organizations to deliver sufficient return of investment (ROI) to the shareholders. To do so the manager have to find the optimal portfolio of projects at each time by constantly evaluating current and possible new projects in order to maximize the total value of the portfolio with the possible resources put in. This has led to increased interest of PPM within organizations (Levine, 2005). But although the interest has increased among organization, there are studies that show that the project portfolio management practices are in general immature. In 2003 a study that was constructed by PM Solutions Research where sixty-four project management practitioners were surveyed. The results described that 64,1% of the respondents had PPM process in place and 61% of them had low maturity, or level 1-2 on a 1-5 level scale (PM Solutions Research, 2003).

But although PPM is important to most project based organizations, it is certainly not important to all of them. Organizations that for example only sell resources to projects, such as many types of subcontractors, might not need the entire PPM practices. They might not need to align their projects to their business strategy or maintain a certain balance between the projects. In these cases, based on the authors experience in management within the contractor industry, the organizations might benefit more from implementing other management practices.

### 3.4 PPM within the organization

There are several things that the organization needs to have in order to be able to implement and maintain efficient project portfolio management. One of them is that there needs to be a clear and communicated corporate, business and innovation strategy that the projects in the portfolio can be aligned to. Senior Management commitment is also an important success factor for implementing and maintaining PPM. Senior Management has to be involved from the beginning so they can realize the potential benefits of PPM and allocate resources to implement it (Killen et al., 2007). Heising (2012) emphasized that the senior management involvement has to start in the early phases of the product development process. They should take part in

evaluation of the ideas because it will become much more expensive and difficult to influence the scope and definition of the projects later on in the process. He also stated that empirical data has shown that senior management involvement is much greater in successful companies than in low-performing companies.

In order for PPM to become successful within the organization it is important that the PPM processes are integrated with the established project management procedures within the organization. The PM practices need to be extended to support project prioritization and selections, and the PPM practices need to fit closely with the PM practices in place. That will allow the organization to select the best portfolio of projects that are aligned with the business strategy, monitor their performance, and iteratively reprioritize the portfolio as business conditions and budgets change (Levine, 2005).

PPM is an organizational wide process. It is important that a certain organizational culture is introduced so that the organization as a whole understands and commits to the process. The PPM process and the decisions that result from it must be accepted at all levels of the organization. The organization also has to be prepared to make changes proposed by the PPM process regarding the structure and formalization of the organization in order to be able to reap as much benefits as possible from the PPM process (Levine, 2005). Certain executive managers such as marketing managers, sales managers etc. have to take part in the PPM process (PMI, 2008a). Six sigma movements required a strong organizational culture in order to move towards zero defects, PPM similarly requires a strong organizational culture to be able to move towards zero failed projects (Levine, 2005).

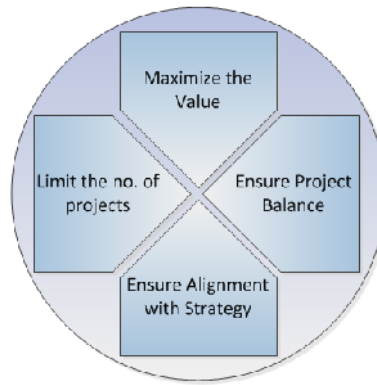
A project management office (PMO) has been implemented to many PBO's and its main role is to support projects within the organization. The PMO should also develop standards and practices directed at the effective execution of projects and the attainment of schedule, cost, scope and quality objectives. Some organizations have added the roles and responsibilities of PPM to the PMO, but that is usually considered a mistake according to Levine (2005). PPM requires governance at the executive level and the PMO should merely be a support function for PPM, by collecting data from projects etc. but the decisions taken within the PPM have to come from the executive level (Levine, 2005).

So, now that it is clear what needs to be in place so the PPM can be fitted into the organization, it is interesting to look at in which cases organizations should implement PPM. Implementing PPM is of course not a feasible investment for all companies and one obvious factor is that the organization needs to execute a significant portion of the operations in projects. Organizations should consider implementing PPM if they are constantly lacking resources in projects, if they suffer from project delays, if there is a fight for resources within the organization and if project do not deliver sufficient value when they are completed because they were based on an old strategy (LaBrosse, 2010). Furthermore, PPM can also be a solution if underperforming and unaligned projects are not terminated, where too many projects are initiated and if few projects yield in major breakthroughs or help to sustain competitive advantage. Many traditional organizations also suffer from a gap between the operation and project management, and the organizations objectives is hardly ever communicated to the management of the projects (Levine, 2005). In these cases PPM can be a solution to the organization by analyzing current and proposed projects, prioritizing them according to defined criteria, and monitor their performance and alignment with company (LaBrosse, 2010).



### 3.5 Main goals of PPM

This chapter will present the four main goals of PPM that are presented in Figure 5 (Cooper and Edgett, 2008). Each goal will be described separately and ways how to achieve the goal will be discussed. Tools and methods that can be used to support the organization to achieve each goal will also be presented and described.



*Figure 5: The main goals of PPM*

#### 3.5.1 Maximize the financial value of the portfolio

Much like in the stock market, portfolio managers in R&D and NPD need optimize their investments and select the winning new product projects that will give the overall maximum financial value of the portfolio (Cooper and Edgett, 2008). In order to be able to achieve that, it is essential that both current and proposed projects are constantly evaluated and assessed. That will give the portfolio management the opportunities to drop or delay project that are not contributing to the financial value of the portfolio and take in other ones with more value potential (Levine, 2005).

To start with, it is important to assess the projects commitments. That is done by gathering a detailed inventory of current, proposed and on-hold projects. Information such as project name, cost to date, estimated duration, business case, resource requirements, constraints, risks, how the project supports the business strategy and so forth have to be gathered, processed and organized. When this information has been gathered, then tools and methods can be used to evaluate the project in order to be able to compare them with each other and determine which projects deliver the most value to the portfolio (LaBrosse, 2010).

There are two phases that needs to be identified in the PPM. The first phase is to select the right projects for the portfolio and the second phase is to maintain the portfolio and make sure the intended benefits will be realized (Levine, 2005). For phase one, the most common tools and methods are the financial ones, such as the Return on Investment (ROI), the Net present value method and the expected commercial value method (ECV). But there are other models that have gained some popularity as well, such as scoring models (Cooper and Edgett, 2008).

ROI is a method that is widely used to assess the benefits from the investments. It builds upon the logic that the profit margin cannot be used in comparison between investments because they do not necessarily require the same size of investment. ROI

can be used to determine the importance of the projects for the overall portfolio value and Formula 1 presents how ROI can be calculated (Phillips and Phillips, 2008).

$$ROI (\%) = \frac{\text{Payback}-\text{Investments}}{\text{Investments}} 100\% \quad (1)$$

Another financial decision making method is the Net present value (NPV). NPV calculates how much value is created from undertaking an investment for the company. The expected future cash flow is discounted according to the required return which is higher for high risk projects. The initial investment is then subtracted from the sum of the discounted cash flow, which results in the NPV. If the NPV value is larger than 0, the investment should usually be accepted. In the context of portfolio management, the project with the highest NPV should under normal circumstances be ranked the highest (Ross et al., 2008). Formula 2 presents how NPV can be calculated.

$$NPV = \sum_{i=1}^T \frac{C_i}{(1+r)^i} - C_0 \quad (2)$$

T = Investment duration in years

C<sub>i</sub> = Cash Flow for year i

C<sub>0</sub> = Initial investment

r = Required rate of return

The third financial decision making method is the Expected Commercial Value (ECV). ECV uses decision-tree analysis, breaks the project into few decision stages and calculates the expected commercial value using probabilities for technical and commercial success and the present value of the future earnings (Cooper and Edgett, 2008). Formula 3 presents how ECV can be calculated.

$$ECV = ((PV \cdot P_{cs} - C) \cdot P_{ts} - D) \quad (3)$$

P<sub>ts</sub> = Probability of Technical Success

P<sub>cs</sub> = Probability of Commercial Success

D = Development cost remaining in the project

C = Commercialization cost

PV = Present Value of project's future earnings

But although these financial tools and methods can be beneficial for the organization to maximize the portfolio value, they have to be used carefully. They require quite detailed estimation and the uncertainty is usually high (Cooper and Edgett, 2008). It is also important to mention that these financial tools and methods cannot be used alone to prioritize the projects. The tools and methods presented in the following chapter used to balance the project portfolio, align it to the strategy and limit the number of project to the organizational capacity also needs to be a part of the prioritization process. The project risks are also important aspects to keep in mind while evaluating the projects. Along with the usual projects risks, technical and commercial risks have to be included in this decision making process (Levine, 2005).

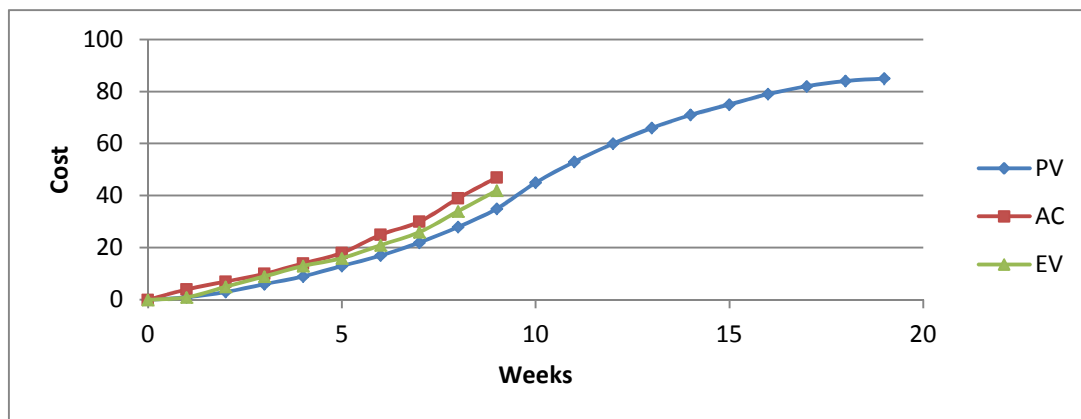
Scoring models contain a number of questions that allows decision-makers to rate the attractiveness of the projects. Scales from 1-5 or 0-10 are often used and the sum of the ratings from the all questions will give an indication of the value of the project for the portfolio taking the strategic alignment and so forth into account (Cooper and Edgett, 2008). A typical Scoring model usually touches upon the following issues, and an entire Scoring model can be found in Cooper's and Edgett's article from 2008:

- Strategic Alignment
- Product/Competitive Advantage
- Market Attractiveness

- Synergies (Leverages Our Core Competences)
- Technical Feasibility
- Risk vs. Return

Identification of the opportunities and the selection of the projects is only the beginning. The second phase involves the maintenance of the portfolio. The projects are constantly evaluated and actions taken if they are not performing at the right level, if they are not aligned to the new strategy, if the window of opportunity has passed to realize the benefits of the project and so forth. In the second phase there are two methods that most commonly used, Earned Value Analysis and the Stage-Gate model (Levine, 2005).

Earned Value Analysis (EVA) is a method for monitoring and controlling projects during their execution. EVA uses measurements in monetary terms in order to provide information whether or not the project is on schedule and budget. In order to be able to perform EVA there needs to be a project plan with time and cost estimates and then a close monitoring of the Actual Cost (AC) and the percentage completed of the project, or the Earned Value (EV). A good way to demonstrate the result of EVA at each time is to produce a graph which displays three main parameters, Planned Value (PV), Earned Value (EV) and Actual Cost (AC).



*Figure 6: Example of Earned Value Analysis*

Figure 6 presents a project that is ahead of the schedule but over budget. EVA can also give the estimated cost at completion and estimated time at completion. EVA is a simple and an efficient method for monitoring the progress of projects in relation to both time and budget, which enables management to take actions early if the project is not performing according the project plan (Maylor, 2010).

In the Stage-Gate model the project life-cycle is divided into several stages and separating them are gates, where a decision whether to continue, delay or terminate the project is taken. Before each gate, the project is evaluated by a set of metrics and in order to pass through the gate, the project needs to meet defined criteria. At each gate the decision to deprioritize or reallocate resources can also be taken (Levine, 2005). Checklists can be beneficial to have at these gates to ensure that the projects meet specific criteria in order for them to pass the gate (Cooper et al., 2001b).

If these methods and tools are used efficiently in the first and second phase and they are integrated with the needs of the organization, the project portfolio management can select and terminate the appropriate projects in order to meet this first main goal. But in order to support these methods and tools, there needs to be efficient non-

stopping project monitoring through status reports and reviews that are integrated with the Project management procedures (LaBrosse, 2010). It is also important that organization put in effort to develop the PPM process constantly in order to find the best ways to manage the portfolio. That can be achieved through lessons learned after each project has been completed.

### **3.5.2 Ensure balance among projects in the portfolio**

The second goal of PPM is to ensure that there is a balance between the projects in the portfolio. Diversification is an important aspect of portfolio management, and it is originated from portfolio management in the financial world. If a stock portfolio is well diversified, a share of the total risk can be eliminated meanwhile maintaining the similar level of reward (Ross et al., 2008). This logic can also be applicable in project portfolio management and in order to gain as much as possible from the project portfolio, a balance between the projects has to be found in terms of several factors. Examples of these factors are (Cooper and Edgett, 2008):

- Long term vs. short term projects
- High risk vs. low risk projects
- Across various markets
- Product categories
- Technologies
- Project types (new products, improvements, maintenance etc.)

Without having PPM within the organization it is difficult to make sure that there is an appropriate balance between the projects. If an organization has only long term projects it might run into troubles to fund operations at some point, if they only have low risk projects the reward is not likely to be high, if they only focus on one market they could face trouble if that market does not respond and so forth. In big organization there might also be duplicated projects or project that will eventually deliver the same result to the organization. The overview PPM provides can reduce the risk of this happening.

Wheelwright and Clark (1992) from the Harvard Business School introduced a way to divide projects to five main categories of projects in product development organizations. These categories are the following:

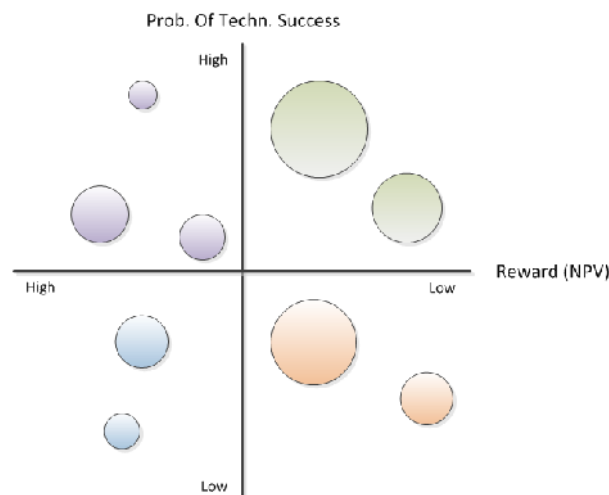
- Derivative projects – Incremental changes to existing products
- Breakthrough projects – Major changes to create entirely new product categories
- Platform projects – Fundamental improvement in cost, quality and performance over previous generations of products
- Research and development projects – Creation of new material and technologies that eventually translate into commercial developments
- Partnership projects – Relationships formed with other organizations to pursue any other type of project.

By using these categories organizations can set out guidelines of how much of resources they intend to spend on each category and by doing that they can ensure

desired balance of the projects in terms of the project types. Many organizations have followed guidelines presented by Wheelwright and Clark (1992), which describe that 50% of resources should be spent on platform projects, 20% on derivative projects, 10% on breakthrough projects and 10% each on R&D and partnership projects. With these guidelines in mind, the organizations can define their own guidelines relevant for their operations.

There are tools that can be used to visualize the balance between the projects within the portfolio. The most common ones are the bubble diagram and the pie chart. These tools are of different kind than the ones used for value maximization of the portfolio. Those were decision-models, meanwhile these tools are information displayers. These tools depict the current situation within the portfolio and where the resources are going. These charts support discussions about how resources should be allocated to different types of projects (Cooper and Edgett, 2008).

The bubble diagram presents all the projects in the portfolio on a two-dimensional grid as bubbles. Several different axes can be used but the most popular ones are risk vs. reward are can be shown in Figure 7.



*Figure 7: Bubble Diagram used to visualize portfolio balance*

The sizes of the bubbles represent the amount of resources allocated to each project. In the example presented in Figure 7, it is clear that the organization is spending too much on the “red” projects and should try to increase the amount spent on “blue” and especially “purple” projects. The “green” projects are safe for the organization but do not deliver high rewards, so it is possible that the organization would benefit from moving some resources from “green” to “purple” and possibly “blue” projects (Cooper and Edgett, 2008).

Pie charts can be used to demonstrate how the resources are allocated within the portfolio. The pie chart can be broken down by project types, markets, product categories etc. (Cooper and Edgett, 2008).

By using these tools and managing the project portfolio efficiently, an appropriate balance between projects can be achieved. By fulfilling this goal, organizations contribute to other goals of PPM as well. With a balanced portfolio there are more probabilities that the portfolio value can be maximized and also it will be simpler for the organization to make sure that the portfolio reflects the business strategy.

### **3.5.3 Ensure that the portfolio reflects the business strategy**

It is of great importance that the organization's operations follow the business strategy and reflect the mission and vision set by the senior management. A strategy is a framework that guides the choices that determine the nature and direction of an organization. Strategy can answer questions such as "What should the organization be doing?" and "What are the objectives we seek and how should we achieve them" (Levine, 2005). It is almost impossible to achieve the long-term goals of the organization if the projects or operations do not reflect the business strategy.

Project Portfolio Management establishes an overview over the projects within the portfolio, which is essential in order to make sure that they are aligned with the business strategy. This overview also makes it much easier to alter and align the projects to a new business strategy, by eliminating or introducing new project, reallocating resources etc. Business strategies are constantly changing within organization and efficient PPM can make sure the projects are evaluated and customized in order for the overall portfolio to be aligned to the business strategy at each time (Solomon, 2002). One could say that the PPM is bridging the gap between the operating and project management by the aligning the projects to the strategy and making sure that the right projects are executed (Cooper and Edgett, 2008; Levine, 2005).

In many organizations a project is considered successful if it meets the requirements of time, cost, scope and quality. But that is not enough, because if it is not aligned to the business strategy it will probably not deliver the intended benefits to the organization, that are supposed to enable the organization to take advantage of the opportunities and profit on the market (Levine, 2005).

By using the methods and tools presented for balancing the projects within the portfolio, organizations can make sure that the spending across projects, products, markets etc. reflects the strategic priorities of the organization (Madic et al., 2011). There are few methods that are presented in the literature in order to align the operations to the business strategy. The most common are the two "top-down" approaches, which use strategic buckets on one hand and product roadmaps on the other hand. "Bottom-up" is another approach that is also sometimes used (Cooper and Edgett, 2008).

To use "top-down" approach with strategic buckets, the organization needs to begin with the business and innovation strategies and from that formulate goals and how to focus the new product efforts. Next, the strategy is used to split the resources according to where the money should be spent. These splits can be by products, project types, markets, industry sectors and so forth. By doing this, the organization establishes strategic buckets of resources. A prioritized list of all the ongoing, on-hold and new projects within the portfolio can then be used to distribute the projects to the buckets until the bucket for a certain type of project is full. If for example, an organization has decided to reduce breakthrough projects this year and focus mainly on new generation products, the breakthrough bucket would be smaller and fewer breakthrough projects could be executed. This will make sure that the spending each year will reflect the strategic priorities of the organization (Cooper and Edgett, 2008).

"Top-down" approach can also be used with the support of product roadmaps. When business and innovation strategies have been constructed, the organization needs to consider what initiatives must be undertaken in order to succeed in the markets,

technologies or product categories that are of strategic focus. So, the organization knows where they would like to be, but what needs to be done in order to reach there? A product roadmap shows the major initiative along a time line and how the strategic objectives can be met. By using this approach, organizations can make sure that the projects are completely strategically driven (Cooper and Edgett, 2008).

The “bottom-up” approach builds on the philosophy that if good decisions are made at the individual project level, the portfolio will take care of itself. In order for this approach to be successful, it is important that the project gating system works well, so that the good projects get accepted and the bad ones terminated. It is also important that to use a scoring models with a number of strategic questions that will have effect on the project selection and in the end have shape the future of the organization (Cooper and Edgett, 2008).

By using these strategic alignment methods within the project portfolio management, it can be ensured that the organization as a whole is working towards the strategic objectives set by the senior management. This is extremely important in order for the company to sustain or gain competitive advantage on the market. When Hewlett Packard and Compaq merged into one company, they stopped over one hundred projects and programs that were not aligned with the emerging strategy or made a poor use of resources (Levine, 2005).

### **3.5.4 Limit the numbers of projects to fit the organizational capacity**

It is common in today’s world that organizations have too many projects on-going for the limited resources available. This results in a large project portfolio where many projects get delayed or queued and products take long time to reach the markets. This adds considerable costs, because some projects that are initiated might never have the resources to be able to finish. By having too many projects, some activities such as sufficient planning may be neglected due to lack of resources and that will result in lower project performance (Cooper and Edgett, 2008). One of the greatest risks to an organization’s ability to deliver the strategies, goals and mission is to commit to more project that it can deliver. Successful firms tend to state that doing fewer projects actually improves the overall benefits. There is less movement of resources, the income from the projects start earlier and new projects can be added sooner so eventually similar number of projects is completed annually (Levine, 2005).

The last goal of project portfolio management is therefore to limit the number of project to fit within the organizational capacity. This goal is closely related to the other three goals and it is in many literature included as a part of them, but not as a separate goal (Killen et al., 2007). There are many methods and approaches that can be used within the PPM in order to meet this goal. Resource limitation method and resource capacity analysis are some of them and they are described in Cooper’s and Edgett’s (2008) article. Pipeline management is a concept that has been borrowed from product development theory and can be used within PPM to support it for example to achieve this goal (Killen et al., 2007).

Pipeline management is a set of tools that can be used to manage the pipeline of projects focus on limiting the numbers of projects to ensure the resources are not overstretched (Killen et al., 2007). By using pipeline management within PPM, resource reallocation according to changes in strategic focus can be managed more

efficiently. The pipeline management can be seen as the link between the PPM and the daily management of new product development (McGrath, 2004).

This fourth goal complements and supports the three other goals of PPM. It is vital that the project portfolio has the appropriate number of projects in order to be able to maximize the value of the portfolio, balance the mix of projects and ensure that the portfolio is aligned to the business strategy.

*Table 1: Overview of the common PPM tools and methods*

| Main Goals of PPM  | Common tools and methods                         |
|--|--|
| Maximize the financial value of the portfolio - Phase 1          | ROI, NPV, ECV<br>Scoring/Selection model         |
| Maximize the financial value of the portfolio - Phase 2          | Earned Value analysis<br>Stage-Gate model        |
| Ensure balance among projects in the portfolio                   | Bubble Diagram<br>Pie-Charts<br>Harvard division |
| Ensure that the portfolio reflects the business strategy         | Strategic Buckets<br>Roadmaps                    |
| Limit the numbers of projects to fit the organizational capacity | Pipeline Management                              |

The most common tools and methods that have been discussed in the chapter above are presented in Table 1.

### 3.6 The PPM process

The project portfolio is a continuous process. Projects and programs come and go but the portfolio stays until a decision is taken at the organization to close it down. Levine (2005) presents a text which describes the five phases of the PPM process. The process is shown in Figure 8.



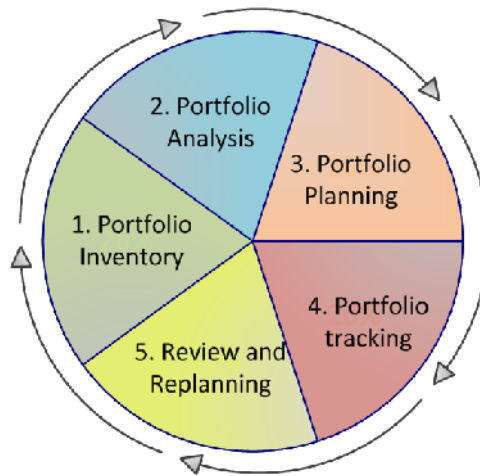


Figure 8: The PPM Process (Levine, 2005)

Some issues or aspects regarding all of the five phases have been presented in previous chapters, such as the relevant data needed for the portfolio inventory, the tools for portfolio analysis, methods for portfolio tracking etc. But to give a holistic view of the process, a short description of Figure 8 will be provided.

The initial project proposals enter the project inventory, where information and data are collected about the project and organized for the portfolio analysis. The projects in the inventory include proposed, on-going and delayed projects. The projects are then analyzed using the tools and methods presented in Chapter 3.5. When the most suitable projects have been selected and initiated, they enter the project planning phase. Resource, time and cost plans are constructed and integrated with the portfolio planning process where the resource allocation and schedule decisions are made, taking the whole portfolio of projects into account. In the portfolio tracking, metrics can be captured through earned value analysis or gates and they are used to evaluate each project. If these metrics do not fulfill specific criteria, a decision regarding the future of the project has to be taken. The review of the portfolio involves a re-verification of the portfolios' critical success factors. There might be a shift in the resource availability, validity of the business case, the corporate strategy or in the business, technology or market condition. This can lead to realignment of the project portfolio and replanning in resource allocation and scheduling. The PPM process is dynamic and iterative, which means that the project portfolio management needs to constantly jump from one phase to another in order to be able to reach the four main goals presented above (Levine, 2005).

### 3.7 PPM Software solutions

As the pressure to deliver higher ROI is constantly increasing, many organizations are turning to PPM software for the project investment visibility they need to make the best project decisions. Levine (2005) presented common features that are often included in these kinds of software:

- A database for proposed and active projects
- Project Selection criteria and weight factors different parameters in the criteria
- A database for financial and resource allocation data
- Tools to compute potential project benefits, incorporating risks and costs

- Project prioritization and ranking
- Project selection

These kinds software also often provide progress reporting, communication of key project data through dashboards along with cost and benefit tracking. These features allow the users to review the portfolio of projects and help them to make key financial and business decisions. Levine (2005) described that many of the PPM software solutions were merely an addition to other existing software that was originally intended for critical path method, earned value analysis, risk management etc. But after looking closer into available software now, seven years later, it seems that many complete solutions have been developed, solely for project portfolio management. Examples of these software solutions, chosen randomly, are Power steering and Daptiv. After going through their websites, watching videos and looking at demos, it is safe to say that nowadays there are many software solutions that organization can implement in order to support their PPM practices. But these software solutions are large, complex and expensive. The software providers seem to be competing to include as many features as they can, which results in higher complexity and prices.

One of the companies that develop and sell PPM software was contacted during the construction of this thesis, and a rough price estimate was inquired. The cost for the PPM software for organizations of similar size to the ones in that participated in the case study research is presented in Table 2.

*Table 2: Rough price estimates for a PPM software, with in total 80 employee licenses with different access levels*

| First year          | Price                    | There after         | Price           |
|---------------------|--------------------------|---------------------|-----------------|
| Implementation fees | \$20.000-\$30.000        | Annual License fees | <b>\$44.000</b> |
| Annual License fees | \$44.000                 |                     |                 |
|                     | <b>\$64.000-\$74.000</b> |                     |                 |

Symmons (2009) illustrated in his article what total economic impact the PPM software can have on organizations, he claims that these investments could return over 255% ROI. That of course depends on the organization but he claims that organizations, especially the ones working with project that are expensive and sensitive to market change can benefit significantly from investing in PPM software.

### 3.8 Main benefits of PPM

To conclude this theoretical background of PPM, the main benefits of PPM stated in the literature will be presented. LaBrosse (2010) stated that the main benefits of PPM are that the portfolio of projects becomes aligned to the organizations strategy, the organizations gets the best usage of the resources, the projects that have become outdated or are not performing well enough are terminated and that key projects are monitored closely so corrective actions can be taken early if need.

Rad and Levine (2008) presented benefits from PPM from another perspective by highlighting that if only the right projects will be selected and/or continued, a better

competitive positioning can be achieved. The effectiveness of the project teams will improve and the overall cost of the projects will be lower.

The Standard for Portfolio Management (PMI, 2008) recognized that the main benefits from efficient PPM are that it can have positive effect on the portfolio cash flow, critical products can have shorter duration to market and thereby fitting into windows of opportunities and that the usage of resources can become more efficient.

These three lists provided by the different sources complement each other and cover most of the main benefits that can be achieved from efficient PPM. In addition to these lists, it can be assumed that PPM will allow organizations to balance risks more efficiently across the projects and improve the information flow and throughput of projects.

## 4 Case Study

### 4.1 Introduction

This case study was constructed in order to get an insight into how project portfolio management practices are operated in NPD organizations. This insight is essential to be able to answer the research questions presented in Chapter 1.1. The two companies that were chosen to participate in this case study are both large international companies that have managed to become one of the leaders in their industry during the last few years. These companies are both originated in Iceland and their main focus is on innovation and product development.

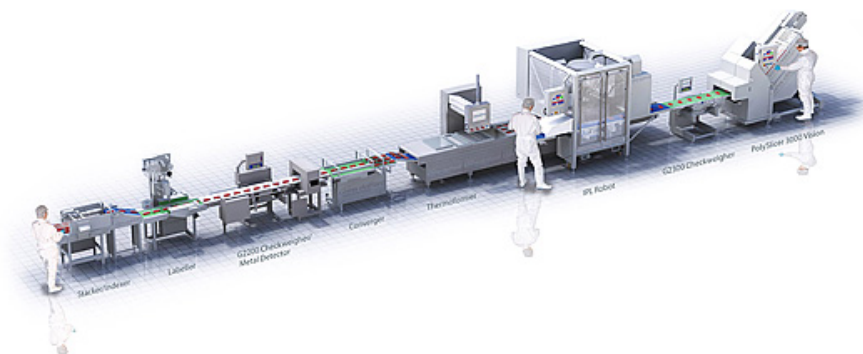
The companies are introduced with a short company description that will give the reader an idea of the companies and how they operate. Then the focal department will be described, giving the reader a better understanding of the environment that the PPM operates in. Finally, the case study results are presented, describing how PPM practices are carried out within the departments. The case study results do mainly come from interviews with two managers from each company.

### 4.2 Company no. 1 – Marel

#### 4.2.1 Company description

Marel is an international corporation that was founded in Iceland in the year 1983. Marel is one of the biggest export companies in Iceland and a leading global provider of advanced equipment, systems and services to the fish, meat and poultry industries. Marel has 3.900 employees worldwide and their operating units are located in the Netherlands, Denmark, the United States, Iceland, Slovakia, the United Kingdom and Singapore. The company has offices and subsidiaries in more than 30 countries along with 100 sales agents and distributors (Marel, 2012).

Marel has three brands, which are: Marel, Stork Poultry Processing and Townsend Further Processing. These brands are among the most respected in the industry and together, they offer the convenience of a single source to meet the customers' needs. They are the global leader in integrated systems for the fish and poultry industry segments, and a major provider in the meat industry. Marel's cutting edge equipment and software components help food processors of all sizes, in all markets, to operate at peak productivity, whether it is in the processing of fish, meat, poultry, cheese or prepared foods (Marel, 2012).

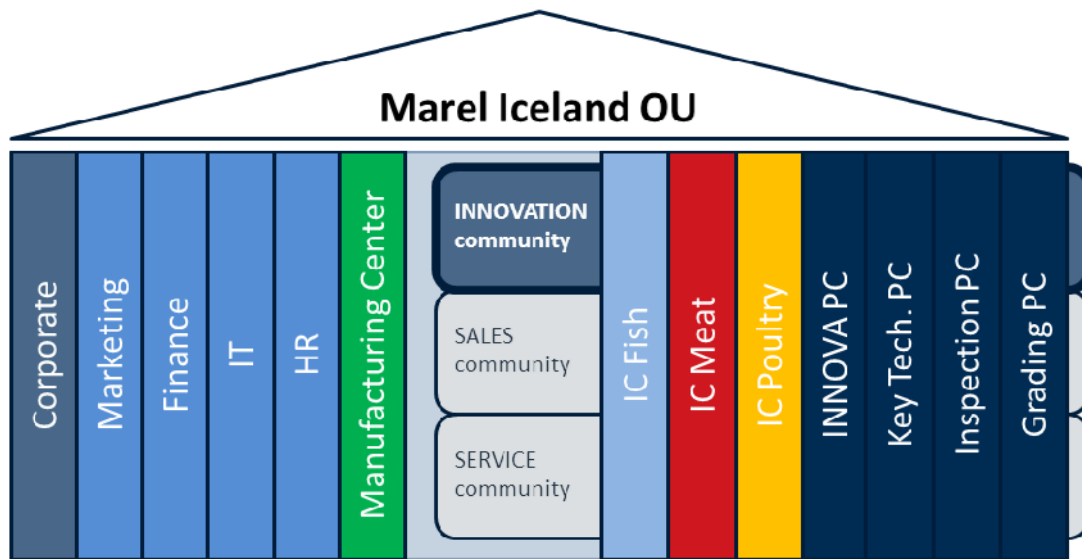


*Figure 9: One of Marel's food processing lines (Marel, 2012)*

Marel emphasizes a lot on innovation and they invest 5-7% of their annual income in research and development. Marel currently holds a portfolio of over 200 granted patents and the patent portfolio is constantly growing each year (Marel, 2012).

Marel's mission is to be the customers' choice in supplying integrated systems, products and services to the fish, meat and poultry industries (Marel, 2012).

The Marel operation unit in Iceland has seven supporting functions such as marketing, finance, IT and so forth. These functions support the three industry centers and four product centers that operate in Iceland. The operation in each center can be divided into three main areas, innovation, sales and services. For each of these centers, there is a supporting community which connects the employees of the areas, shares best practices and so forth. There are in total four industry centers and twelve product centers in Marel. The operations of the industry centers are spread over few locations and there are operations for three of the industry centers in Iceland. The product centers have fixed locations and there are four of the twelve product centers located in Iceland. The organizational structure is presented in Figure 10.



*Figure 10: Organizational structure - Marel Iceland operating unit*

Marel is a company that has grown significantly during the last two decades through strategic acquisitions and organic growth. In the year 1993 Marel's turnover was less than 10 million Euros, in the year 2005 the turnover has increased to 129 million Euros and in the year 2011 the turnover was 668 million Euros. From the year 2006, Marel has increased their market share from 4% to 15% and in 2011 their EBIT (Earnings before interest and taxes) margin was 10,9% which resulted in 73,2 million Euros in operating profit. All the mergers and strategic acquisitions that Marel have taken part in during the last decade have made synchronization of operations difficult and that is why they have chosen to decentralize product development and other operations. This was done by establishing operation units in few locations around the world and exploiting the cultures and operation habits at each location (Marel, 2011).

## 4.2.2 Department description

This case study will focus on Marel's product development in Iceland which operates in three industry centers and four product centers. Around 80 employees work directly

with product development and they are located in the centers and also in a coordination team for the innovation community. The innovation community connects all the employees that work within product development in the different centers and the innovation community coordination team gathers best practices and focuses on operational excellence in order to enhance the product development in the centers.

Each center has its own budget, employees and so forth and it is responsible for innovation, internal sales and services within the specific industry or product area. The centers have on average 2-3 on-going product development projects at each time which means that there are around 15-20 product development projects in the operating unit in Iceland at each time. The product centers are responsible for specific product solutions such as portioning and batching that are both sold internally to the industry centers and also externally through sales agents. The main purpose of the product centers is to sell standardized products in as large quantities as possible, but the products centers do also take the role of a subcontractor for the industry centers, especially when the industry centers are developing and selling large industry specific processes. The industry centers do also develop some products that are needed specifically for completing their industry process.

Managing and coordinating each of the industry centers are groups called the product market groups (PMG's) but for the product centers they are called the innovation to market groups (I2M). These groups take care of managing the product portfolio for each center and they consist of stakeholders, managers and other individuals that are concerned with the development in each center and can challenge the decisions taken at these forums. Any conflicts between these groups are raised at the integrated product group (IPG) that has the ultimate decision power over all the product development. This group can also reallocate budgets and make other executive decisions regarding the product development or innovation the operating unit in Iceland.

The innovation community coordination team consists of seven individuals that have responsibilities within different areas, as can be seen in Figure 11.



*Figure 11: Structure of the Innovation Community Coordination Team*

### 4.2.3 Case study results

These case study results are based on interviews with two individuals that work within product development at Marel in Iceland.

The key informant provided documents and other information about the Marel's product development early in the case study research process and participated in two interviews later on. He is the director of the Innovation community and participates in one of the I2M groups and the IPG group. His main role is to support the product development operations and work towards enhancing these operations. He both takes part in determining the project portfolio and also to enhance the project portfolio management practices.

The other interviewee is a vastly experienced project manager within product development at Marel. He is currently responsible for driving few product development projects within one of the industry centers. He is involved in the PMG meetings for his industry center and participates in the project selection process.

#### 4.2.3.1 Maximize the value of the portfolio – Phase 1

Ideas for new projects or products are collected from many different sources, both inside and outside the organizations. The process for working with the new ideas is informal and the ideas are for example not documented. The ideas do generally mature within the organization over a period of time and when the ideas have reached a certain degree of maturity, they will be brought in the product development process. The evaluation process for the ideas is mainly based on feeling and instincts rather than quantitative analysis. The most important issues regarding the evaluation of the ideas are whether or not this idea can meet the customer needs and also what value this idea can bring to Marel. Due to the fact that they are in a business to business market, they know their key customers and the trends on the market well and thereby have a good understanding of what products will be successful. There have been discussions about implementing a scoring model to evaluate the value of the ideas in a more formal way, but that has not been done yet.

When an idea is brought into the product development process, a project is initiated for the idea which goes through the project life-cycle presented in Figure 12. The project life-cycle consists of three main phases and between these phases are gates, where decisions are taken about the future of the project. The project is evaluated in the first phase and a program of requirement (POR) for the project is constructed. The POR is a document that includes information about the project, the end product, a value proposition both for Marel and also for their customers. It also contains other analysis that can be used to compare the projects individually and decide which projects should be selected for further development. When the projects have been evaluated, they reach a gate where the decision is taken whether or not money should be spent to develop this particular product. This decision is taken in the PMG or I2M groups.



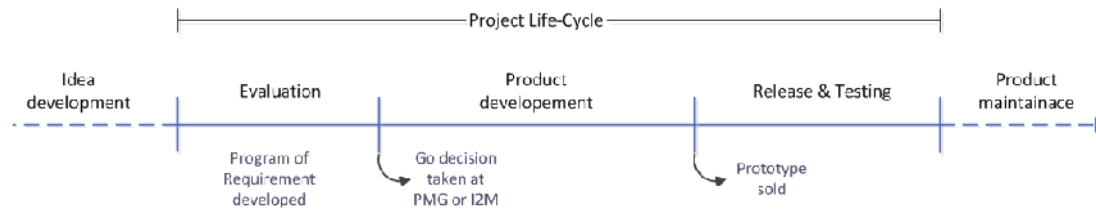


Figure 12: Marel's R&D project life-cycle

#### 4.2.3.2 Maximize the value of the portfolio – Phase 2

When a project has advanced through the first gate, the project goes through a phase where the actual product is developed and in the end of that phase a prototype is usually ready. At the next gate the prototype has to be sold, if that is achieved, the project goes through release and testing phase. The product goes to maintenance after the release and stays their out the lifetime of this generation of the product. This stage-gate model helps Marel to ensure that only the projects that have the sufficient commercial value are continued.

Most of the NPD projects within Marel are now executed using agile methodologies, such as Scrum and Kanban. By using these methods, the progress of the projects becomes visible to everyone in the office and information can be shared easily both inside and outside the project team. Marel has been implementing these methods over the last two years, and they aim to have all their projects follow these agile methodologies. The Scrum methodologies are mainly used for software development and Kanban is mainly used for mechanical development. By using these methods the projects are broken down more extensively which enables the management to follow the progress more closely than before.

Once a year a five-year strategic plan for the centers is revised within the PMG's and I2M groups. This plan includes market analysis, life-cycle analysis of key products and so forth. They do also regularly revise their roadmaps for new products. These groups are responsible for terminating, reprioritizing and delaying projects for each center and make sure that the right projects are on-going at each time.

The monitoring of the product centers are done locally in the operating unit in Iceland. They have formed a product center (PC) management group which the four product centers in Iceland report to. The PC management is supposed to follow up the progress of the product centers on monthly basis by analyzing financial, service, product development and sales measurements.

The industry centers are larger and not fixed to a certain location. They report their progress straight to the board of management in standard reports that are sent once a month.

Decisions for reallocation of budget, reprioritization of projects and so forth does takes part mainly in the PMG's and I2M groups for each industry or product center. IPG can reallocate budgets between the centers but that is not common. The main conflicts that IPG resolves are when projects or products fall between two centers and a decision has to be made which center should add it to their roadmap.



#### **4.2.3.3 Ensure balance among projects in the portfolio**

As described in Chapter 4.2.2, the product development is executed in centers for different industries and different product areas. Each center has a separate budget to carry out their operations in sales, services and product development. By doing this the organizations make sure that there is a relevant balance between the projects in terms of industries and product areas.

The organization also has guidelines for how they would like to distribute their resources within different project types. They divide their projects into three project types: breakthroughs, new generations and sales related projects. They are currently spending roughly 15% on breakthrough projects, 25% on new generation projects and 60% on sales related projects. Marel has realized that they have been spending too much on breakthrough projects and too little on new generation projects that are supposed to sustain their current market shares. They aim to increase the spending in new generation project and on the same time to reduce spending on breakthrough projects and sales related projects. They aim to lower the spending of resources on sales related projects by making their products more modular and thereby reducing the efforts needed for selling and setting up the products. They do also use these guidelines to ensure that they spend appropriate amount on projects that are supposed to ensure revenues now (sales related projects), in the near future (new generation projects) and in the long-term (breakthrough projects).

#### **4.2.3.4 Ensure that the portfolio reflects the business strategy**

The industry and product centers are operated as small companies within the Marel Corporation. These centers are responsible for their own product development, internal sales and so forth, along with the responsibility of revising their five-year strategic plan on yearly basis. These strategic plans are then collected, reviewed and eventually accepted by the board of management that will then release a combined strategy for the whole organization. Each center constructs roadmaps from their strategic plan to visualize what projects will be undertaken and what product will be delivered in the near future.

#### **4.2.3.5 Limit the number of projects to fit the organizational capacity**

The product development projects at Marel do suffer from delays due to lack of resources and they see it as the nature of NPD projects that there is a under capacity for resources. They had some guidelines in the past for how many NPD project can be on-going at each time, but now they try to control it more on the industry and product center level. Marel have always had an aggressive market philosophy and if they see an opportunity on the market, they usually react quickly in order to exploit it, often without planning or overthinking things. This is also illustrated in Chapter 4.2.3.1, in the way they evaluate ideas. This approach has sometimes backfired but in the long run they have gained a lot from this aggressive approach.

#### **4.2.3.6 General issues**

The biggest problems that Marel has had in management of the product development projects are related to the fact that Marel has been too sales driven, rather than market

driven. They have a strong product development team which has been able to develop products for the customers and deliver them quickly before turning to the next product for the next customer. This has resulted in high turnover which has allowed Marel to grow fast, but the operations have not been as efficient as they could have been if they would have focused more on finishing, standardizing and reusing the products. To design products for each customer is not efficient and Marel has been trying to improve this during recent years by making sure that the products meets the need of as wide customer group as possible.

They are also constantly trying to improve best practices and implementing new ways of working, for example by introducing agile methodologies to the product development process. Marel has been a part the few merger and acquisition processes during recent years and there is a lot of knowledge and best practices that can be retrieved for the organizations joining the corporation.

### 4.3 Company no. 2 – Össur

#### 4.3.1 Company description

Össur is an international corporation that was founded in Iceland in the year 1971. Össur has wide-ranging expertise in the development, manufacture and sale of non-invasive orthopedics. Össur has 1,800 employees in 14 locations around the world. They have extensive operations in the Americas, Europe and Asia, with numerous distributors in other markets. The Company's headquarters are in Iceland (Össur, 2012)

The Company is named after its founder Össur Kristinsson, an Icelandic prosthetist who designed an improved interface for prosthetic sockets in the 1970s. He soon discovered the ideal properties of silicone and used it to create the Iceross liner. His invention helped thousands of amputees to secure their artificial limbs in a more comfortable and effective way than ever before. Össur has added numerous life-changing products to its portfolio, dynamic braces such as the Unloader One to relieve the pain of osteoarthritis and the unique prosthetic Proprio foot. Several other products have also been added to the product portfolio such as artificial knees and ankles along with various spinal, wrist, thumb, shoulder, elbow, clavicle and rib support solutions (Össur, 2012).



*Figure 13: Two of Össur's many products*

Össur offers advanced products in three categories:

- Bracing and Supports
- Prosthetics
- Compression therapy

Bracing and support products account for around 50% of Össur's total sales and these are mainly products for therapeutic and preventive purposes. Össur holds 7-9% market share globally for these products and they are the second largest player on the market. Prosthetics products account for around 45% of Össur's total sales and these products are artificial limbs and related products. Össur holds 19-21% market share for these products and they are the second largest player on the market. Compression therapy products account for 5% of the total sales and they are mainly sold in France. These are products for treatment of vascular disorder, ulcers and oedema. Össur holds 6% market share for these products in France (Össur, 2010).

Össur has a reputation for pioneering successful products and that has led to significant increase in sales during the last decade. Össur had total sales of 401,3 million USD in 2011 and that is more than twenty times higher than their sales in the year 1999 (Össur, 2010; Össur, 2011). An assertive acquisition strategy has complemented ambitious organic growth through investments in innovation and technology and established the company as one of the leading global players in the industry. The Company invests significantly in research and product development, and Össur's innovative R&D unit helps ensure a consistently strong position in the market. Össur has a strong patent portfolio which consisted of 557 granted patents, 369 patent applications, 79 granted and 14 depending registration in the end of 2010 (Össur, 2010 and 2012).

Össur's main mission is to improve people's mobility and do that by seeking out and seizing new opportunities. They aim to become the leading company in their field, exceeding the expectations of its customers and maintaining a strong focus on continuous improvement (Össur, 2012).

Össur's R&D operations are divided between two locations, one in Reykjavík and one in California. The R&D projects have been separated into two project portfolios, one for each location, managed by the PMO at that location. Prosthetics products are developed in Iceland along with one bracing product group. The rest of the products are developed in California.

Össur has a matrix organizational structure in Iceland with cross functional project teams. The employees belong to the functional departments but each project team usually sticks within the same product group. The project managers belong to the PMO and they do focus on specific product groups.

#### **4.3.2 Department description**

This case study will focus on the R&D department in Reykjavík, Iceland and especially on the operations within their PMO. The PMO consists of four project managers and a project portfolio manager that also works as a project manager. Each of these project managers is managing few projects at each time, which vary in size and are in different phases of the project life-cycle. The PMO takes care of monitoring and controlling the projects and works towards enhancing the management of them, providing an overview of the project portfolio and being responsible for project

prioritization. The members of the PMO along with few middle and upper managers, such as the R&D manager and product managers are responsible for the PPM process as it is defined in the literature.

There are product managers that own the product groups and they are responsible for product development within each group and take care of initiating new projects.

The two project portfolios have a combination of roughly twenty active NPD projects at each time in the two locations. Össur decided to divide up the product development project portfolio last year in order to be able to manage the operations more efficiently. Now the product development has been moved closer to the location for the production for each product group. Also the product development of each product group is mainly done locally now but not in virtual teams as before. This has resulted in more efficient management of the product development projects and also lower costs due to less travels etc.

The projects are selected using a project selection model that Össur has developed and incorporates many of the main PPM aspects. Össur's R&D department started working with PPM over ten years ago and started using the project selection model over five years ago. Össur has been enhancing the project management practices over the last several years, especially within R&D. These improvements have led to more efficient and structured PM and PPM practices.

### **4.3.3 Case study results**

These case study results are based on interviews with two individuals from Össur's R&D project management office at Iceland.

The key informant is the Project Portfolio Manager of R&D projects in Iceland, the head of the PMO and a project manager. She is responsible for handling the project selection model and the dashboards that are used to visualize project progress. She supports the project managers with the management of the projects and works towards making sure that the project teams are working on the right projects at each time. Resource management and project reporting upwards are also among her daily tasks.

The second interviewee is a project manager for few R&D projects and a member of the PMO. She manages 4-6 projects at each time within the bracing and supports products developed in Reykjavík. Her main tasks are to control project meetings, ensure that the project is on track and drive them through the product development process. She also takes part in the project selection process by taking part in the product council meetings and providing information about the resources available and needed for the projects in discussion.

#### **4.3.3.1 Maximize the value – Phase 1**

Ideas for new projects are usually brought forward a Product council meetings where the participant are sales people, designers, product managers and other individuals that might have ideas for new products or projects. Product council meetings are held for each product group. The product managers in collaboration with the designers and technicians prepare ideas from their perspectives and the sales people do also prepare by analyzing the market and customer needs. The ideas are discussed at these meeting taking into account issues such as market needs, technical complexity and so forth.

The ideas that are discussed at these meeting are then ranked roughly according to the issues raised during the discussions. The product managers will then start to construct a rough business case which is then inserted into a project selection model, which is the essence of project portfolio management at Össur's R&D in Iceland.

The project selection model is used to rank the projects according to several parameters with different weight. The projects get a score from 1-4 for each parameter, but these parameters are not equally important, so they have different weight in the final ranking. The PMO works towards evaluating the projects and constructing a plan for the project portfolio taking into account the project rankings, the resources plan, the time plan, the business strategy etc. This is then used to construct a launch plan for next year which is done by the R&D manager. These plans are living documents and can sometimes change if some new projects are brought into the model that gets a high ranking or if some external factors change. But the basic trend is to do extensive sessions for project selections on yearly basis and in the end of that process a project portfolio plan and a product launch plan for the next year are released.

#### 4.3.3.2 Maximize the value – Phase 2

Össur uses gates between different stages in the project life cycle, as presented in Figure 14.



*Figure 14: Össur's R&D project life cycle model*

When projects are selected, they go through gate 1 and then a more thorough business case including risk analysis and so forth is constructed before the project can pass gate 2. At gate 2 a prototype, drawings or something that show functionality is also presented and then a decision is taken whether or not this project should be executed. The gates are used to monitor the project and there are specific checklists of what needs to be done and which individuals need accept before the project can pass the gates. Included in each gate is a presentation of some key metrics such as resource usage, current NPV, project cost, estimated launch date etc. A baseline is defined in the business case and the metrics are compared to that baseline at each gate to illustrate the progress of the projects in perspective. The gates are not only used to monitor the projects, they are also used to maintain the project portfolio, by providing opportunities to terminate or postpone project that are not meeting specifications.

The parameters in the selection model are evaluated by the board of directors on a yearly basis and that can result in changes in the ranking of the projects. This can lead to re-evaluation of the project portfolio, but usually the changes are not that significant so that the on-going projects are affected.

The R&D manager has the ultimate decision about whether or not a project should be terminated, delayed, reprioritized and so forth. He is responsible for the launch plan and he needs to approve any changes that affect the launch plan. The portfolio manager and others can provide input and advice about these decisions but the R&D manager has to make the final decision. The project selection model stores information about all the projects and the model is used to support these decisions.

Dashboards are used to monitor the projects from different perspectives and move information from the projects and upwards. The project managers update the dashboard regularly for their projects, but the portfolio manager has the overall responsibility for the dashboard. The dashboard is reviewed once a week with all the project managers, where the status, launch date, risks, critical path and delays of the projects are discussed. These are detailed information, but there is also a top dashboard, where the traffic lights are shown for the key parameters for each project. The top dashboard is shared with the senior management and the status of projects is discussed with them at monthly meetings.

Root cause analysis is done once a month where the project managers analyze the problems that have occurred in the projects and try to identify the root cause using the 5 why's method. The projects go through an in-formal lessons learned process which could be enhanced by documentation and so forth. The products go through gate 5 about a year after the product release, where a post market analysis is constructed.

#### **4.3.3.3 Ensure balance among projects in the portfolio**

In order to ensure that the appropriate combination of projects is chosen in the project selection model, constraints are added to the model. The constraints are evaluated on yearly basis by the senior management. An example of constraint might be that there has to be at least two project on-going in each product group. This can lead to that all the highest ranked projects in the model are not selected, because the constraints should not be broken.

The product portfolio has been divided into several product groups and that ensures that there is an appropriate balance between different product types. Each product group should also spend a certain amount to resources on technical projects. These are side-projects that give the technicians freedom to work on new technical issues and ideas that can later transform into a development project.

The dashboards do also show how many projects are on-going in each product group along with upcoming and the competed projects. This visualizes the spread of the project portfolio in terms of product types. The weight of the parameters in the Selection model also contributes to the desired balance in the portfolio.

#### **4.3.3.4 Ensure that the portfolio reflects the business strategy**

The business strategy is well communicated to the employees of Össur through presentations and employee meetings. There was recently a competition within Össur where people were asked to answer questions about next year's strategy. This is done to make sure that the business strategy is familiar to everyone.

The strategy is presented by the senior management on yearly basis and they change the weight of the parameters in the selection model to ensure that the projects that will be chosen will reflect the new strategy. Most of the on-going projects are working towards this year's business strategy. Individuals from the middle and upper management, such as product managers, the R&D manager and the project portfolio managers are highly involved in the PPM processes and it can be assumed that they know the strategy well and make sure that the project portfolio mirrors the strategy. Roadmaps are constructed for next year's projects and product launches, illustrating where the company is heading.

#### **4.3.3.5 Limit the number of projects to fit the organizational capacity**

Össur has suffered from project delays due to lack of resources during recent years, and when one projects gets delayed, the next one will also suffer. They have recognized that the biggest problem behind that is that people are working on too many projects at the same time. They are now trying to get people to focus on fewer projects, not more than 2-3 projects at each time. During the construction of the business case the project managers construct a resource plan in Microsoft Project. This is done to reduce the risk of resource shortage during the project life cycle.

The selection model and the dashboard also contribute to the process of limiting the number of projects to the organizational capacity by visualizing how many projects are on-going at each time. Also the constraints are used to ensure that each project team is not working on to many projects.

#### **4.3.3.6 General issues**

The biggest and most common problems that Össur has with projects and managing them are usually connected with the resources. Designers and others project members belong to the functional department and sometimes it can be hard to get or maintain the appropriate resources for the projects. They do also encounter delays because of other reason that could hardly be anticipated, such as material flaws, design problems, communication etc.

They are now updating the dashboard software, so that the dashboards can retrieve information automatically from the project management sharepoint site. This will integrate the project management practices with the PPM practices and ensure that the information showed on the dashboards is always up to date.

### **4.4 Overview of case study results**

Table 3 gives an overview of the case study results in the two organizations that were presented in Chapters 4.2.3 and 4.3.3.

*Table 3: Overview of the case study results*

| Main Goals of PPM  | Marel   | Össur   |
|--|---|---|
| Maximize the financial value of the portfolio - Phase 1          | Informal process<br>Program of Req. (POR)                 | Project Selection model                         |
| Maximize the financial value of the portfolio - Phase 2          | Stage-gate model<br>Revision of the strategic plan        | Stage-gate model<br>Dashboards, RCA             |
| Ensure balance among projects in the portfolio                   | Organizational structure<br>Rendition of the Harvard div. | Product groups<br>Constraints for Proj. Select. |
| Ensure that the portfolio reflects the business strategy         | Roadmaps<br>Strategic plan                                | Roadmaps  |
| Limit the numbers of projects to fit the organizational capacity | Lack of resources is the nature of NPD                    | Limitations on how many projects people work on |



## 5 Discussions

The following sub-chapters are structured to be able to answer the three research questions of this thesis. Chapter 5.1 will present discussions about how the project portfolio management practices are applied in practice. The different parts of the theory will be discussed individually supported by the case study research. Conclusions will be made about which parts of the theory are the most important ones for PPM practices within NPD organizations and which parts are less important.

Chapter 5.2 will present discussions about how the organizations can improve their practices and what they could gain from these improvements. These recommendations are based on the case study research, using the literature review and the case study result from the other organization in support.

### 5.1 How PPM theory is applied in practice

The respondents from both organizations understand the concept of PPM and they did not confuse it with the related concepts, program and multi project management. Although the two companies had different ways of operating with PPM, they have both grasp what PPM is and how it can be beneficial for companies. Increased coverage of PPM during the last several years has reduced the risk of people confusing PPM with these related concepts.

It was clear in the interviews that the organizations did agree with the statement presented in Chapter 3.3, that “the companies that have the best ability to select the today’s projects will become the tomorrow’s product winners”. Both organizations did understand the importance of selecting the right projects, maintaining the project portfolio, strategic alignment and efficient resource usage.

Senior management commitment and involvement in the PPM process is strong in both organizations. They are involved in the PPM process from the early stages and they are the ones that take ultimate decisions about the project portfolio. This is an important aspect of PPM, and the organizations should make sure that they maintain the senior management involvement in their PPM. There seems to be quite good integration between the project management and the PPM processes in both organizations, especially in the case of Össur.

The PMI (2008a) standard for portfolio management and Levine’s (2005) book stated that organization should try to adapt the structure and the culture of the organization to the PPM practices when they are implemented. The PMI standard does also give a description of which executive managers need to take part in the PPM, what groups and boards need to be in formed, what skills are needed to be a portfolio manager etc. These statements were not reflected in the observations made in the case study research. They did actually show the opposite, that PPM has to be customized in order for it to fit the organization and not vice versa. The case study results do also show that there is no correct way for implementing and structuring the PPM, organization have to find a way to implement and structure PPM that complements their current operations and deliver maximum benefits to the organization. The focus of the PPM theory should be on the outcome of the PPM process but not who sits in what committee and so forth, the organizations can figure that out themselves. These observations made in the case study research are supported by the research made by

Teller et al. (2012). They state that there is no single method of formalizations of PPM that fits all portfolios. How the PPM is structured must correspond to the specific requirements of the individual project portfolio in order for it to reach the optimal level of success.

Levine (2005) among others states that it would be a mistake to operate the PPM practices within the PMO of the organization. Össur's PPM practices operate within their PMO and that seems to fit them well. The project managers are involved in the PPM process and they have the support from the executive management to make ultimate decision. The same could be said about Marel, their PPM practices are being done at the industry and product center level, but with the support of the executive management. Again here, the observations made in the case study contradict with the literature and they show that organizations need to have some breathing room to customize PPM to their own needs.

Chapter 3.4 presents few point from Labrosse (2010) and Levine (2005) that describe what kind of companies should have PPM or should consider implementing it. The case study results show that both Marel and Össur meet this description quite well. They do both work a lot with projects and they do suffer from resource shortage and delays in their projects. They both understand the importance of project selection and so forth and use projects in order to retrieve and sustain competitive advantage. Össur has been more projects oriented in the past and that might be the reason why they have focused more on the PPM processes. Marel on the other hand want to enhance their project management and PPM processes and by doing so the product development process will certainly become more efficient.

### **5.1.1 Maximize the financial value of the portfolio – phase 1**

It is important that the projects are documented early in order for the organization to be able to take ultimate decisions whether or not the projects should be executed. Össur uses the project selection model to store information about the project ideas and the business case while Marel uses the POR to store information about the projects when they have been evaluated. Both organizations use NPV in their financial analysis of the projects which seems to be the most common method within the evaluation of product development projects. ROI and ECV that were also presented in the theory were not used by the organizations to evaluate projects.

It came as a surprise to see how scoring/selection model play an important role in the PPM process in NPD organizations. Össur's selection model is the central aspect of the PPM practices and Marel stated that they are interested to implement such a model. It was realized during the construction of the case study that a simple scoring/selection model can have huge benefits to the organizations. These models can be customized completely to the needs of the organizations, using preferred parameters with appropriate weight to reflect the vision of the executive management. Cooper et al. (2001b) presented an empirical research that concluded that the most popular PPM tools are not in fact the most effective one. The result highlighted that although scoring models were only used by 38% of the companies in the study, the model was considered as one of the most effective PPM tools, combining financial and strategic aspects when scoring and selecting projects.

### **5.1.2 Maximize the financial value of the portfolio – phase 2**

Both organizations have a very well defined product development project life-cycle model that is a type of the stage-gate model. The organizations depend highly on these models in order to monitor the projects during their life-cycle. These models do also provide the organizations with the option to terminate, delay or reprioritize projects, if they do not meet certain specifications at the gates.

EVA on the other hand does not seem to be used as much in the product development projects. That is understandable because it can be hard to define on regular basis how far ahead in the projects the team has reached in the product development process.

### **5.1.3 Ensure balance among projects in the portfolio**

It became evident that both companies actually work towards diversifying their project portfolio. Neither of the companies seems to focus on the balance of high vs. low risk projects, but they think about the balance in the other terms, such as product and project types. The structure of the both organizations does contribute to the desired balance between the products.

A rendition of the Harvard project division for NPD companies is used by Marel to monitor and control how the resources are spent on different kinds of projects. Neither of the organizations used the tools, bubble diagrams and the graphs. Even though the organizations do not use these tools, they could be beneficial to be able to visualize the balance in the portfolio, especially the bubble diagram.

### **5.1.4 Ensure that the portfolio reflects the business strategy**

The organizations use different approaches for the business strategy construction, but both strategies seem to be well communicated. The projects that are chosen seem to be aligned to the strategies that they are supposed to be working towards. Both organizations use roadmaps to visualize the project and product launches. The roadmaps seem to be very important tool for both organizations. Strategic buckets are not used by the organizations.

### **5.1.5 Limit the numbers of projects to fit the organizational capacity**

Both organizations did acknowledge problems in relation with too many on-going projects at each time and that they do suffer from lack of resources. They both understand the importance of limiting the number of projects to fit the organizational capacity and stated that they are trying to improve this. The organizations do not use pipeline management to support their resource allocation.

### **5.1.6 Other aspects of PPM**

The PPM process presented in Chapter 3.6 and published by Levine (2005) gives a good picture of how PPM can operate in organizations. It seems that both companies follow this process roughly, but as stated in the literature, this is a dynamic and interactive process, which might force them to jump from one phase to another. This

process description can be beneficial for organizations in the process of implementing PPM.

The organizations do not use one of the complete software solutions available on the market. Össur uses software solutions for their selection model and the dashboards those have been developed internally and customized to their own operations. Based on the analysis that was made on the PPM software the solutions available, the price inquire and the case study research, it can be assumed that it is preferable for organizations similar to Marel and Össur to focus on developing their own software to support PPM. By doing so, they can customize the software completely to their operations instead of buying these expensive and complex solutions that might not be able to fulfill their specific needs.

In general, both companies are realizing many of the main benefits from PPM presented in Chapter 3.8, but Össur has probably progressed more due to the fact that their PPM practices are more matured. They seem to benefit a lot from having a designated project portfolio manager that works closely with their project and the project selection model does also seem to help them a lot. It is hard to comment on what are the most important benefits of PPM but from the observation made in the case study research it could be concluded that these six benefits are of high importance:

- The portfolio of projects becomes aligned to the organizations strategy
- The organizations gets the best usage of the resources
- The projects that have become outdated or are not performing well enough are terminated
- Only the right projects will be selected and/or continued
- Critical products can have shorter time to market and thereby fitting into windows of opportunities
- The information flow from the projects is improved

According to the observations from the case study research, there are few aspects of the PPM theory that are more important for NPD organizations than others. These aspects are presented in Table 4 along with the aspects seem to be not as important for those kinds of organizations.

*Table 4: Summary of most and least important aspects of PPM theory based on the case study research*

| Most important aspects                       | Least important aspects                                 |
|--|---|
| Senior management commitment and involvement | Changes in organizational culture and structure         |
| NVP financial analysis method                | Strict definitions of roles and responsibilities of PPM |
| Scoring/selection model                      | ROI and ECV financial analysis methods                  |
| Stage-Gate project life-cycle models         | Earned value analysis                                   |
| Project and Product Roadmaps                 | Strategic buckets                                       |
| Customized simple software solutions         |   |

One of the main purposes of this thesis was to analyze how PPM theory is applied in NPD organizations. The discussions here above have compared the results from the case study research with the PPM theories presented in Chapter 3. The PPM theory is relatively young but the theory is strong and certainly applicable for most NPD organizations. Organizations around the world are still implementing PPM and working towards reaching higher level of maturity and the organizations analyzed in the case study are no different. The discussion that was carried out in this chapter analyzes the PPM theory from a practical perspective in order to highlight the most important aspects of the theories and thereby guide organizations to focus on the appropriate aspects when implementing or enhancing PPM practices.

## 5.2 Recommendations to the companies

As presented in the case study research in Chapter 4, it is clear that the two organizations have different structure and ways to operate although they have very similar background and history. Össur has chosen a quite traditional way to operate while Marel has chosen to develop their own ways. Although they have chosen different approaches, they have both managed to grow extremely fast and become one of the world's leaders in their industries. Marel seems to have stronger product focus while Össur seems to have more project focus. Össur seems to have focused more on PPM and project management during the last decade compared to Marel. That is why the recommendations for the two organizations will have different focus.

### 5.2.1 Company no. 1 – Marel

Marel has developed its own organizational structure that differs quite a lot from traditional organizational structures. Their innovative structure where the operations are divided into separate industry and product centers is not ideal for implementation of PPM as it is defined in the literature. But they should absolutely implement some of the tools and processes in order to enhance the project selection, portfolio maintenance and so forth.

The main recommendation to Marel is to develop and implement a project selection model. Project ideas are currently not formally documented but with the implementation of a selection model, ideas could be brought into the model early. That would make it easier to work with and coordinate the project ideas. The process of selecting the ideas that will be brought into the product development process would become more structured and efficient. During the project evaluation phase, the information in the project selection model could be revised and at the gate after the first phase, all relevant information about the project and also other projects are available for the PMG's and I2M groups to make decision which projects should be continued.

Marel's project selection process does take into account intangible aspects of the projects and it is important that the project selection model will have parameters that cover these aspects. The project selection model could contain the following parameters and they could have different weight on the final score.

- Marel's value proposition (NPV)
- Alignment to customers' needs
- Product/Competitive Advantage
- Market Feasibility
- Technical Feasibility
- Risks (Technical/Commercial)
- Resource availability
- Protectability (Intellectual property rights)

After the project evaluation, these parameters should be rated using a scale such as 1-5 and then a list could be exported sorted by the weighted average of these parameters. The parameters and their weight should then be revised regularly by the executive management to ensure that they reflect the vision of the management.

There are few main benefits that Marel can get from implementing a project selection model like this one. Project ideas are brought into the model and documented early in the process, and ideas that do get a bad initial score could be filtered out. Basic information about all projects and project ideas could be stored at one central place and be available to the individuals at the PMG's and I2M groups at any time. This would give the industry centers the opportunity to follow what projects are on-going and proposed in the product centers and vice versa. This would also provide an overview for all the product development projects and that would make the tasks of the innovation community coordination team easier. Statistics about the whole product development project portfolio could easily be gathered and the coordination team could use the statistics to follow up their improvements or changes in focus, such as their plan to focus more on new generation products. Because the project portfolio is distributed in the centers, it can be important to have an overview what projects will be initiated in the near future in the other centers when the projects for a certain center are selected.

Marel has been trying to improve the project evaluation process for example by starting to construct POR for each project. The project selection model requires that certain information about all project are inserted and that can provide a structure to support that POR will be constructed for all projects. Marel is currently trying to improve their project management practices in order to increase the efficiency of their

operations. Teller et al. (2012) presented that research has shown that the optimal project portfolio success can be reached if the practices are improved at both project and portfolio level. These practices complement each other and Teller et al. (2012) recommends that these practices should be implemented and improved simultaneously. So if Marel want to implement more formal project management practices, PPM tools such as a selection model could be implemented in a similar timeframe having positive result on the project portfolio success.

Marel uses a bottom-up approach for their strategy construction. When that approach is used, it is important that the project selection process is strong. The bottom-up approach relies on that the right decisions are made in the industry and product center because they will shape the future of the organization. Choosing the right projects are essential for Marel to retrieve and maintain competitive advantage and a project selection model can support them in doing so.

By using a selection model like the one that has been described here above, there is an option to add constraints to the model like Össur has done. These constraints could be used to support the management to keep the desired balance in the portfolio and limit the number of projects to the organizational capacity. By limiting the number of projects, the risk of resource shortage and other problems regarding resource allocation could be reduced.

### **5.2.2 Company no. 2 – Össur**

Össur has been working with project and portfolio management for several years and they seem to have reached quite high maturity in both areas. Their PPM practices are run by a designated project portfolio manager and their project selection model supports the PPM processes well. Although they have quite strong PPM practices, the following recommendations could improve their practices even further.

The first recommendation is to do some minor changes in the project selection model in order to make it even more beneficial for Össur. The project selection model is currently a complex MS Excel spread sheet which stores a lot of data, which is then processed and used to generate project lists in order to support the project selection process. MS Excel spread sheets are usually not considered ideal for working with databases, but MS Access among other programs has those competences (OpenGate Software, 2012). By moving the project selection model into MS Access, the database could be stored in a better way, the information could be inserted in specially designed input forms and data that should not be presented to the user is kept hidden. The selection model would then be more user friendly and changes in the model in would become much easier. This operation would be a simple task for an experienced programmer.

It could also be beneficial for Össur to add features into the project selection model that would visualize the balance between the projects in the portfolio. Bubble diagrams could be added to show balance among projects, both in the entire portfolio and also in each product group. Different axis could be used, such as NPV vs. Product type, NPV vs. project type. An example of a bubble and detailed description can be found in Chapter 3.5.2. Bubble diagrams are a good way to visualize on what kind of projects the organization is spending their resources and bring out information that are usually not available to portfolio and senior managers. The Harvard product development project division could be used to categories the projects and set

guidelines of how much percentage of the resources should be spent on each project type, as is being done in Marel. If the preferred percentage of, for example, breakthrough products is not mirrored in the reality, constraints could be added to affect the projects selection and steer it to the preferred division of resources according to the project types.

Össur could also improve their operations with regards to reviewing the projects after they have been finished and performing formal lessons learned. This could benefit them both at project and portfolio management level. At the project level, the pitfalls and some positive aspects could be documented more formally in order for it to be available and beneficial to other project teams. At the portfolio level, discussions could take place about if the project selection and monitoring process was sufficient and whether some improvements could be made to the PPM practices. PMO is a great forum for documenting and keeping this information centrally so best practices are brought into every new project. Also common mistakes could be shared and remedy plans generated.

Össur should also continue the process of limiting the number of project that individuals are working on at the same time and possibly think about putting more strict constraints on the total number of projects on-going in each product group. It is important to keep in mind that if they can reduce the amount of on-going projects, they will have less movement of resources, income from project will come earlier and that they will finish the a similar amount of project annually with a lot lower risk of delays that can result in loss of market opportunities. There is also the risk that if the employers are working on many project at the same time, that they will choose to spend more time on the projects that they enjoy the most, without considering organizational priorities.



## 6 Conclusions

### 6.1 General conclusions and summary

During the construction of this thesis, the author has analysed a large quantity of published PPM material and done a thorough case study research within two NPD organizations. To give a short summary about the thesis, the following statements were extracted from the literature review and the observations that have been made during the construction of this thesis will be used to give short comments about them.

*Effective project management of a single project is no longer sufficient, nowadays the management of the whole project portfolio has become a vital factor for achieving long-term success and competitive advantage.* (Chapter 3.3, p. 10) Based on Heising (2012).

The times are changing and with increased global competition, the selection of projects is becoming more and more vital for the future of the organizations. It is also important to maintain the project portfolio and terminate, delay or reprioritize project according to internal or external changes. These highly competitive times do also require that the right resources are used at the right place at the right time. That cannot be achieved when the focus is merely on the project level.

*But although the interest has increased among organization, there are studies that show that the project portfolio management practices are in general immature.* (Chapter 3.3, p. 11) Based on PM Solutions Research (2003).

The maturity of PPM practices in organizations in general has increase quite a lot during the nine years since this research was published. There seemed to be good awareness and understanding of the PPM practices in the organizations that participated in the case study research. They seemed to understand quite well the importance of PPM and it can be assumed that they will both have a relatively mature PPM practices in the near future.

*Senior Management commitment is also an important success factor for implementing and maintaining PPM.* (Chapter 3.4, p. 11) Based on Killen et al. (2007).

This is a key aspect of the PPM theory and it is safe to say that PPM is in serious problems within organizations where the senior management is not committed and involved in the process. An important role of PPM is to connect the strategy and vision of the senior management to the projects and that is why it is vital for the senior management to be involved in to decision making process of PPM.

*The organization also has to be prepared to make changes proposed by the PPM process regarding the structure and formalization of the organization in order to be able to reap as much benefits as possible from the PPM process* (Chapter 3.4, p. 12) Based on PMI (2008a).

The observations made in the case study research do contradict strongly with this statement. They illustrated that the PPM practices have to be customized and adapted to the current operations of the organization.

Taking all the work that has been done as a part of this thesis into account, it is the opinion of the author that all NPD organizations should think about implementing some kind of PPM practices. But they do not have to implement all methods and tools

at once, instead they should implement PPM slowly, choosing the things that would benefit them the most and adapt them to the current operations. It can be assumed, based on the findings of this study that it could be good to start by implementing a selection model and a clear stage-gate project life-cycle model. Roadmaps could also be beneficial for these companies, both for portfolio planning and visualizing the strategy in terms of project and product releases.

This thesis has discussed how project portfolio practices are applied in organizations and compared them to the theory. It has also described the most important aspects of the PPM theory for NPD organizations and described how the organizations in the case study could improve and what benefits they could reap from the improvements. So the four research questions that were presented in Chapter 1.1 have been discussed and answered.

## **6.2 Future research**

The PPM theory is quite young as was presented in Chapter 3.2 and there are many areas within PPM that could be researched further. Two future research areas could be proposed that would complement the research that was done during the construction of this thesis.

It could be interesting and beneficial to use the knowledge that has been generated in this thesis to do a quantitative analysis of how PPM theory is applied in practice. This quantitative analysis could be done by sending a questionnaire to multiple companies. It would give a broader view of what are the most important aspects of the PPM theory for NPD organizations and some stronger generalizations could be made.

Secondly, it would also be interesting to look closer into how project portfolio management is structured in the most efficient way in organizations that work mainly with project using agile methodologies. Agile methodologies have become a very popular way to structure projects, especially within the IT industry. These projects do not use the tradition project management tools and processes, so some alternations might be needed at the portfolio level compared to traditional PPM.

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## **8 Appendixes**

### **8.1 Appendix A - Interview guide for key informants**

#### **8.1.1 Short Description of this Thesis work**

This is a thesis that is being done as a part of a master program at Chalmers University of Technology called International Project Management. The main focus of this thesis is on project portfolio management, which according to many theoreticians the fastest developing area within project management and the biggest new thing in project management for over 50 years. It has been becoming more and more popular during the last decade and in 2006 PMI published the standard for portfolio management. The reason why this has been becoming so popular is that during the last two decades organizations have been executing more and more operations in projects and becoming project based organizations. With this increase in number of projects there has emerged a strong need for practices to evaluate, prioritize, select and coordinate the projects. The PPM practices provide a simple framework of processes, methods and tools that can be used in order to meet these needs.

But although theories have been published through articles, textbooks and standards, theoreticians agree that the level of maturity of PPM is generally low in organizations, and the reason for that is that the theories are quite young. The purpose of this thesis is first of all to analyze the presented PPM theory and summarize why and how PPM should be implemented within organizations dealing with multiple projects. Secondly, a case study within two organizations will be done in order to analyze how the PPM theories are applied in practice. Lastly, the purpose of this thesis is also to provide the two organizations with recommendations of how they can change their practices in order to become more efficient in selecting, maintaining and coordinating the projects within the project portfolios.

#### **8.1.2 Respondent**

- Who are you and what is your background?
- What is your position within the organization?
- What are your responsibilities and daily tasks?
- How long have you been working in your current position?

#### **8.1.3 Opening Questions**

- Could you give a short description of how the organizational structure within your unit is?
- Do you have a project management office? Or some individuals that take care of synchronizing project management practices?
- How involved would you say that you and your unit are in the projects and the project management?

#### **8.1.4 Maximize the Value of the Portfolio**

##### **8.1.4.1 Phase 1**

- Can you describe the process from an idea to project startup?

- How does the business case look?
  - What information is provided?
  - Do you have many project ideas that never become executed?
- How do you evaluate the projects early in the process?
  - ROI, NPV, ECV?
  - Scoring models?
  - What information is the most important for the evaluation process?
- Do you have a project inventory? Collection of all on-going, proposed and on-hold project and relevant information about them so they can be evaluated and compared with each other?
- How to you prioritize and select the projects to be initiated?
  - What are the most important parameters?
  - Do you involve the potential risks into this process?
- Who is it that takes the ultimate decision for project startup?
  - What about resource allocations?

#### **8.1.4.2 Phase 2**

- How do you monitor the technical and financial performance of the projects?
  - EVA? Stage-Gate model?
  - Monitor and control reports?
- How do you maintain the portfolio of projects?
  - Terminate?
  - Reprioritize?
  - Delay?
  - Reallocate resources?
- How often is the portfolio of projects re-evaluated?
  - Change in strategy, market, technology?
  - Under performing projects?
- Could you describe the reporting process from the projects and upwards?
- Is it common that a project is terminated or paused?
- Roughly what is the success proportion your overall projects?
  - How do you measure it? Cost, Schedule, Quality, Market Value?
- Would you say that the processes for evaluating, prioritizing and selecting the projects are integrated with the project management processes?
  - In what way?

#### **8.1.5 Ensure balance among projects in the Portfolio**

- How is the distribution of projects in terms of:
  - Long vs. Short term?
  - High vs. low risk?
  - Maintenance vs. NPD?
  - Product types?
- Do you try to diversify the portfolio in some way? If so, how do you do that?

- Do you have some rules or guidelines for this distribution?
    - Where does that come from?
- Do you use any tools for visualizing the balance of the portfolio?
  - Bubble Diagram?
  - Pie Charts?

#### **8.1.6 Ensure that the portfolio reflects the business strategy**

- Could you describe to me the business or innovation strategy of the organization?
- How is it communicated to the individuals? Is the communication clear enough?
- Would you say that most of the projects are contributing directly to the business strategy?
  - Could you give me an example of a project that is doing that?
- How often does the strategy change? Is there any direct reaction from you?
  - Do you re-evaluate the projects?
- Do you use any tools that help you to ensure that the projects are aligned with the business strategy?
  - Road Maps?
  - Strategic buckets?

#### **8.1.7 Limit the number of projects to fit with organizational capacity**

- Many project orientated organizations have constant problems with lack of resources, is that the case for you?
  - Do suffer from project delays?
- Do you have specific rules for the number of projects within the portfolio?
  - How is that decided? What about if the strategy changes?
- Have you ever had to close down project, merely because you had too many projects ongoing?

#### **8.1.8 Closing Questions**

- In this interview I have focused on the four goals of PPM. What of these goals do you feel is most important for the organization?
  - Maximize the value of the portfolio
  - Ensure balance among projects in the portfolio
  - Ensure that the portfolio reflects the business strategy
  - Limit the number of projects to fit the organizational capacity
- What area that we have spoken about here do you feel that you do the best job in? Worst?
- Can you describe the most common or biggest problems that they organization faces in relation to projects?
  - Lacking resources?



- Project delays?
  - Projects do not deliver intended value?
  - Underperforming, unaligned project not terminated?
- How involved is the senior management in the prioritization and selection of projects?
- Have you made any improvements in how you manage your projects during the last year?
- Is there anything else you would like to state?