



**KTH Industrial Engineering
and Management**

Evaluation and selection of ideas and projects in product development

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Doctoral thesis
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Ernesto

Uppsala, September 2012

Abstract

Product development has become an important competitive factor for most companies. A central task is to select which projects, often from a large number of project proposals, are to be developed in order to achieve strategic objectives without exceeding available resources. Project Portfolio Management (PPM) is the research discipline which focuses on the decision-making processes used to evaluate, select and prioritise projects. Previous research has stated that companies must be able to select and commit resources to different types of ideas and projects. However, it is widely believed that PPM literature has not sufficiently investigated the challenges that companies might face when putting into practice different decision-making approaches to select different types of ideas and projects.

This thesis aims to explore how different types of ideas and projects are evaluated and selected in the context of the development of complex technological products. It is based on a qualitative research approach and interviews and observations have been carried out with the cooperation of six companies.

The findings of this thesis reveal that because different decision-making approaches encounter different levels of acceptance within an organisation, the dynamics by which an idea evolves are affected by the way in which decision makers deal with the legitimacy of the decision-making approaches that they put into practice. Decision makers use some mechanisms that allow them to avoid drawing exclusively on the highly accepted approaches when they are not considered to be suitable, and to give legitimacy to the decisions that have been made by the less accepted approaches. In addition, the way in which decision makers experience a decision situation influences how it is approached. If they experience ambiguity, they might display a decision-making logic in which actions are allowed to be taken within self-organised social interactions, in order to make sense of the idea, project or criteria. However, the occurrence of self-organised interactions is conditioned by how decision makers negotiate resources with stakeholders that display different interests and decision-making logics.

These findings question the objective view that assumes that ideas and projects are already defined at the moment the decision is made and are able to be classified in pre-defined categories. It also led to the question of whether problems in fulfilling resource allocation plans and the risk of biases in decision making are problems that arise due to poor decision-making practices, and whether they should, instead, be understood as probable consequences of a flexible process.

Finally, this thesis explores a way of enhancing decision makers' abilities through scenarios in which decision makers experience decision situations and reflect on their own ways of making decisions.

Keywords: decision making, product development, project evaluation, project portfolio management, project selection.

Sammanfattning (in Swedish)

Produktutveckling har blivit en viktig konkurrensfaktor för de flesta företag. En nyckeluppgift är att välja ut vilka projekt, oftast bland ett stort antal av projektförslag, som ska utvecklas för att uppfylla strategiska mål utan att överskrida tillgängliga resurser. Projektportföljshantering är det forskningsområde vars fokus är beslutsprocesser för utvärdering, urval och prioritering av projekt. Tidigare forskning har visat att företag måste kunna välja ut och avsätta resurser till olika typer av idéer och projekt. Det framstår dock som om litteraturen avseende projektportföljshantering inte utrett alla de utmaningar som företag ställs inför när de i praktiken använder olika angreppssätt för beslutsfattande för att välja olika typer av idéer och projekt.

Syftet med denna avhandling är att undersöka hur olika typer av idéer och projekt utvärderas och väljs i samband med utveckling av komplexa teknologiska produkter. Den bygger på en explorativ och kvalitativ forskningsansats med intervjuer och observationer från sex företag.

Resultaten visar att utvecklingen av idéer och projekt påverkas av hur beslutsfattare hanterar den organisatoriska legitimiteten av de olika beslutsfattande metoder som de tillämpar i praktiken. Beslutsfattare använder olika mekanismer som hjälper dem att kringgå de mer accepterade beslutsmetoderna när dessa inte anses vara lämpliga och att legitimera de beslut som fattas med mindre accepterade metoder. Dessutom visar resultaten att hur beslutsfattarna upplever en viss beslutssituation påverkar det sätt på vilket de fattar beslut. Om beslutsfattare upplever tvetydighet kan de uppvisa en beslutsfattandelogik genom vilken handlingar sker enligt självorganiserade sociala interaktioner, i syfte att skapa mening av en idé, ett projekt eller ett beslutskriterium. Det observerades dock, att förekomsten av självorganiserade sociala interaktioner betingas av hur beslutsfattare förhandlar resurser med aktörer som visar olika intressen och beslutsfattande logiker.

Resultaten ifrågasätter i viss mån de objektiva perspektiv som förutsätter att idéer och projekt redan är definierade när beslut tas och att de kan sorteras i fördefinierade kategorier. Resultaten ifrågasätter också att kaoset i resurstilldelning och risken av systematiska fel i beslutsfattande beror på bristande rutiner, och ser dem, istället, som möjliga konsekvenser av en flexibel process.

Slutligen utforskar denna avhandling ett sätt att öka beslutsfattarens förmågor genom utformningen av scenarier i vilka de får uppleva beslutssituationer och reflektera över sina egna sätt att fatta beslut.

Nyckelord: Beslutsfattande, produktutveckling, projektportföljshantering, projektutvärdering, val av projekt.

List of Appended Papers

Paper I

Gutiérrez, E., Ölundh Sandström, G., Janhager, J., Ritzén, S. (2008) Innovation and decision making: understanding selection and prioritization of development projects. *In Proceedings of the 2008 IEEE International Conference on Management of Innovation and Technology*, Bangkok, September 2008.

Awarded “Outstanding paper award” at the conference.

Paper II

Gutiérrez, E., Ölundh Sandström, G., Janhager, J., Ritzén, S. (2008) Designing Work Procedures for Project Portfolio Management. *Proceedings of NordDesign 2008*, Estonia 2008.

Paper III

Gutiérrez, E., Kihlander, I., Eriksson, J. (2009) What’s a good idea?: Understanding evaluation and selection of new product ideas. *Proceedings of International Conference on Engineering Design, ICED’09*. CA, USA, 2009.

Paper IV

Gutiérrez, E., Hemphälä, J., Abedi, A., Wallsten, J. (2010) A Method for Designing Processes for Project Portfolio Management. *Proceedings of NordDesign 2010*, Göteborg, Sweden 2010.

Paper V

Gutiérrez, E. (2011) When sensemaking meets resource allocation: an exploratory study of ambiguous ideas in Project Portfolio Management. *Proceedings of 18th International Conference on Engineering Design, ICED’11*, Copenhagen, Denmark, 2011.

Paper VI

Gutiérrez, E., Magnusson, M. (2011) Dealing with legitimacy: a key challenge for Project Portfolio Management decision makers. (Conditionally accepted for publication in *International Journal of Project Management*, 2nd round of review).

Paper VII

Gutiérrez, E. (2011) Managing ambiguity when evaluating and selecting new ideas in Project Portfolio Management. (Conditionally accepted for publication in *International Journal of Innovation and Technology Management*, 2nd round of review).

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1 Introduction

1.1 Product development and multi-project organisation

Product development, understood as the organisational activity of identifying customer needs and business opportunities and creating products that meet these needs and can be commercialised, has become an important competitive factor for most companies (Killen and Hunt, 2010; Ulrich and Eppinger, 2008). The development of new products helps to capture and retain market share and increase profitability; prepare firms to cope with shortening product life cycles, respond to shifts in people's expectations and legislation; and maintain the competitiveness of mature products (Tidd and Bessant, 2009; Wheelwright and Clark, 1992).

The most common and widespread form used to organise the development of new products is the project (Archer and Ghasemzadeh, 1999; Killen and Hunt, 2010). A project is a temporal organisation that is set up to carry out the development of a new product, function or technology. Projects are considered to be adequate for handling undertakings of a unique nature, with development as a central feature, and to optimise the objectives of time, function and cost (Zika-Viktorsson, 2002). The aim of any product development project is to take an idea from concept to reality in the form of a specific product that fulfils a market need in an economical and manufacturable form (Wheelwright and Clark, 1992). Over the past few decades, significant expertise has been developed within the area of project management, focusing on "doing the projects right", that is, ensuring that each individual project achieves its goals (Martinsuo and Lehtonen, 2006; Dooley et al., 2005).

However, as more and more projects are developed, companies are faced with a new set of challenges and problems (Dooley et al., 2005). The common situation in most product development departments is the existence of several simultaneous projects that are somehow dependent on each other. Research literature has acknowledged this phenomenon as the "projectisation" of product development activities (Killen and Hunt, 2010). It has described the development organisations as "project-based organisations" (Aubrey et al., 2007), "multi-project organisations" (Engwall and Jerbrant, 2003) and "management by projects" (Killen and Hunt, 2010). Furthermore, it has been recognised, both in research and in practice, that the challenge is no longer how to manage a single project, but how to manage a set of projects (Verbano and Nosella, 2010).

1.1.1 Not only “doing the projects right”, but also “doing the right projects”

A consequence of the multi-project organising of product development is that, for most innovative companies, the fulfilment of strategic objectives relies increasingly on the results from groups of projects (Aubrey et al., 2007; Killen and Hunt, 2010). In other words, the set and mix of development projects that are running today decide tomorrow’s products and market position (Cooper et al., 1998; Wheelwright and Clark, 1992). Therefore, a central task for companies is to select which projects are to be developed in order to achieve strategic objectives without exceeding the available resource constraints (Verbano and Nosella, 2010). Thus, the challenge for innovative companies has become not only “doing the projects right”, but also “doing the right projects”, that is, deciding to which projects, from a large number of project proposals, resources should be assigned (Stilling and Eskerod, 2008).

At the same time, several authors have pointed out that an inadequate design or execution of an evaluation and selection process might lead to the selection of certain types of ideas and projects and the rejection of others (Brun et al., 2008; Cooper et al., 1998; Engwall et al., 2003; Kester et al., 2009). For example, Verganti (2011) states that when technology that allowed people to play video games by making real movements was developed, Nintendo was able to see the potential and it created motion-sensitive controllers, but Sony and Microsoft rejected the innovation because it did not target current market needs. Furthermore, Christensen and Bower (2007) studied how leading firms in the disk-drive market failed because of the technologies they decided to prioritise or reject when faced with a major architectural change. As the new technology seemed to be competitive only in emerging market segments, and not fulfilled current customers needs, the resource allocation mechanisms used by several companies denied resources to such technology. Thus, the ability to deal with technological change is not only dependent on technological competence, but also on the decision processes that actually provide resources to some areas of product development, while denying resources to others (Christensen and Bower, 2007).

Thus, the consequences of an inadequate process of evaluation and selection would be a risk that certain types of ideas and projects for product development are filtered out not because they are bad, but because they do not fit with the evaluation and selection model (Sandström and Björk, 2010; Corso and Pellegrini, 2007). For example, it might lead to an “exploitation trap”, which tends to favour short-term, incremental or low-risk projects at the expense of more radical, longer-term exploration projects that might be essential for long-term success (Killen and Hunt, 2010). What is more, there is empirical evidence which shows that most companies experience that a major part of their strategy is never implemented because the selected group of projects does not reflect the future vision of the company in terms of new products, new markets and new technological platforms (Cooper et al., 1998; De Reyck et al., 2005; Meskendahl, 2010).

1.2 Project Portfolio Management

According to Killen and Hunt (2010), although companies have always faced the challenge of making decisions about the best way to invest limited resources across a range of possible activities, the emergence of a distinct management capability or function is a fairly recent phenomenon. In recent years, the development of a research discipline and a group of management practices called Project Portfolio Management (PPM) has taken place, which aims to provide a coherent basis on which to judge the development projects that should be undertaken (Killen et al., 2008; Tidd and Bessant, 2009). PPM is the decision-making process in which ideas for new products are evaluated and selected, development projects prioritised and resources allocated between development activities (Cooper et al., 1998).

1.2.1 The challenge of evaluating and selecting different types of projects

In their influential works, Cooper et al. (1998) and Wheelwright and Clark (1992) stated that to implement a business strategy companies needed to evaluate, select and commit resources to different types of development projects. This is because each type of project has a different role and provides a different competitive contribution. However, they also stated that different types of projects imply different challenges for decision making. For example, evaluating and selecting projects that aim to develop products based on new technological platforms or focusing on new markets is much more comprehensive, ambiguous and uncertain than projects that focus on improving existing products for existing markets (Wheelwright and Clark, 1992).

Thus, in order to cope with the several, and sometimes opposite, demands that a business strategy imposes on product development (i.e. short-term profit and long-term competitiveness, differentiation and standardisation, low-cost and high performance, the exploitation of existing knowledge and the exploration of new knowledge) different types of projects have to be represented in the project portfolio (Cooper and Edgett, 2003; Geraldi, 2008; Jerbrant, 2009). At the same time, because different types of ideas and projects imply different challenges for decision making, companies must evaluate and select ideas and projects through a flexible decision-making process (Bessant et al., 2011; Geraldi, 2008; Stilling and Eskerod, 2008; Wheelwright and Clark, 1992, 1998).

However, although PPM literature has addressed the importance of selecting a certain set and mix of development projects, it is considered that PPM literature has not sufficiently investigated the challenges that companies might face when evaluating and selecting different types of ideas and projects. PPM research has not provided a thorough understanding of how decisions for selection, prioritisation and resource allocation are really made in product development (Dawidson, 2006; Engwall and Jerbrant, 2003; Kester et al., 2011; Stilling and Eskerod, 2008). Consequently, more research is needed to understand what types of approaches are used when evaluating and selecting certain types of ideas and projects, how decision makers cope with adapting the ways in which they make decisions and what the implications are for achieving an intended mix of development projects (Aubrey et al., 2007; Bessant et al., 2011; Floricel and Ibanescu, 2008; Geraldi, 2008).

1.3 Purpose and scope of the thesis

Thus, the research problem addressed in this thesis is defined both by empirical evidence and a theoretical understanding. The former indicates that most companies experience problems when trying to achieve an intended set and mix of development projects; and the latter points out that PPM as a research area has still not provided a thorough understanding of the process of evaluation and selection when it involves different types of ideas or projects.

Therefore, the purpose of this thesis is to explore how different types of ideas and projects are evaluated and selected in the context of product development. This thesis aims to contribute to the research area of PPM, by developing an empirically and theoretically grounded framework that increases our understanding of the evaluation and selection process of ideas and projects in multi-project organisations.

PPM is a research area that considers a wide range of multi-project organisations (e.g., software development, civil engineering, plant engineering companies (Geraldini, 2008)) and encompasses several decision-making processes (e.g. portfolio selection, prioritization of projects, resource allocation (Cooper et al. (1998))). However, this thesis focuses on a particular type of organisations and decision-making process. The scope of this thesis is the process of evaluation and selection of ideas and projects for the development of complex technological products in multi-project environments. Thus, it aims to investigate companies whose strategic goals are explicitly stated, are based on the development of existing and new products and that carry out product development via several simultaneous projects. Furthermore, it focuses on the development of complex technological products, i.e. products that require qualified personnel in several technological areas, e.g. due to the integration of mechanical, electronic and software components. It implies that product development presents both technological and commercial challenges and requires the integration of several organisational functions such as engineering, financing, manufacturing, and marketing. The focus on the process of evaluation and selection of individual ideas and projects implies that some aspects of the management of project portfolios are not going to be thoroughly investigated, e.g. dependencies and synergies between projects, or tools and methods regarding the optimisation of portfolio composition.

1.4 Outline of the thesis

Chapter 2 presents the theoretical framework by which the area of contribution, the research problem and research questions are defined. In Chapter 3, the research approach and research methods used for data collection and analysis are described and the criteria used to assess the quality of the research study are stated. Further, in Chapter 4, an overview of the appended papers and their contribution to the thesis are presented. Then, Chapter 5 presents the results of the interview studies and the analysis that answer the research questions. Chapter 6 explores the practical management of PPM through the analysis of the observation studies. Chapter 7 discusses the analysis presented in Chapters 5 and 6 in relation to previous research. As a synthesis of the empirical analysis and discussion, a model for PPM decision making is proposed in Chapter 8. Finally, Chapter 9 presents the main conclusions of the thesis, discusses the limitations of the research study and suggests areas for future research.

2 Theoretical framework and research questions

This thesis aims to contribute to the research area of PPM. However, this thesis focuses on a particular type of multi-project organisations and a particular type of project portfolios; namely, the ones aiming to develop complex technological products. Therefore, in this section an overview of the research literature in PPM in this particular context is given. Thus, the first part of the theoretical framework (section 2.1) presents an overview of the principal concepts, assumptions and prescriptions stated in PPM literature. The second part (section 2.2), defines the challenge of evaluating and selecting different types of ideas and projects for product development. Finally, research needs are identified through a critical analysis of PPM literature and the research questions are drawn.

2.1 Project Portfolio Management

First, a general definition of PPM and its relation to business success are given. Then, the main objectives of PPM are presented. After that, a view of PPM as a process is presented, describing the decisions and activities that it encompasses. Finally, the most accepted prescriptions for the design and execution of PPM are presented.

2.1.1 What is PPM?

Companies that engage in developing new and existing products need a framework that helps them to judge which projects should be undertaken to achieve their strategic view (Tidd and Bessant, 2009; Wheelwright and Clark, 1992). Furthermore, Cooper et al. (1998) state three main reasons for using a managerial process that provides an overarching view of the entire group of projects. First, it is crucial to have the ability to select the right projects that will become tomorrow's successful products. Second, projects are a manifestation of the businesses' strategy. Thus, choosing the wrong projects or the wrong mix of projects leads to a failed implementation of an intended strategy. Third, since the development resources that companies are able to invest are limited, the consequence of allocating them to the wrong projects is that truly good ones are deprived of the necessary resources.

This overall management of projects is commonly called 'Project Portfolio Management' (PPM). It is generally accepted in PPM literature that it can be viewed as a dynamic decision-making process in which the list of active projects is constantly updated and revised (Martinsuo and Lehtonen, 2006). However, it is necessary to point out that different authors give different meanings to the concept of PPM, especially when it is related to the scope of processes that are supposed to be encompassed in it. Although this lack of precision in its definition, PPM is a concept that is being increasingly used both in research and practice (Killen et al., 2008).

In the present thesis, is going to be addressed the definition of PPM suggested by Cooper et al. (1998), because it is considered to be commonly used by many authors contributing to the field (Dawidson, 2006). PPM is defined as follows: “*Project Portfolio Management is a dynamic decision process wherein a list of active development projects is constantly revised. In this process, new projects are evaluated, selected and prioritised; existing projects may be accelerated, killed or reprioritised, and resources are allocated and reallocated among the projects in the portfolio*” (Cooper et al., 1998; Dawidson, 2006).

2.1.2 PPM impact on business success

In conceptual papers, based on extensive studies of PPM literature, Jonas (2010) and Meskendahl (2010) define the impact of PPM on business success as being composed of two elements: economic success and ‘preparing for the future’. Economic success is the combination of market success and commercial success. Market success is the extent to which sales objectives, like market share or sales volumes, are achieved. Commercial success refers to classical financial management criteria, like return on investments, and also the share of revenue generated by new products. ‘Preparing for the future’ is a dimension that takes into account the influence of the current portfolio of projects in the long-term competitiveness of companies. It is related to aspects such as the creation of new markets, development of new technologies and building skills and competencies between people.

Figure 2.1 shows the relationship between the grade of implementation of PPM, the performance of the PPM process and its impact in business success. Although still more research is required to fully understand this relationship, some studies suggest that there is a positive correlation between PPM performance and new product success (Killen et al., 2008; Martinsuo and Lehtonen, 2006; Meskendahl 2010). Furthermore, De Reyck et al. (2005) showed that an increased PPM adoption level has a positive impact on the return on the projects and a significant negative impact on the number of project-related problems. According to Killen et al. (2008), those results suggest that innovative companies should prioritise adopting and improving PPM processes.

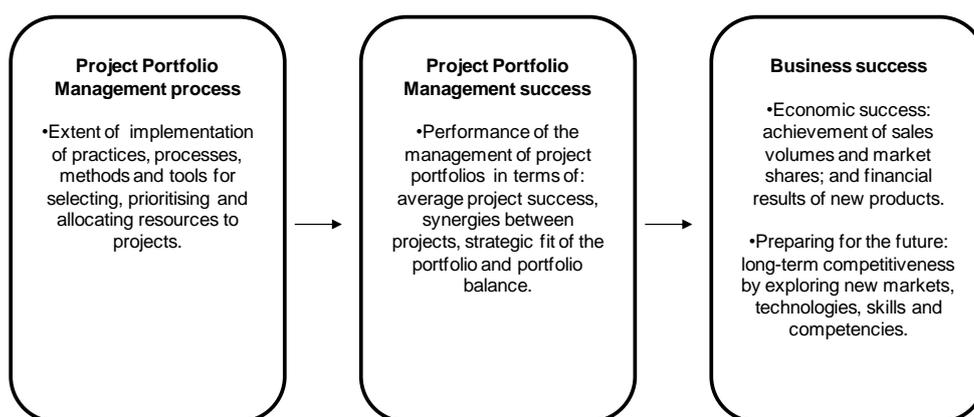


Figure 2.1. The relationships between the level of adoption and performance of PPM and business success. (Adapted from Jonas, 2010; and Meskendahl, 2010).

2.1.3 PPM objectives

According to Cooper et al. (1998), the three main objectives of the PPM process are to maximise the value of the portfolio, align the group of projects with the firm's business strategy and achieve balance between different types of projects. Those PPM objectives are well established in PPM literature (Meskendahl, 2010). However, some authors consider a fourth one: to achieve an appropriate number of projects that fit with organisational capacity (Killen et al., 2008).

In the following, the objectives of PPM are described in detail, mentioning the tools and methods often reported as being used in relation to them. However, in this thesis, methods and tools are not extensively assessed. Detailed reports of the practical use of PPM tools and methods can be found in Archer and Ghasemzadeh (1999), Cooper et al. (1998), Danilovic and Sandkull (2005), Dawidson (2006), Dye and Pennypacker (1999), Ghasemzadh and Archer(2000), Levin (2005) and Verbano and Nosella (2010).

Maximising the value of the portfolio

Product development is an investment in which the money that is spent today in development projects will provide a return when the new products are sold. PPM aims to maximise the value of this investment by selecting a group of projects that gives the optimal mix against one or more business objectives, such as profitability, acceptable risk, strategic impact, value for customers etc. (Cooper et al., 1998). Furthermore, Jonas (2010) and Meskendahl (2010) consider that portfolio value has two key components: average single project success and use of synergies between projects. Average single project success refers to projects being delivered on time, within budget, meeting specifications and achieving customer satisfaction. The use of synergies is related to the technical and market interactions between projects that allow a portfolio to achieve a higher value than considering only the value of independent projects. The exploitation of market and technical synergies between projects is a form of value generation (Jonas, 2010) and might contribute to sales growth (Nobeoka and Cusumano, 1997). According to De Reyck et al. (2005), when investment interactions are considered, portfolios can be created with the same expected return but lower risk than when interactions are not taken into account.

The concept of value varies depending on the characteristics of the project and the methods used to assess them. For example, economic methods, such as Net Present Value or Expected Commercial Value, allow a quantitative calculation of the economic return to be obtained, which means that the technical and commercial risks can also be evaluated. However, through the use of economic methods it is not possible to take into consideration certain strategic aspects that are difficult to monetise. Therefore, another method commonly used by companies is the scoring model, which uses quantitative or qualitative criteria (or a combination of both) in order to achieve a rank-ordered list of projects. Scoring models are suitable to valorise strategic factors such as social and environmental impact, management consensus etc. (Verbano and Nosella, 2010).

Aligning projects with strategy

The strategic fit of a portfolio of projects describes the degree to which the sum of all projects reflects the business strategy of the company (Meskendahl, 2010). According to Cooper et al. (1998), strategic alignment is reflected on “where the money is spent”, that is, how resources are allocated between projects. A commonly used method to achieve strategic alignment is Strategic Buckets (Cooper et al., 1998; Verbano and Nosella, 2010). It consists of predefined spending categories which are derived from business strategies. Categories might be defined from which markets, technologies, platforms and product lines the company is planning to focus on, the relative split between them and how each will be approached e.g. leader versus follower, differentiator versus low-price competitor. Those categories, or buckets, are then filled with projects, ensuring that all categories are represented and the split between them is fulfilled. This method is often used in an iterative way, considering not only the strategic categories to be filled but also the project proposals. This helps to avoid suboptimisation in case there are very promising proposals in one category and just poor ones in another category.

Balancing different types of projects

Balancing a portfolio of projects is understood as selecting a combination of projects that enables a firm to achieve its objectives without being exposed to unreasonable risk (Meskendahl, 2010). The concept of balance highlights the problem that, despite each individual project being considered to be ‘good’, the whole portfolio might still not be a desirable one. For example, a portfolio could contain too many short-term projects in terms of competitive impact, or too many big projects in terms of resources, or too many projects related to a certain product line or technology etc. (Cooper et al., 1998). Thus, balancing is related to the adjustment between diverse types of projects in the portfolio (Jonas, 2010). An imbalanced portfolio might lead to negative consequences. For example, according to Archer and Ghasemzadeh (1999), while a high proportion of high-risk projects could be dangerous to the future of the company, too many low-risk projects might lead to a too low expected return. Other consequences of a lack of balance are that having just a few large projects can be dangerous if more than one fails, and too many long-term projects may cause financial or cash flow problems.

Visual models are a commonly used tool to portray and analyse balance (Cooper et al., 1998). One example is bubble diagrams, in which projects are displayed in a two-dimensional diagram. Some dimensions that might be used are: probabilities of technical and commercial success; time to completion; capital investment required; financial reward; and type of projects, such as new product, product improvements, fundamental research and technology platforms. The bubbles represent the different projects, and the size of the bubble could be used to display the amount of resources that each project requires.

2.1.4 The PPM process

PPM is considered to be a complex decision-making process that encompasses or is interconnected with several other processes (Cooper et al., 1998). Although some frameworks have been proposed, PPM literature does not provide a generally accepted model of a PPM process. According to Jonas (2010), only a few studies include a broader view of PPM tasks instead of just focusing on certain activities. Furthermore, it seems to be unclear if the different tasks and decisions are supposed to be organised in one process or if PPM is the coordination of several independent and simultaneous processes.

Although this thesis focuses on the process of evaluation and selection of ideas and projects for product development, it also aims to take into account how this process interacts with other processes in PPM. The processes that are often named as fundamental components of PPM are: evaluation and screening of project ideas, individual project evaluation, portfolio selection, portfolio steering and prioritisation of projects, resource allocation, strategy development, idea generation and handling and individual project management. While some authors consider those processes as being a part of PPM, others see some of them as supporting processes, or activities that are preconditions for PPM. Those processes are briefly described below, mainly based on two of the most referred frameworks for PPM processes, Cooper et al. (1998) and Archer and Ghasemzadeh (1999), and a study of PPM literature reported in Jonas (2010).

Evaluation and screening of project ideas

Ideas or project proposals are initial definitions of new products whose development has not yet been organised in the form of a formal project. In this process, ideas are evaluated and the ones that do not fit certain criteria are rejected. It aims to ensure that all the project proposals that are considered for the portfolio fit with the strategic focus of the company.

Individual project evaluation

Project proposals that have been accepted in the first screening process and ongoing projects are analysed individually and a calculation of common parameters for each project is made. The ones that do not meet the required portfolio criteria are rejected or put on hold.

Portfolio selection

Project proposals are evaluated in relation to the whole group of ongoing projects and project proposals. Besides individual project evaluation, the interactions between projects, resource constraints and the balance and strategic alignment of the whole portfolio are considered. Some projects and project proposals are selected and others might be completed, stopped or cancelled.

Portfolio steering and prioritisation of projects

This is the continuous reviewing of the status of active projects and projects that are on hold. It includes monitoring the strategic alignment of the portfolio, correcting portfolio composition in case there are any deviations from the target portfolio, identifying synergies between projects and coordinating projects across business lines. A prioritisation rank is added for the list of projects, and this works as a guideline to reallocate resources between projects.

Resource allocation

This is the process in which, consistent to previous decisions, human and financial resources are allocated between projects. Other tasks related to resource allocation might be cross-project resource planning; formal resource approval; conflict management, in the case of conflicts due to different project leaders or departments competing for the same resources; and resource reallocation in reaction to short-term changes or requests.

Strategy development

The development of a business strategy and breaking this down to a strategy for product development is considered, in PPM literature, as the most important precondition for a successful PPM. It works as a fundamental guideline and decision criteria to evaluate, select and prioritise projects. In turn, strategy development might be made at different managerial levels and processes depending on the time horizon and grade of detail. In general terms, it could be said that there is a long-term and corporate-level strategy and a short-term and business unit level one. In the long-term strategy, general business goals and the total budget for development is decided for the whole company. In the short-term strategy, each business unit defines its strategy for product development in the form of markets, product lines, technological platforms and the way of approaching each category, e.g. market leader, follower, low-cost competitor. Product planning is often included in this process, e.g. planning to delete, release and upgrade existing products and customer needs being defined in terms of functionality and performance.

Idea generation and handling

In general, PPM literature considers ideas or project proposals to be an input for the decision-making process. The ideation process, that is, the process in which ideas for new products are developed and handled, appears to be previous to and detached from the formal PPM process. However, according to Cooper et al. (1998), some companies have an informal portfolio of early-stage projects – those ideas that are being developed but are not formally taken into account in the PPM decision-making process. Sometimes there are also special resources which can help to finance those early ideation processes.

Individual project management

Companies usually have a model to manage the product development process for individual projects. The most common are stage-gates models, in which the development process is carried out in a number of sequential steps and before each step there is a decision point or gate. At each gate, a committee decides if the project is allowed to receive resources to take the next step in its development or if it must redefine some aspects of its development beforehand. Some authors, like Cooper et al. (1998), give a fundamental importance to individual project management in PPM performance arguing that gate decisions should include both the individual project evaluation and a comparison to the rest of projects.

2.1.5 A model for the PPM process

Figure 2.2 shows a model of the processes encompassed in PPM and their mutual relationships. The dashed line shows the processes that this thesis focuses on. Because of the mainly normative character of PPM literature, this model should be considered more of a visualisation of the different activities and processes that should be encompassed in the management of project portfolios and not as a description or predictor of how companies actually work. Furthermore, some authors have questioned the assumption of linearity and sequentiality between different activities and processes in PPM (Dawidson, 2006; Kester et al., 2008). Therefore, the connections between different processes displayed in the model do not assume a sequential order. Instead, they should be considered as an influence between processes, e.g. that decisions made in one process might influence activities or decisions made in another, or that information generated in one process might be important for decisions or actions made in other processes.

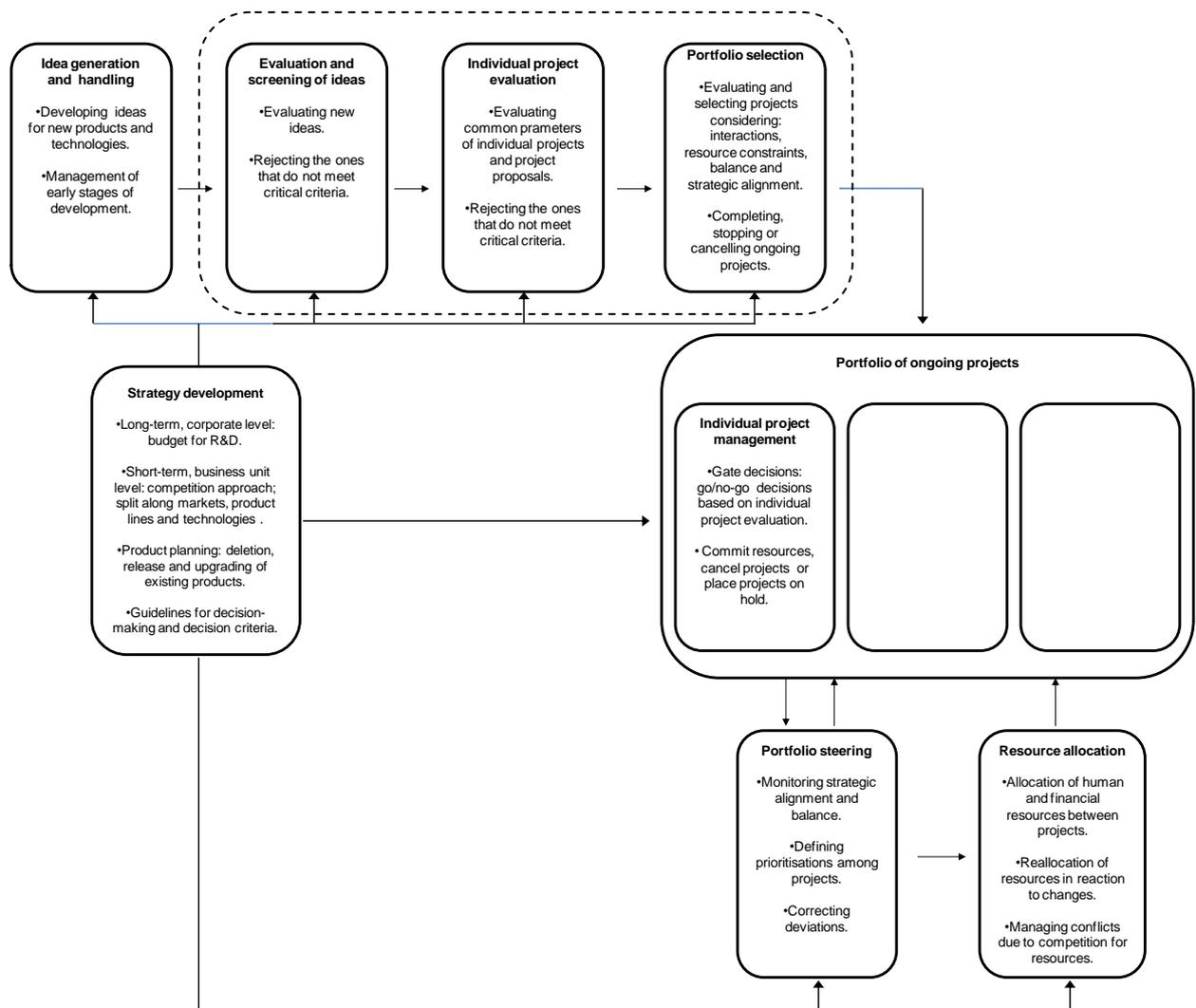


Figure 2.2 A model over Project Portfolio Management process (Adapted from Archer and Ghasemzadeh, 1999; Cooper et al., 1998; and Jonas, 2010). The dashed line shows the processes that this thesis focuses on.

2.1.6 Guidelines for designing, implementing and executing PPM

PPM literature suggests a set of guidelines for designing, implementing and executing the processes involved in PPM. Those guidelines are often a result of best-practice studies, that is, common practices assessed in companies that are considered to be successful in managing project portfolios for product development. Although they are mainly accepted, it is important to point out that there is little empirical evidence about the relationship between PPM practices and outcomes (Killen et al., 2008) and explanations about the causality between the practice of PPM and its performance (Muller et al., 2008). Some of the guidelines are presented below.

Centralised view of the project portfolio

The need to centrally monitor and control the whole group of projects that are being carried out in a company is widely emphasised in PPM literature (Cooper et al., 1998). Also, the existence of an area responsible for collecting, analysing and distributing project information in a common format is considered to be important (De Reyck et al., 2005). Because the stakeholders in PPM are often distributed between different actors, functions, decision levels etc., an efficient way to collect and distribute the related information is considered to be essential (Dawidson, 2006).

Formalisation

According to Meskendahl (2010), numerous studies have emphasised the importance of formalising PPM processes, rules and selection criteria. Killen et al. (2008) state that the degree of formality of the PPM process is a measure of the maturity of a company in the management of project portfolios. Jonas (2010) emphasises the importance of clearly defining the objectives and the different roles that people are expected to play within PPM processes.

Integration and requirements

Because of PPM processes overlaps with several organisational functions and departments, it is important that managers with different levels of knowledge are allowed to be involved, especially when portfolios present different types of projects (Dawidson, 2006). Thus, the integration of responsibility of different departments and functions of the permanent organisation and temporal projects is suggested for PPM decision making (Jonas, 2010; Meskendahl, 2010). Furthermore, more organisational units than those directly involved in PPM might state requirements on it, beyond the overall goals of a maximum return on investments, strategic alignment and a balanced project portfolio. Thus, an inventory of the requirements to fulfil through PPM should be made between possible stakeholders (Dawidson, 2006; Cooper et al., 1998).

Combination of tools and methods

It is extensively accepted in PPM literature that there is not any single method or tool to support PPM decision making that will suit all situations. Therefore, it is suggested that different evaluation and visualisation methods and tools are used to support the different decisions within PPM (Killen et al., 2008; Verbano and Nosella, 2010).

2.2 The challenge of managing different types of projects

The process of evaluating and selecting ideas and projects for product development becomes crucial because of the set and mix of development projects that are running today define tomorrow's products and market position. According to Wheelwright and Clark (1992, 1999) there is no ideal mix of projects that fits all companies and every company must pursue the projects that match its opportunities, business strategy, and available resources. Since different types of projects are able to be defined, and each type of project plays a different role and provides a different competitive contribution, companies must be able to identify, select, prioritise and commit resources to different types of ideas and projects (Cooper and Edgett, 2003; Geraldi, 2008; Stilling and Eskerod, 2008; Wheelwright and Clark, 1992, 1998).

There is empirical evidence showing that most companies experience problems for selecting a set of projects that reflects their business strategy (Cooper et al., 1998; De Reyck et al., 2005; Meskendahl, 2010). However, although PPM literature has addressed the importance of selecting a certain set and mix of development projects, it is considered that PPM literature has not sufficiently investigated the challenges that companies might face when evaluating and selecting different types of ideas and projects (Bessant et al., 2011; Aubrey et al., 2007; Floricel and Ibanescu, 2008).

In the following, the challenge of evaluating and selecting different types of ideas and projects is defined through a critical analysis of PPM literature and insights from decision-making theory. Finally, research gaps are identified and research questions are drawn.

2.2.1 Types of development projects

A classical dimension to classify development projects suggested by Wheelwright and Clark (1992) considers the degree of change represented by the project. That is, the extent to which the project involves a change in the product and the extent to which the project involves a change in the manufacturing process can be combined to define several types of development projects (Wheelwright and Clark, 1992; Ullrich and Eppinger, 2008). Common types of projects defined by using this approach are: incremental, radical, platform, and research projects.

Incremental or derivative projects improve already existing products by minor changes in the product and/or its manufacturing process e.g., adding new features, achieving a lower cost of manufacturing. Radical or breakthrough projects involve significant changes to existing products and processes, establishing a new core product or product category, or leading the entry of the firm into a new business. Platform or next-generation projects imply a new system solution for an existing product family that provides a fundamental improvement in cost, quality and performance over the preceding generation. Research and advanced development projects do not focus on the introduction of viable and profitable products but on the creation of new knowledge.

However, the heterogeneity of ideas and projects seem to be multidimensional. For example, projects competing for resources might also have different purposes, e.g. some projects may relate to product development while others might relate to changes in work processes, the implementation of IT systems or environmental issues (Stilling and Eskerod, 2008). In addition, the heterogeneity between projects is also caused by the different stages of

completion among them. Project portfolios might contain unclear ideas without defined scope or feasibility, and projects that are more defined and formalised (Geraldi, 2008).

Portfolios might also include projects that are based on existing knowledge and competences, while other projects might imply the development of new knowledge and competences. Furthermore, projects might also present different levels of risk and uncertainty of information. For example, basic research for the improvement of core competences uses to have a greater risk than projects which aim to apply previously known knowledge to develop new products (Verbano and Nosella, 2010). In addition, some researchers have pointed out ambiguity as another attribute of the variety of ideas and projects. In the early stages of idea development, people might experience ambiguity, e.g. when they experience conflicting interpretations of a product idea or a market need (Brun et al., 2008, 2009), or when they feel that they are not able to understand or formulate what an idea for a new product is about (Engwall et al., 2003).

Sometimes it is assumed a relationship between some of the dimensions presented above. For example, it is often assumed that incremental projects also present low levels of risk and are based on existent knowledge; and that radical projects present high levels of uncertainty or ambiguity and are based on exploring new knowledge. However, it is difficult to state typologies of projects that are generally valid. According to Calantone and Rubera (2012), although it is commonly assumed that incremental projects are based on the exploitation of existing knowledge, and radical projects in the exploration of new knowledge, some scholars do not agree that this is always the case. One reason is because the grade of innovativeness is usually considered from a market perspective and the type of knowledge from a firm perspective. For example, a new product might be considered to be radical by users in spite of have been developed by exploiting existing knowledge.

2.2.2 Different approaches to different types of projects

The challenge of coping with heterogeneous project portfolios leads us to question what requirements it might impose on the evaluation and selection process. Thus, it is necessary to thoroughly investigate what characteristics differentiate different ways of making decisions and in which situations some approaches would be more appropriate than others. In other words, what types of approaches are used when facing certain types of ideas and projects.

It seems to be widely accepted in PPM literature that different tools and methods for evaluation and selection should be adapted according to the characteristics of the idea or project that is being considered. Cooper et al. (1998) state that only relying on financial criteria to evaluate and select ideas for new products might lead to the rejection of major breakthrough projects. Instead, evaluation methods with financial and non-financial criteria should be combined. One reason for that is that it is harder to quantify expected outcomes and pay-offs from breakthrough projects, especially in the early phases of their development. This is supported by a quantitative study reported in Killen et al. (2008) that suggested that the use of financial methods does not relate to high-value projects in the portfolio and is linked to a negative correlation regarding the ability to orient product development into new product arenas.

Furthermore, several scholars point out the grade of formalisation of the decision-making processes as a dimension of flexibility in PPM. According to Olausson and Berggren (2010), when managing uncertain and complex development projects, both formal and informal

approaches are required. Formal processes ensure that decisions are made consistent with overall goals and provide documentation that allows previous decisions to be analysed. At the same time, informal approaches, based on interaction and learning, are necessary in the presence of uncertainty and novelty. Steffens et al. (2007) found that strategic or high-impact decisions were approached in a relatively more informal way than operative or low-impact decisions, and they argue that informal decisions are related to the management of uncertainty and the dynamic of the business environment. Furthermore, Brun et al. (2008, 2009), Engwall et al. (2003) and Westling (2002) suggest that when experiencing ambiguity, formal and rigid approaches for decision making might be inadequate, because of the requirements on an idea or project definition that they impose.

Another aspect of flexibility is related to the objective or subjective nature of the information that is used when making decisions. Sundgren and Styhre (2004) argue that intuition could be useful when making decisions under time pressure. Moreover, Kester et al. (2011) assert that it might be necessary to use both objective and subjective information as a base for decisions. They state that because of data associated with predicting market, technological and financial success is often incomplete, even decisions based on objective information may lead to product failures. Furthermore, individuals' opinions and power might come into play in making decisions, especially for more breakthrough ideas, where uncertainty will be highest.

Bessant et al. (2011) developed a model in which different types of development projects and the decision-making approaches needed for their selection are displayed (see figure 2.3). The model is based on two axes that shape four selection spaces. The vertical axis represents the grade of change in technological and market systems, from small changes to more fundamental ones. The horizontal axis represents the environmental complexity, in terms of the number of elements of the systems and their potential interactions, from component change to architectural change. The four spaces imply different challenges for the selection of development alternatives and different approaches needed to face those challenges.

Zone 1 implies the exploitation of existing knowledge through adaptive and incremental developments. It should be managed through formal and structured approaches based on stage-gate reviews and decision-making processes with clearly defined rules, roles and criteria. Zone 2 involves exploration, but within the same basic cognitive frame. It implies risk taking and high uncertainty and political debate about choices between radical options. Appropriate approaches are risk assessment tools, multiple portfolio methods with a mix of financial and non-financial criteria and strategic, rather than operational, decision making. Zone 3 involves the selection of options with alternative architectures. The potential innovations might not be radical, but they need to be seen through a different lens. It is difficult to make rational decisions because the information might not exist, or organisations may lack the experience or competence in the technological field. It should be approached by probe and learn by prototyping, alternative evaluation and funding models and decentralised authority. Zone 4 represents a highly complex environment in which prediction becomes impossible. Radical innovations may emerge, but these occur in a process of coevolution. A relevant approach implies autonomous groups with the active participation of stakeholders in the emergence process.

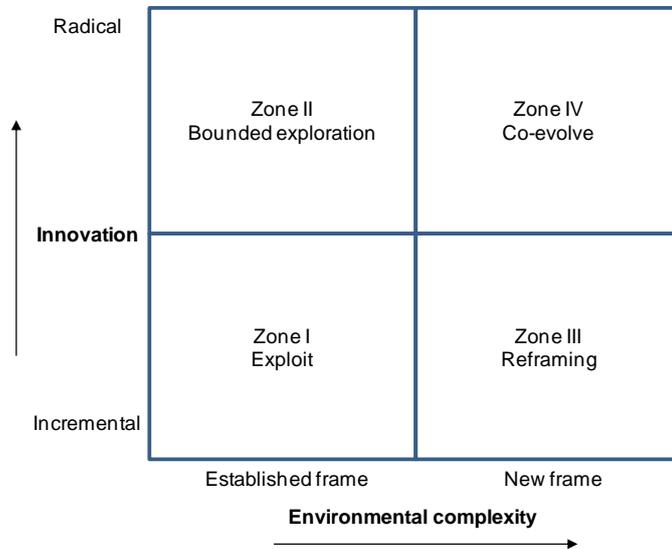


Figure 2.3. Different types of ideas and projects for product development and the appropriate ways of approaching their evaluation and selection (adapted from Bessant et al., 2011).

Thus, so far, the theoretical exposition indicates that the evaluation and selection of various types of ideas and projects may benefit from a flexible decision-making process in which different approaches are allowed to be used. For example, quantitative and qualitative tools for evaluation; formal processes and alternative patterns of decision making beyond the formal structures, objective information and subjective opinions, as a base for decisions; decision groups that are independent of the development process, and the active interaction of decision makers in the evolution of projects.

Furthermore, it appears to be questionable some of the assumptions and prescriptions stated in PPM literature, e.g. the focus on formalisation and centralisation, linear and sequential views of the development process, stressing of predetermined criteria based on already stated strategies and the detachment of decision making from development activities. Therefore, it is necessary to investigate how the assumptions and prescriptions made in PPM literature might influence an organisation's capability to manage heterogeneous project portfolios.

2.2.3 A critical view of PPM literature

PPM literature is considered to be rather atheoretical, in the sense that suggestions, prescriptions and models are mainly based on best-practice studies and that few theoretical areas have been used to identify relevant aspects of PPM and to discuss their implications (Aubry et al., 2007). However, the lack of theoretical foundations does not imply that PPM literature is theoretically neutral. PPM literature is based on a set of assumptions about the nature of innovation; decision making; interplay between different processes and activities, which is embedded in the models and recommendations that it presents; and the aspects and problems it focuses on. Rational decision making (Stilling and Eskerod, 2008), linear and sequential views of development processes, detachment of decision making from development activities (Christiansen and Varnes, 2007), reallocation of resources as a planning and scheduling problem (Engwall and Jerbrant, 2003) and a focus on increasing effectiveness, structuring (Jerbrant, 2009) and formalisation (Steffens et al., 2007) are just some of the assumptions that PPM literature relies on.

Prescriptive models of PPM decision making are described as being based on rational decision-making logic. This is because of their focus on maximisation of value, seeking clear definitions of alternatives and predetermined decision criteria (Christiansen and Varnes, 2008; Stilling and Eskerod, 2008; Brun et al., 2009). It is assumed that decisions lead to actions that are consistent with the objectives of the decision. For example, the fact that the allocation of resources is consistent with previous decisions for starting, prioritising and cancelling projects. Furthermore, according to Christiansen and Varnes (2007), decision making is supposed to be detached from the process of idea development. The logic is that some people make decisions about ideas and projects while others carry out the development activities in which information is acquired and then delivered to decision makers. Moreover, resource allocation is assumed to be committed gradually as long as the project meets the requirements stated at defined decision points. It is based on a linear development perspective in which uncertainty is assumed to decrease over time as more information is acquired (Christiansen and Varnes, 2007). The underlying rational theoretical base of PPM literature is also reflected in the variables that are considered in quantitative studies and conceptual models, e.g. financial success, share of revenue generated by new products; and these are mainly based on the logic of consequences.

2.2.4 The limitations of rational decision making

Because the assumptions and guidelines stated in the main body of PPM literature are based on the logic of consequences and rational decision making, it is necessary to state what the limitations of this approach could be. In general, decision-making theory supports the assertion that decision models based on rational theories are not suitable in every decision situation, and that different decision-making approaches should be combined in order to be able to cope with various situations. Rational decision models assume a sequential process of gathering information, developing alternatives and then selecting the optimal one; and decision makers with known objectives that determine their preferences (Eisenhardt and Zbaracki, 1992). However, according to March (1994), this model is difficult to apply in certain situations.

One explanation is that human beings have cognitive limitations when analysing and interpreting information, and that, in practice, they operate under the absence of complete information. Thus, people develop heuristics for acting under uncertainty, and instead of

maximising (choosing the best alternative), they use a logic of satisfying (choosing the alternative that exceeds some criterion) (Simon, 1979). For example, Eisenhardt and Zbaracki (1992) state that strategic decision makers display a behaviour that is simultaneously rational and intuitive. They make plans and strategies, but they also act quickly on incomplete information; they develop many alternatives, but they do not analyse them thoroughly or just focus on a few. Furthermore, it is believed that the heuristics and inductive logics that decision makers use often lead to effective decisions (Sarasvathy, 2001).

Another factor that explains limitations in rational behaviour is that rational theories of choice do not thoroughly consider ambiguous situations. Weick (1995) defines ambiguity as a state of confusion that is not necessarily related to the amount or quality of the information, but rather to the way in which the information is interpreted. According to March (1994), rational theories of choice assume an objective reality, in which contradictions, inconsistencies and fuzziness are ignored. However, when making decisions, preferences and goals might have multiple interpretations, change and be affected by choices. That is, decision makers might experience ambiguity, a lack of clarity in reality, causality or intentionality that makes them less confident that the limitations can be overcome by seeking more information.

Furthermore, rational decision models assume that decision makers have known and clear objectives that determine their preferences (Eisenhardt and Zbaracki, 1992). However, according to March (1978), sometimes behaviour is not considered to be intentional; instead, intentions are discovered to be an interpretation of action. For example, Sarasvathy (2001) states that when people create things that do not already exist, such as new technologies, markets and firms, the rational assumption of decision makers with prior goals is not fulfilled. Instead of choosing from a set of alternatives to achieve a given and clearly defined goal, people might use a different decision-making logic. They might start with given means and choose between possible effects that can be created with those means.

Thus, rational decision-making approaches might be considered to be appropriate in situations in which the quality of the information enables people to seek out alternatives, state clear criteria based on preferences and make an optimal choice. However, in decision situations affected by uncertainty, ambiguity and the absence of prior objectives, rational approaches might not be appropriate. Moreover, it is not just a matter of cognitive limitations or a lack of information. In fact, other patterns of decision making that do not display a rational logic might be considered, under certain conditions, to be “intelligent” (March, 1978).

2.2.5 The balance between exploitation and exploration

One dimension of the heterogeneity of project portfolios is about the presence of ideas and projects that implies the exploitation of existing knowledge and the exploration of new knowledge. The tensions between exploitation and exploration have been addressed in decision-making theory and discussed in relation to rational decision making. In general, decision-making models based on rationality presume the exploitation of knowledge, because they emphasise the use of existing knowledge to anticipate future consequences and future preferences (March, 1994). The ideas and projects that involve a competitive advantage based on the exploitation of existing knowledge could be prioritised to the detriment of those based on the exploration of a new one, what is sometimes referred to as an “exploitation trap”.

However, March (1994) argues that firms might also fall into an “exploration trap” in which resources are spent on trying out new ideas without gaining enough from them.

Furthermore, March (1994) states that improving the balance between exploration and exploitation is complicated because of the different characteristics that the two options present. While exploitation is based on the refinement of already existing competences, technologies and paradigms, and its returns are positive, proximate both in time and space, and predictable; exploration is based on experimentation with new alternatives, and its returns are uncertain, distant in both time and space, and often negative. March (1994) argues that traps to exploitation are not to be understood to be the consequence of incompetent decision makers but a consequence of learning. As an organisation improve its competence in certain knowledge, technologies and routines, decision makers become less willing or able to change to newer ones.

2.2.6 Sensemaking of ideas, projects and decision rules

Bessant et al. (2011) assert that people develop individual and shared models which allow them to make sense of the environment and guiding strategic behaviour. For example, decision rules and criteria that are used in PPM decision making are consistent with an established framework influencing the commitments that companies make to certain technologies and markets (Bessant et al., 2011; Corso and Pellegrini, 2007). Sensemaking is the process through which people understand and interpret experience (Weick, 1995). It is about the placement of items into frames of reference that enables people to understand, explain and predict. People often consider limited parts of reality from which they develop a larger sense of what may be occurring, what needs to be explained and what should be done next.

In the context of product development, sensemaking has a fundamental implication: the same idea or project may be interpreted differently by different individuals and groups. That is, Hildreth and Kimble (2002) assert that abstract knowledge is able to be reified, giving to it a concrete form such as tools and procedures. However, people who use the artefact, make their own interpretations of it. More clearly, Miller (2002) argues that although we are able to “objectify” our knowledge by expressing it by words, we cannot be sure that those words provoke the same meaning in others. What is captured and processed is information, not the human experience behind it and making sense of it. Thus, Bergman et al., 2007 argue that since sensemaking is influenced by individuals’ prior knowledge and preferences and their heuristics for acquiring, processing and evaluating information, individuals might make sense of it differently when making decisions about which new technology to adopt and develop.

Furthermore, decision-making approaches also undergo a process of sensemaking. De Maio et al. (1994) assert that decision makers show a natural tendency to categorise situations and approach them according to previous experiences. Thus, projects are managed following the approach used in successful experiences. Accordingly, Christansen and Varnes (2009) state that rules are not applied strictly, but according to what is sensible in the specific situational and organisational context. When facing different types of projects, people make sense of rules by local interpretations within organisational units and individual interpretations based on previous experiences. Furthermore, Christansen and Varnes (2008) show that PPM decision meetings provide a forum to discuss the meaning and appropriateness of decision methods, rules and criteria. Meetings provide an opportunity for decision makers to learn which decision rules are considered to be appropriate in the organisation.

2.3 Research questions

The theoretical exposition presented before suggests that, in order to cope with various demands imposed on product development, companies must be able to identify, select, prioritise and commit resources to different types of ideas and projects. The heterogeneity between ideas and projects seems to be multidimensional, encompassing several aspects, such as the degree of change in the product and the manufacturing process, the uncertainty and ambiguity of the information and the complexity of the technological and market systems related to the idea or project. Furthermore, both studies of PPM practice and decision-making theory support the fact that, since different types of ideas and projects imply different challenges for decision making, PPM decision makers would benefit from combining formal and rational behaviour with other decision-making approaches in order to be able to cope with various decision situations. It entails the challenge of managing portfolios with various types of ideas and projects via a flexible decision-making process in which different approaches are allowed to be used.

If approaches that are of a different, and sometimes opposite, nature have to be managed simultaneously, it raises the question of how organisations actually cope with adapting the ways in which they make PPM decisions and what the implications are if they want to achieve a certain mix of development projects. However, PPM literature has not thoroughly discussed the challenges that decision makers could face when combining different decision-making approaches (Geraldi, 2008; Bessant et al., 2011).

Bessant et al. (2011) argue that it would be a challenge for organisations to put into practice different approaches to select different types of ideas and projects. They state that the existence of different approaches may create tensions and conflicts across the organisation, and they argue that more research is needed to explore the nature of these tensions. Furthermore, Aubrey et al. (2007) state that defining decision-making rules might raise tensions between PPM decision makers, functional units and project and programme managers. Floricel and Ibanescu (2008) suggest that at the same time that formal PPM processes aim to coordinate innovation activities, they might also impose a structure on these activities, which may limit their ability to change.

Thus, the challenge of evaluating and selecting different types of ideas and projects needs to be considered in relation to how decision makers put different decision-making approaches into practice when faced with different types of ideas or projects. In other words, it is the dynamics (Stacey, 2007) of PPM decision making that needs to be investigated, that is, what influences decision makers to approach decisions in one way or another and how patterns of decision making are generated and evolve over time along the development of ideas and projects. In particular, how decision makers combine formal PPM structures and rational decision-making processes with the alternative decision-making approaches that they might put into practice. This leads to the first research question:

RQ 1: How do PPM decision makers combine formal and rational decision-making processes with alternative decision-making approaches?

The theoretical exposition also suggests that it is important to understand the sensemaking processes (Weick, 1995) through which people understand and interpret experience and information, as these are important to comprehend how ideas and projects are evaluated and selected. For example, people develop individual and shared frames of reference which allow them to make sense of the environment and guiding strategic behaviour (Bessant et al., 2011); the same idea or project may be interpreted differently by different individuals and groups when making decisions about which ones to adopt and develop (Bergman et al., 2007); and decision-making rules are not applied strictly, but according to what is understood to be sensible in a specific context (Christansen and Varnes, 2009).

This reasoning implies that the way in which decision makers make sense of ideas, projects and decision-making approaches is crucial when trying to understand how they make PPM decisions and which ideas and projects are actually selected or rejected. However, although sensemaking processes are important in the recognition of new innovations and business opportunities, there is still a need to increase our understanding of sensemaking processes in product development (Bergman et al., 2007; Verganti, 2011).

A particular situation in which sensemaking becomes crucial is when people experience ambiguity (Weick, 1995). According to Weick (1995), a situation is affected by ambiguity when people experience a subjective state of confusion created by difficulties in interpreting information. In the context of product development, people might experience conflicting interpretations about a product idea or a market need (Brun et al., 2008, 2009), or they might feel that they are not able to understand or formulate what an idea for a new product is about (Engwall et al., 2003). When experiencing ambiguity, the assumptions that are necessary for rational decision making are not met and people might engage in a process of sensemaking in order to overcome the shock of confusion (March, 1994; Weick, 1995).

Thus, managing portfolios with various types of ideas and projects might imply a situation of evaluation and selection in which decision makers experience ambiguity. Since the sensemaking of ideas, projects and decision-making approaches has not been thoroughly investigated in PPM research, there is a need to explore how people build an understanding of an idea or project and how this sensemaking process influences the way in which the process of evaluation and selection is approached. That is, it is necessary to consider the subjective and interpretative aspects of PPM decision making, taking into account the perspective of the people involved in those decisions. This leads to the second research question:

RQ 2: How do PPM decision makers manage the evaluation and selection process of ideas and projects when they experience ambiguity?

The research questions presented above are answered in Chapter 5, by analysing the interview studies. In Chapter 6, the findings are integrated with the analysis of the observation studies to explore the practical management of PPM. Then, in Chapter 7 the findings are related to the theoretical framework in order to state their implications. A synthesis of the whole study is made in Chapter 9. However, prior to this information, Chapters 3 and 4 present the research path and the different studies and papers that are included in this thesis.

3 Research approach and methods

The phenomenon that is being investigated and the theoretical context that is chosen to formulate it, state conditions for how the research study is going to be designed and executed (Alvesson and Sköldbberg, 1994). In this section, the research approach and research methods are presented and their coherence and suitability with the object of investigation and the purpose of the study are discussed. First, the ontological and epistemological positions taken in the study are presented. Then, the research process and methods used for data collection and analysis are described. Finally, the criteria for assessing the quality of the research study are stated.

3.1 Ontological and epistemological positions

In science there are different opinions about the nature of reality, what can be investigated and how it should be done for being scientific (Burrell and Morgan, 1979). Thus, a research study is based on certain assumptions about the nature of the world (ontological position) and the way it may be investigated (epistemological position).

3.1.1 Ontological position

The ontological position assumes whether the social reality to be investigated is constituted by objective entities that are external to the actors involved in it; or if it is the product of constructions based on actors' understandings and actions (Bryman, 2002; Burrell and Morgan, 1979). This study assumes a constructivist position (Bryman, 2002), in the sense that the meaning of social reality is the result of interactions between individuals, in which values and understandings are under continuous construction. This constructivist position is consistent with the focus of the research questions (see section 2.3) that aim to understand how the subjective interpretations of people involved in PPM influence the way in which they understand reality and, thereafter, the decisions they make and the actions they take.

However, this study does not take an extreme phenomenologist ontological position, by which the existence of any objective entity is denied. An "ontological oscillation" (Burrell and Morgan, 1979; Weick, 1995) is to be expected, in the sense that, sometimes, this study is going to refer to several entities in an objective way. For example, process, project, product and prototype might sometimes be considered as external and objective. At the same time, the ontological position aims to have a critical view regarding the ontological nature of some entities that are treated in PPM literature from an objective perspective. Some concepts, like ideas, radical ideas or incremental ideas, are going to be analysed from a constructivist point of view, when the analysis suggests that they are related to subjective interpretation.

3.1.2 Epistemological position

An epistemological position means to state what is going to be considered to be knowledge within a research area (Bryman, 2002). In other words, how one might begin to understand the world and communicate it as knowledge (Burrell and Morgan, 1979). Because this study aims to investigate PPM decision making from the perspective of the decision makers, it takes an interpretative position. That is, the building of knowledge is considered to be the result of an understanding of the social reality from the social actors' own perspective (Bryman, 2002). Therefore, knowledge is achieved by interpreting how people experience and make sense of their situation (Gustavsson, 1998; Hartman, 2001).

Furthermore, this interpretative approach includes several levels of interpretation (Bryman, 2002). The different levels of interpretation arise when actors' interpretations of their own reality are collected, then when the empirical information is analysed and interpretation of actors' interpretations are made and, finally, when a new interpretation is made by relating the analysis of the empirical data with a theoretical framework.

This thesis also assumes that hidden patterns (deep structures) exist that influence the observed parts of reality (superficial structures) (Alvesson and Sköldbörg, 1994). Those hidden patterns are assumed to be plausible to be investigated and discovered, and in that way it is possible to develop understandings and explanations of the original observed phenomena. In particular, exploring PPM from a decision-making perspective implies the existence of a theoretical framework that allows patterns of observed behaviour to be interpreted. It also implies that certain conditions are observed which might lead a person or an organisation to choose a certain pattern of decision making (March, 1994). Thus, this assumption leads to the epistemological issue of whether a theory (or any structured explanation of observed regular decision-making pattern) is to be considered to be valid or not.

However, searching for decision intelligence might also be problematic. First, intelligence could be defined as related to outcomes or processes, depending on how the decision making is understood (March, 1994). Second, although observed patterns of decision making that deviate from the prescriptions of rational theories might be sensible under some general conditions, links between processes and outcomes must be demonstrated. That is, whether and when decision-making processes are likely to lead to good outcomes (March, 1978, 1994). This thesis follows Alvesson and Sköldbörg's (1994) view that, instead of searching for decision-making theories of general validity, the research analysis aims to state the context and conditions in which a particular decision-making behaviour might be considered to be appropriate. In particular, what are the situations in which decision making, as it is prescribed in PPM literature, would be valid, and when are other patterns of decision making to be understood as being intelligent?

3.2 Research process and methods

This thesis is based on three main research studies (see Figure 3.1). The first study was a long-term learning network between three companies and the research group. It was carried out via an interview study, several discussion meetings and an observation study, in the form of a workshop. The second study was a master's thesis carried out by two students in one company, which I supervised. Different methodologies to analyse and improve PPM processes were put in practice and assessed, and an observation study was also carried out. In the third study, two companies were investigated through interviews and an observation study.

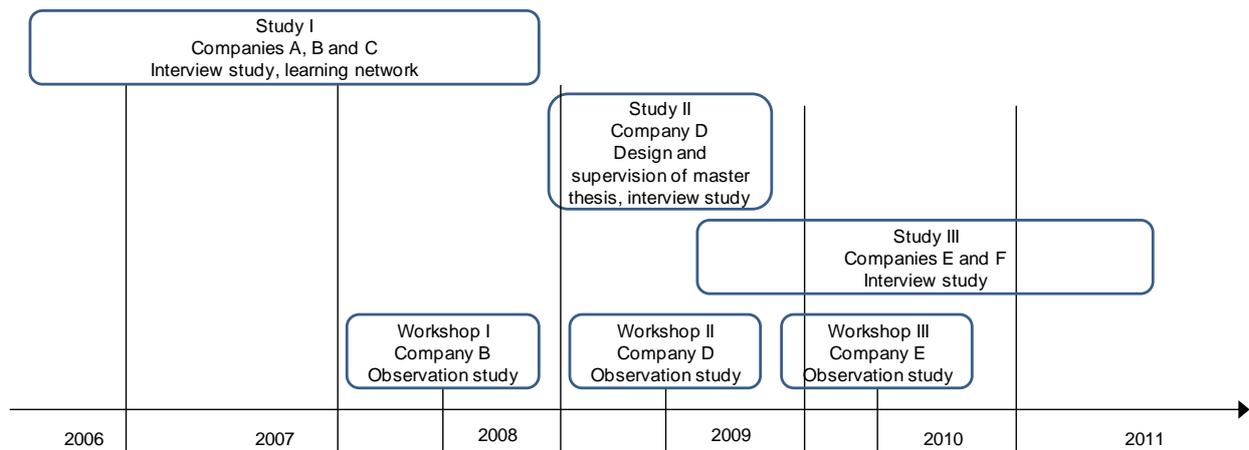


Figure 3.1. Overview of the studies carried out in this thesis.

3.2.1 An explorative and qualitative research approach

PPM, as a research area, is considered to be relative underdeveloped. In spite of some existing prescriptions on how PPM processes should be designed, implemented and executed, there is no evidence of when a particular practice leads to a particular outcome (Martinsuo and Lehtonen, 2006; Killen et al., 2008). Muller et al. (2008) assert, in most cases in which a causal relationship is assumed, that there are no explanations about how this relationship actually works. This is a consequence of two characteristics of the main body of PPM literature. First, it has been reported that few empirical studies aim to understand the practice of PPM (Dawidson, 2006; Engwall and Jerbrant, 2003; Stilling and Eskerod, 2008). Second, there has been insufficient discussion on the different aspects of PPM in relation to established theoretical perspectives (Aubrey et al., 2007; Christiansen and Varnes, 2008).

The lack of theoretically grounded explanations of PPM organisational phenomena implies that research studies having a qualitative and explorative character, that is, a starting point in the study of empirical data that is relatively free from established theories, would be a suitable research approach (Gustavsson, 1998). Furthermore, explorative and qualitative research is suitable to generate explanations in a research area that has not been thoroughly investigated and to grasp the complexity of social interactions and subjective interpretations (Bryman, 2002; Alvesson and Sköldbberg, 1994).

3.2.2 An abductive research process

The research process in this thesis is abductive, that is, it implies a combination of inductive and deductive approaches. It starts with the formulation of a research problem that is investigated to give an initial explanation. Then this explanation is used as a hypothesis that is both verified and further developed by studying new cases and relating this to established theories. In that way, it differentiates from deduction that starts from an already established theory for defining hypothesis; and from induction that builds understanding just from the analysis of empirical data (Alvesson and Sköldbberg, 1994).

Alvesson and Sköldbberg (1994) argue that, in comparison to a pure inductive approach, an abductive process might contribute to achieving a deeper understanding of the empirical grounded patterns that have been identified. Through alternating between theory and empirical cases, both are interpreted and reinterpreted, leading to the discovering of deep structures that allow understanding. In that way, it is possible to prevent identified patterns reflecting common sense, as they do not display a conceptual distance from the data that is analysed. This benefit of the abductive process is evident in Paper VI and Paper VII, which discuss conceptual categories that have already been discovered in previous papers, Paper I and Paper V respectively, but relating them to new research theories that had not been used initially.

Figure 3.2 illustrates the abductive process of this thesis, starting with the empirical evidence that companies experience problems with PPM decision making. A literature study was then made in areas related to PPM, which aimed to define a research domain and to identify general research needs. Then, a first research study was carried out to identify which aspects of PPM would be relevant to build descriptions and explanations in relation to the research problem. Guided by this preliminary analysis, research literature was then sought. Through integrating the empirical analysis with research literature, conceptual categories and their relationships were developed. Those first explanations were used to guide the focus of new empirical studies. Then, the abductive cycle was repeated again, alternating empirical studies and looking at research literature and analysis in which all data were integrated.

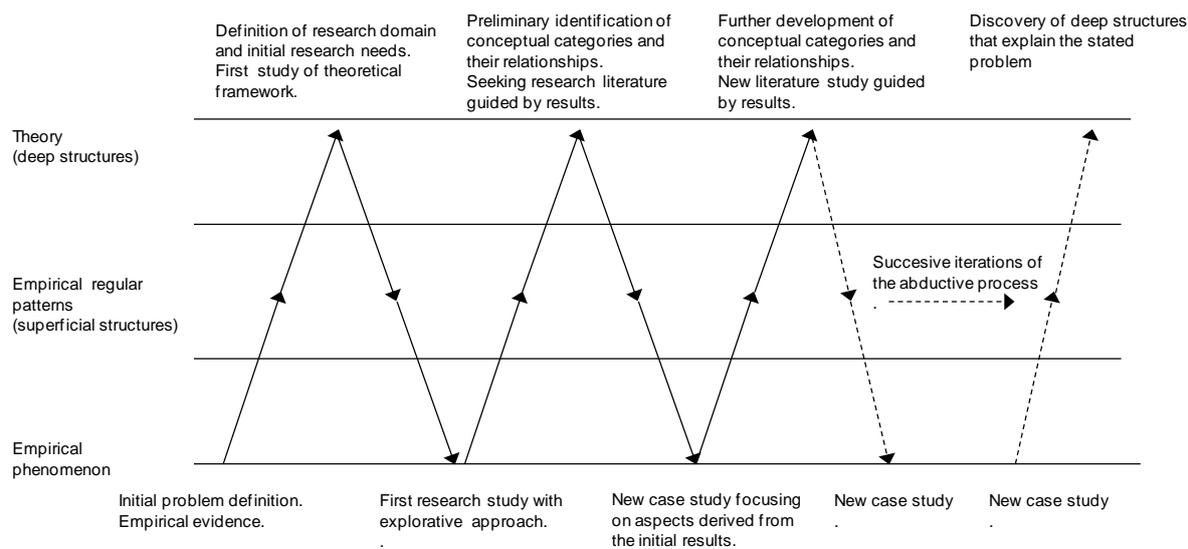


Figure 3.2. The abductive research process.

While the first study has a very open and general goal of identifying relevant aspects of PPM for building general descriptions, in successive posterior studies the focus of the investigation becomes more concrete and aims to study more specific aspects of PPM. For example, Study III focuses on particular decision situations in which decision makers experienced ambiguity. Also, the different workshops for observing decision making, which started with simple exercises and scenarios built up in Workshop I, were successively developed to more theoretically grounded exercises in Workshops II and III. In Chapter 4 the contribution of the papers to the thesis is described and a more detailed description of how each paper guided the focus of analysis of posterior studies is clearly presented.

A similar path was followed to carry out the search for research literature. In each abductive iteration new literature was sought, guided by the aspects that were identified in the different analysis of the empirical data. In that way, the conceptual categories and their relationships, which had been built up from the analysis of the interviews, were developed by integrating insights from new research areas. For example, Study I identified that decision makers experienced that different decision-making approaches are not accepted in the same way within companies. That led to the introduction of the concept of legitimacy to the analysis, which is understood in different decision-making theories. Along the abductive process, as new aspects that are important when trying to understand PPM decision making are identified, other theories are integrated, in particular, theories to explain how people can interpret information and make sense of reality (sensemaking theory) and theories that explain self-organising social interactions in processes of change and knowledge creation (complexity theory).

3.3 The studied companies

The companies that were selected to carry out the empirical studies were all aware about experiencing problems with PPM and the need to actively improve their decision-making processes. However, from the PPM literature a set of characteristics were extracted that the companies had to fulfil in order to be included in the investigation. Thus, the six investigated companies (described in Figure 3.3) had the following common characteristics:

Having a business strategy with an emphasis on developing new products

The research problem defined in this thesis considers companies whose strategic goals are based on the development of existing and new products. In the studied companies, new product development is a central activity which is defined in the company strategy. There are defined plans about how product development would contribute to fulfilling different business objectives. Furthermore, product development is organised as a formal department with defined responsibilities, such as product development managers, technical managers and project managers. There are defined working procedures for the development activities, such as project management models, routines for defining plans and road maps for product development.

Developing complex products that require qualified personnel in several technological areas

This thesis also aims to study the challenge of managing different types of ideas and projects. That implies that companies should present a product development activity in which projects present a wide range of technological and commercial challenges. Thus, it was stated as a requirement that companies should present both the development of products that imply a relatively high technological challenge with others whose technical development was considered to be simpler.

Carrying out product development in a multi-project environment

One important aspect of PPM that was to be investigated was the challenge of allocating resources between several parallel projects that were, somehow, connected to each other. To carry this out, it was necessary for the selected companies to present a multi-project environment, in which parallel development projects shared human and financial resources.

Actively managing PPM decision-making processes

This thesis aimed to have a critical view of the assumptions and suggestions made in PPM literature. Therefore, it was considered to be important that the selected companies had a certain level of formalisation and maturity in the management of project portfolios. Although they displayed different grades of formalisation and maturity, all the companies had formal decision forums and defined routines to manage the selection of development projects, an overview of the entire group of projects and formal routines for how resources were allocated between projects.

	General description	PPM organisation
Company A	<p>High-tech machinery for the electronics industry. Products require highly qualified personnel in several disciplines and technical areas.</p> <p>It has <i>c.</i>500 employees, including <i>c.</i>100 in product development.</p>	<p>A board of directors approves the overall budget for development. A forum of senior managers divides the budget between two business units (BUs). Each BU has its own development department and selects and prioritises its own projects.</p>
Company B	<p>Machinery for diverse industries, including aerospace and electronics. Products encompass mechanics, electronics and software.</p> <p>It has <i>c.</i>350 employees, including <i>c.</i>100 in product development.</p>	<p>The development unit is divided into two sections. One section manages a single large project and the other is responsible for all the other projects. Development and product managers are involved in the definition of road maps and selection criteria.</p>
Company C	<p>Mechanical and electronic solutions for property security. Both mechanical products and a combination of mechanical and electronic components.</p> <p>It has <i>c.</i>1000 employees, including <i>c.</i>50 in product development.</p>	<p>Several BUs are served by a central development unit. A senior board decides the development budget for each BU. Each BU manages its own budget, selecting and prioritising its projects.</p>
Company D	<p>Products, technology and services for medical applications. This requires highly qualified personnel working in several disciplines and technical areas.</p> <p>It has <i>c.</i>14,000 employees worldwide. The study was conducted in one division, located in Sweden, with <i>c.</i>700 employees and <i>c.</i>250 in product development.</p>	<p>Three different decision groups control and make the decisions about ideas and projects. One forum defines and controls the strategic alignment of the projects and decides the start of new projects. A second forum collects and evaluates new ideas. A third forum aims to review the status of the group of ongoing projects.</p>
Company E	<p>Products and processes for the medical and chemical industry. Combines highly complex chemical, mechanical and software components.</p> <p>It has <i>c.</i>2,000 employees and <i>c.</i>500 in product development.</p>	<p>A matrix organisation which is divided into three BUs and five technical areas. BUs are the owners of the products and manage their own portfolio of projects. There is a general forum in which the portfolio of the whole company is prioritised and discussed. Technical Managers assign resources between projects. A group to identify, evaluate and select innovative ideas was recently created.</p>
Company F	<p>Multimedia products, software and other solutions for the telecoms sector. It has <i>c.</i>10,000 employees worldwide, and the study was conducted in one product development division, located in Sweden, with <i>c.</i>2,000 employees.</p>	<p>Several BUs are responsible for their own portfolios. Each BU has several Product Managers who decide the start of development projects. Development Managers assign resources and organise the different projects. A Portfolio Manager reviews and coordinates the ongoing projects from all the BUs. There is a database which enables new ideas to be stored, and a special group has the job of evaluating them. There is another group that manages its own budget and evaluates and selects innovative ideas.</p>

Figure 3.3. General descriptions of the studied companies.

3.4 The research studies

Three main studies were carried out, the first one with companies A, B and C, the second one with company D, and the third one with companies E and F (see Figure 3.1). The main activities carried out in each study were an interview study and a workshop in which observations were made. However, the studies differ in the particular activities that were carried out, and the methods used to collect and analyse the empirical data. First, the three interview studies are presented. Then, the three workshops in which observation studies were carried out are described.

3.4.1 Research study I

This study was a part of a learning network, that is, a collaboration between companies and a research group which was set up to learn from each other and reflect on the PPM practices that are used. Companies A, B and C participated in this network, which was organised and led by a group of four researchers, including me. The learning network was conducted over three years; therefore, data was collected in different forms and opportunities. The principal activities in which data was collected were an interview study and several meetings in which discussions and reflections were made by people from the company and the research group.

Data collection

In total, 30 interviews were carried out – 10 interviews in each company. Each interview was conducted by two researchers, and I was present at all of them. The interviews were audio recorded and then transcribed. Because the intention was to understand the organisational complexity of PPM decision making, not only formal decision makers were interviewed. Respondents were selected from those with an active role in PPM, either by being formal decision makers, people who influenced decisions (because of hierarchical position or technical competence) or being affected by the decisions made by others. Among them were product development managers, business unit managers, product managers, general managers, experienced developers, sales managers and project leaders.

Because it was the first empirical study, it had an open explorative character. There were semi-structured interviews, stating general questions about the practice of PPM and allowing the respondent to describe current practices, problems and challenges. Interviews focused on what people did in several processes that are named in PPM literature as related to PPM (see section 2.1.4): handling of ideas, evaluating and selecting ideas, starting and managing projects, prioritising and cancelling projects, allocating resources between projects and developing strategies for product development.

After the main interview study was made, each network meeting was used to collect additional data. As long as the empirical data was analysed and preliminary descriptions were built up, the researchers presented and discussed those results with people from the companies. It helped to confirm the interpretations, including additional data and refining the results. Furthermore, each company made presentations regarding some aspects of their current PPM practices that were also discussed in the group. For example, company A presented its selection and evaluation process, describing the decision criteria it used to select projects. It also presented the tools it used to review the status of ongoing projects. Company B presented its short-term resource allocation process, including its visualisation tool of available resources and how these are distributed between ongoing projects. Company C

presented its product development process and how business strategy is translated into development projects. Finally, the relative long duration of research study I made it possible to discuss how some organisational changes that occurred in companies impacted on PPM processes. For example, the implementation of a framework to help organise PPM decision-making processes delivered by a consultant firm, a main reorganising of PPM due to a severe downsizing and a reorganisation of the formal decision forums because of an integration of several business units into a common structure were discussed.

Data analysis

The analysis of data was made continuously and in parallel to the other activities carried out in the research study. Two main approaches were used to analyse the empirical data, depending on the object of investigation. The first one was based on traditional methods for analysing processes. The purpose of the analysis was to describe the different activities carried out in PPM, how they relate to each other and how people participated in them. The second approach was based on an interpretation and coding method. Its purpose was to understand how people experienced their participation in PPM and how their subjective impressions influenced PPM decision making. In the following, the two approaches of data analysis are described in detail.

The first approach was based on different techniques for the analysis of processes, inspired by Sörqvist (1998) and Norling and Olsen (1994). In this analysis, three different types of diagrams were built up from the empirical data. The first diagram intended to describe the different processes that were related to PPM decisions. Processes were described through several parameters, such as activities, decisions, decision groups, frequency of meetings etc. The second diagram focused on the role of the different actors in each process. It was a double entry chart in which one axis constituted the formal and informal actors that influenced PPM decision making. In the other axle, the different organisational processes described in the first diagram were placed. The chart displayed the roles that each actor played in the different formal and informal processes. The third diagram displayed the interactions between the different formal and informal processes. It consisted of a double entry chart in which the different organisational processes were placed in both axles. This diagram displayed how processes interplayed, specifically how decisions made in one influenced the other.

The second approach for the analysis of data was based on an open coding approach, following Hartman (2001) and Gustavsson (1998). Interviews were read out, line by line, and the researcher focused on how different decision situations were approached and interpreted and how the respondents experienced the decision situations. Codes for labelling the different statements were chosen. Research notes were taken all the time, developing interpretations about how the codes could be classified into different categories. After the first two or three interviews, the list of codes was relatively large. Afterwards, some codes seemed to have appeared repeatedly while others seemed just to appear in individual interviews. When the same categories appeared in several sources of information, they were considered to be main categories, and these were used to lead the successive analysis of the rest of the interviews. The main categories and their relationships were further developed by relating them to research literature and discussing them within the research group. A validation of the findings was made by presenting them to the companies in discussion meetings.

3.4.2 Research study II

The second research study was based on the data collected in a master's thesis reported in Abedi and Wallsten (2009). Two students carried out the investigation under my supervision. The master thesis had the purpose of mapping, analysing and improving the PPM process in company D. For that, the students used a methodology based on the experience and results derived from research study I. It consisted of a sequence of steps that guided the data collection and data analysis to map and analyse the current PPM practices, and a set of steps, activities and suggestions to improve them.

Data collection

The study was limited to the decision-making processes of screening ideas and starting development projects. According to the methodology, the students outlined the study in six steps: preparation, data collection, data analysis, discussion, workshops and development. In the preparation phase they built up two groups. One group consisted of managers who were involved in the screening of ideas. This group provided information which mapped the current process and helped to design the improved one. The second group consisted of people that influenced or were affected by portfolio decisions, and they contributed with additional information. Data was collected via interviews and by internal documents in which PPM decisions were reported.

I had regular meetings with the students, helped them with the planning of the thesis and to carry out the analysis of data. After the master thesis was completed I interviewed the two students individually. The students were asked to reflect on their experience in assessing and improving a PPM process and the challenges they faced. Then a third interview was carried out with a manager at the company who was responsible for the early evaluation and selection of product development ideas. The interview was made eight months after the master thesis was finalised and focused on the problems that the company experienced with PPM and how the activities carried out by the students and the suggestions they made helped the company to improve its PPM process.

Data analysis

The first part of the analysis aimed to evaluate to what extent the methodology proposed to the students contributed to facilitating mapping and improving the PPM processes. This analysis was carried out mainly by evaluating the progress of the students' work during the study. It was evaluated if the method provided the necessary steps to be taken to improve PPM processes, if it worked to map PPM procedural complexity and if it contributed to the implementation of the new PPM process in an organisation.

The second part aimed to address if the activities that were made in the company and the propositions made to improve the PPM process were beneficial for the company. For that, the interview with the manager responsible for PPM decisions was analysed. The analysis intended to understand which activities and improvements were experienced as beneficial by the manager some months after the study was finished.

3.4.3 Research study III

The previous research studies contributed to the identification of several aspects of PPM decision making that were considered to be important to understand companies' challenges. Thus, research study III had a relative more concrete purpose, focusing on exploring the sensemaking processes within evaluation and selection of ideas and projects in companies E and F.

Data collection

Several meetings were initially conducted in both companies with different managers engaged in product development activities, with the purpose of achieving a mutual understanding about their challenges regarding PPM. The meetings also contributed to building an overview of the organisations and the PPM processes. Then, an interview study was planned for each company. We conducted 16 semi-structured interviews – 10 interviews in company E and 6 in company F. Two researchers were present at all interviews except one, and I was present at all interviews. All the interviews were audio recorded, except one, because the respondent requested that it was not recorded.

Respondents were selected using the same criterion as in research study I (formal and informal decision makers and people affected by the decisions made by others). However, based on the results of the previous studies, it was considered important to also include people who presented ideas for evaluation. Also, similarly to study I, interviews focused on what people did in processes related to PPM. However, it also focused on asking people to describe situations where ideas were evaluated and what their experiences were, e.g. what their first impression about the idea was, if the idea was difficult to understand, whether there were different or opposing opinions about the idea's purpose or its classification according to certain criteria. In addition to this, it was also asked how the situations evolved, e.g. with whom they talked about the idea, what they said to or were told by other people and what they did next.

Data analysis

For the analysis of the interviews a combined approach with selective and open coding, based on Hartman (2001) and Gustavsson (1998), was used. Through selective coding, already defined conceptual categories were used to guide the search for information in the empirical data. It was used to look for aspects of PPM that had been identified in the previous studies as relevant, namely situations in which respondents experienced ambiguity. At the same time, an open coding approach similar to the one described earlier, in research study I, was used to analyse how those ambiguous situations were managed. That is, through the open coding it was intended to understand what decision makers do when experiencing ambiguity and how those situations evolve while ideas were further developed. Finally, a validation of the findings was made by presenting them to the companies in meetings and discussion sessions.

3.4.4 Observation studies: the workshops

Workshops were an activity in which a group of PPM decision makers had to simulate decision situations. The purpose was to make it possible for decision makers to be aware about their own way of making decisions and to critically reflect on them. At the same time, it was possible, for me and other researchers, to make observations of diverse PPM decision situations. Three workshops were arranged in total, in companies B, D and E. In general terms, the activities were designed as follows:

- The research group prepared a set of decision situations that had been identified in the analysis of the interview studies to be important or challenging for the company.
- Scenarios were created by combining real ideas and projects that the company currently developed with strategic goals and competitive conditions. Some unexpected changes were added to each scenario to create the conditions for a decision situation. For example, financial problems that required a project to be cancelled.
- Decision makers were instructed to make a certain decision under a particular scenario.
- Then, decision makers reflected and discussed how the decision was made, what difficulties they experienced and how they related the exercises to their real PPM practice.
- After the workshops, the researchers discussed the observations they had made during the workshops.

Workshop I

The first workshop was carried out in company B, with the purpose of helping decision makers to reflect on the appropriateness of certain decision approaches in different situations. It was a half-day activity in which two product managers and one project portfolio manager participated. I was responsible for leading the workshop and presenting the different exercises. Two other researchers were present as observers.

First, decision makers had to choose five ongoing projects that the company was currently working on. Then, I introduced different evaluation methods, such as financial tools, qualitative scoring models and balance visualisation charts. Then, decision makers had to rank the projects using financial tools. Then, they had to repeat the exercise but using evaluation methods based on qualitative criteria. Finally, they had to reflect on when it was appropriate to use a certain method to evaluate a particular project, and how to combine methods, in practice, to make better decisions. Another exercise consisted of eliminating one project from the list, and then repeating the exercise, but using a chart to display the balance of the group of projects. They had to reflect on the concept of balance in PPM, which dimensions of balance would be relevant for the company and how taking balance into account would improve PPM decisions.

Workshop II

A similar workshop was carried out in company D. The activity was a part of research study II, in which two master students improved a PPM process. The initial purpose of the workshop was to identify relevant decision-making criteria to improve the current PPM processes. It was a full-day activity, with the participation of five decision makers, all of them with an active role in the evaluation and selection of new ideas and development projects. I was present during the whole workshop as observer.

Before the workshop was carried out, a preparation meeting was arranged between the students and a manager who was responsible for the early phase of idea development. The manager suggested a list of six ideas for new products that the company had been considering recently. During the workshop, the participants formed into two decision groups. The groups were instructed to rank the ideas in order of importance. Then they had to reflect on which criteria they had considered to outline the relative importance of the different ideas. After that, the groups presented their results to each other, discussed the differences in the rankings and the criteria they used. Then they agreed on a common set of relevant criteria to evaluate their ideas. A similar exercise was carried out, but, in this case, the decision groups had to choose three diagrams to display the portfolio balance, and they had to place the ideas in the diagrams. Finally, they discussed the balance dimensions which they considered to be relevant and agreed on a set of relevant diagrams.

Workshop III

In company E, a half-day activity was carried out, which consisted of nine people participating from the development department of one business unit. Among them were the head of the department, the project portfolio manager and several senior developers and project leaders. I led the whole activity, and three other researchers acted as observers.

To identify the challenges that the company experienced with PPM, a careful preparation was carried out by analysing the interviews that were made in the company. Then, exercises were designed to simulate the decision situations in which the identified challenges could be experienced. Before the workshop, the head of the department was asked to suggest three ideas and five development projects to design the different exercises. The ideas had to be unfamiliar to the participants and contain technical and commercial challenges that were new to the company. The formulation of the idea was modified according to Gustafsson's (2004) suggestion to design decision-making scenarios that imply radical innovations: the information had to be insufficient, contain irrelevant details and be non-measurable.

The first exercise was the simulation of an informal decision situation involving a radical idea. To experience the informal situation, the participants had just one minute to read the idea, write down what they thought about it and the feedback they would give to the person who had, hypothetically, told them about the idea. Then, the whole group discussed the challenges and consequences of informal decision situations.

In the second exercise, the participants received three diagrams in which each axis represented a criterion for the evaluation of ideas and projects. They had to discuss the meaning of the different criteria, and then they had to place different ideas and projects in diagrams. The third exercise consisted of choosing one project from a list of four to be

eliminated. Then, they carried out the same exercise but displayed the projects in two diagrams that showed the balance among certain dimensions. Then they discussed the relevance of different balance dimensions and the consequences of taking balance into account when making decisions. Finally, the participants had to consider one ongoing project that was considered to be strategically important for the company. Then, they had to imagine that the information about this project became accessible by the public in order to facilitate the collaboration with external actors. Participants discussed the benefits and challenges of open innovation, and what this approach would imply for the selection of ideas and projects.

Analysis of observations

In the three workshops the same analytical process was repeated. First, after each workshop, each researcher reflected individually about the observations that had been made. Then, a group discussion was arranged to exchange impressions and opinions. The topic of the discussions depended on the initial purpose of each workshop. Interviews were also made in workshops II and III with the managers who were present both at the workshops and the preparation, to gather their impressions about the exercises. As long as the different research studies and workshops were carried out, and new research literature was integrated into the analysis of the empirical data, the observations made at the workshops were reanalysed from a new perspective. The abductive research process resulted in a synthesis of the workshops and the implications they might have for the practice of PPM, and that is presented in section 6 *Supporting the evaluation and selection of ideas and projects*.

3.5 Papers, research studies and research questions

Figure 3.4 shows how the different papers included in this thesis are related to the research studies described earlier and how they contribute to answering the research questions. Paper VI and Paper VII are submitted to journals and are based on Paper I and Paper V, respectively, with a more detailed discussion integrating additional theory. A more detailed description of the papers and their contribution to the thesis is presented in Chapter 4.

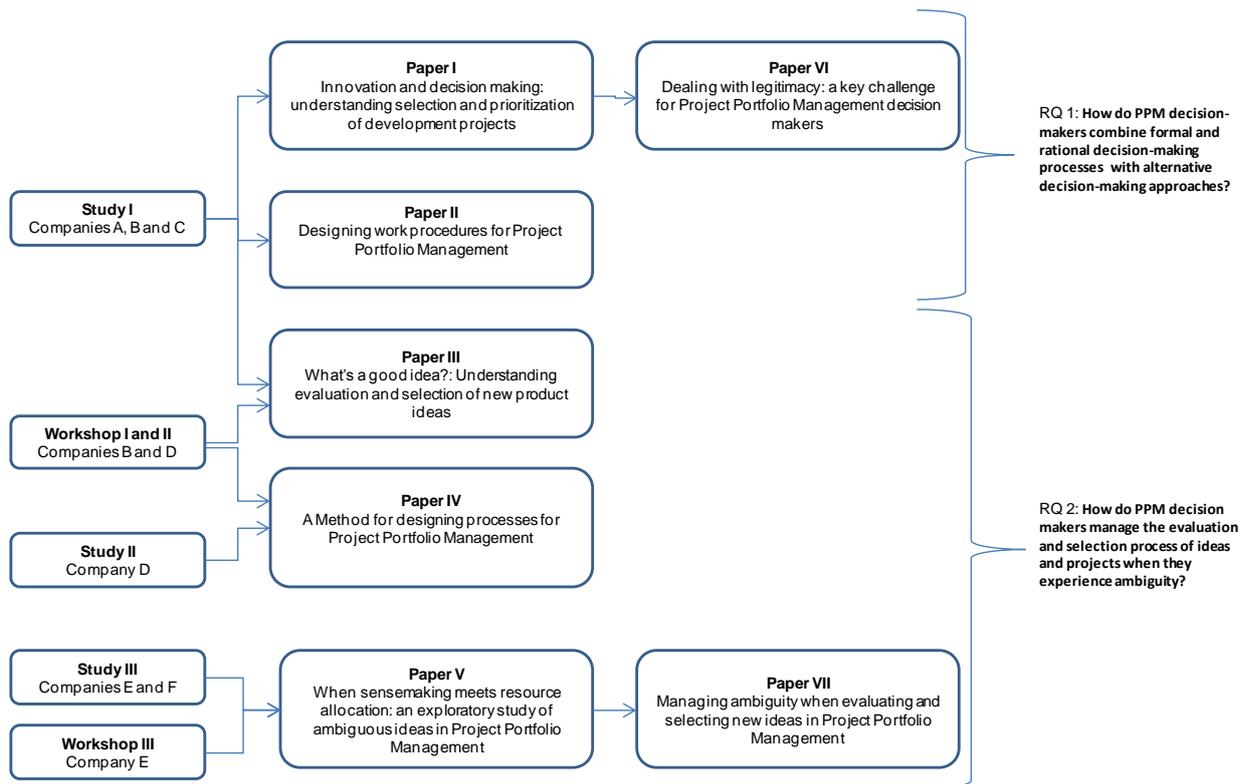


Figure 3.4. Contribution of the research studies, workshops and papers to answering the research questions.

3.6 Criteria for evaluation of the research study

Two important criteria to assess the quality of a research study are validity and reliability (Bryman, 2002). Validity assesses if the indicators developed to measure a concept actually measure what it was intended to be investigated. It is usually considered along two dimensions, intern and extern validity. Intern validity is related to when an argued causality between two variables is not caused by non-considered factors. Extern validity is about whether the results are able to be generalised to other contexts. Reliability considers if the results will be the same if the study is carried out again.

According to Bryman (2002), it is still being discussed, in the theory of science, if the classical criteria to evaluate quantitative studies, based on validity and reliability, are or are not directly applicable to qualitative studies. The different opinions depend mainly on the position regarding the possibility to capture reality in concepts and theories. A generally accepted position is that results from qualitative research are just possible representations instead of definitive versions of the social reality. Therefore, some researchers have suggested that alternative criteria are used to evaluate qualitative studies.

In this thesis, alternative evaluation criteria are used, which are generally accepted for qualitative research. The criteria are credibility, transferability, dependability, and relevance, and some of them are considered to be equivalent to validity and reliability. In the following, these criteria are described based on Bryman (2002), Gustavsson (1998) and Hartman (2001).

Credibility

This criterion evaluates how probable it is that the results actually explain the reality that was investigated. It is equivalent to intern validity in quantitative studies; however, here it is not meant causality between quantitative variables. In this thesis, the studied reality is of a subjective character and interpretations must be made in order to discover the real world behind it. Then, one way to ensure credibility is through the clarity and grade of detail from which it is shown that the analysis and results are grounded on the empirical data. Thus, two main factors are going to be considered to assess credibility in this thesis. First, the extent to which it is clearly reported how the interpretations of the empirical data were made, especially when they refer to subjective experiences such as conflict, confusion etc. And second, the extent to which triangulation (the use of more than one method or source for data collection) has been used to confirm the results.

Regarding how interpretations have been reported, this thesis and the appended papers intended to describe how the empirical data have been analysed. That is, the recursive process of interpretations and analysis in which conceptual categories were built along data were reanalysed and new theoretical insights were integrated. Furthermore, quotations from the interviews were used to give to the reader the elements to consider what elements in the data lead to the different interpretations. Although the written reports just allowed for illustrating each conceptual category with a few quotations it is considered that it gives an idea about what elements were used for made the different interpretations.

Concerning triangulation, data collected from different sources have been contrasted in order to confirm the identified aspects, descriptions and explanations. For example, sensemaking processes in PPM that were described initially from data collected in interviews were then contrasted by the exercises carried out in the workshops. In that way, it was possible to

confirm the way in which sensemaking manifests in PPM and the impact that it has for decision making. Furthermore, meetings and diverse activities for reporting the analysis of the empirical data to practitioners were carried out. It is considered that those discussions reinforced the evidence that the findings were also regarded to be relevant for the people involved in the practice of PPM.

Transferability

In a qualitative study based on a limited number of companies, generalisation is not evaluated by a statistical representation in a given population. On the contrary, it is the abstraction level in the building of categories and their relationships that gives the possibility to make several situations understandable beyond the specific empirical material that was used. This grade of transferability of the results, from one environment to other, is considered as an equivalent to external validity. Therefore, in this thesis, the grade of conceptualisation will be evaluated, that is, the extent to which the results display an elaboration in the concepts and the relationships between them.

The abduction process alternating empirical studies and search of research literature allowed having a theoretical distance from the empirical data in the form of conceptual categories and their relationships. This implies that the findings reported in this thesis, although grounded and representing the empirical data, still display a conceptual distance from it, and can be used for guiding the study of the same phenomenon in other empirical settings, for example, by a selective coding of data guided by the conceptual categories built in this study.

Dependability

This refers to the extent to which it is possible to audit what has been done, and how, during the whole research process. It is considered to be equivalent to reliability in quantitative studies. This criterion is going to be evaluated, first, in relation to the auditing that happened during the whole research process, and, second, in relation to the extent to which an audit of the research process is possible to be made a posteriori. Auditing during the research process includes the extent to which other researchers have evaluated the research methods and their application. A posteriori implies considering if the descriptions that have been done of the different phases of the research process, the selection of research methods and the way they were applied, allow a researcher who has not been involved in the research process to critically review the studies and the results.

The research studies were performed by a research group in which it was possible to carry out an internal auditing process in order to control, discuss and confirm the quality of the different steps. For example, as it was explained in section 3.2 there were almost always two researchers present at the interviews and several were present at workshops. Five papers were written with the collaboration of those researchers. Two papers were conditionally accepted to publication in journals and five were accepted and presented in international conferences. It implies a reviewing process carried out by independent and anonymous qualified reviewers. Furthermore, the publication of this thesis and the included papers allows a posterior auditing.

Relevance

This criterion assesses if the study gives a relevant contribution to the related research area. On the one hand, it is going to be evaluated the theoretical contribution, i.e., if the results fulfil the research needs that have been identified in the chosen research domain. And on the other hand, it is going to be evaluated the relevance for practitioners, i.e. if the results are of interest to the people involved in the daily practice of PPM.

Regarding the theoretical relevance, in this thesis was intended to present the theoretical reasoning that lead to the research questions, the analysis that answer the research questions, and to explicitly formulate the contributions that the findings imply. In Chapter 2, both the area of contribution and the research needs were presented. This allows for a critical analysis of the theoretical reasoning that was used for the formulation of the research questions. Furthermore, the findings and their contributions for the research area of PPM were presented and discussed in Chapters 5, 6, 7, 8 and 9. In Chapter 5, it was intended to, explicitly, guide the exposition of the analysis of the empirical data along the two research questions. In that way, the originally abductive process of inquiring and analysis, is synthesized in order of giving an answer to the research questions. In the other chapters, it was intended to relate the findings to established research areas and theories, in order to contribute to the theoretical development of the research area of PPM. In that way, it is fulfilled the need of more theoretical insights in PPM, as it was stated in sections 2.2.3 and 3.2.1. In Chapter 9, the contributions of this thesis to the research area of PPM are explicitly formulated, allowing to a critical analysis of them.

The relevance for PPM practitioners has been evaluated in the initial contact with managers when the research studies were planned. In those discussions with managers, they agreed on the importance of PPM and the research problem that was presented, and they committed their participation in the research studies. Furthermore, both the theoretical findings and the practical activities derivate from them (workshops) were discussed with people involved in PPM, confirming its value for the improvement of PPM practice.

4 Summary of appended papers

In section 3.5, an overview of the appended papers and how they are related to the different studies and research questions was presented. Due to the abductive research process, some aspects of PPM decision making that had been addressed in certain papers were not chosen for a deeper investigation in posterior papers. However, all papers have made relevant contributions to the research process of this thesis. This chapter presents the purpose and main findings of each paper, and their contribution to the conceptualizations made in this thesis.

In all papers the first author was present at the totally of the interviews and observations, made the major part of the analysis, and the paper writing. The other authors were present at some of the interviews and observations, and contributed to parts of the analysis and reviewing of the writing.

4.1 Paper I

Title: Innovation and decision making: understanding selection and prioritization of development projects

Authors: Ernesto Gutiérrez, Gunilla Ölundh Sandström, Jenny Janhager, Sofia Ritzén

This paper had an explorative character and aimed to understand PPM from the perspective of decision makers, and to identify which aspects of PPM decision making they experienced as problematic. It is based on the interpretive and open coding analysis of interviews carried out in companies A, B and C.

The findings indicate that to deal with all the situations and problems that may arise in the innovation process, various approaches for making decisions and understanding innovation are needed. However, regardless of the appropriateness of these approaches for given circumstances, they receive different levels of acceptance on an organisational plane. This puts decision makers in the conflictive situation of sometimes having to use approaches to work that are appropriate but not accepted, and other times accepted but inappropriate. Furthermore, an organisation's potential to create new products, and consequently its future competitiveness, depends on how its members deal with the organisational acceptance of the approaches used.

Contribution to the thesis: This paper defined the research problem related to the selection and prioritization of product development projects. Furthermore, it identified the acceptance of decision-making approaches as a relevant aspect for understanding PPM decision-making, and a key challenge experienced for decision makers. It also stated a critical view of the main assumptions and prescriptions of PPM literature. Finally, it influenced later empirical and

literature studies mainly guiding to the concept of legitimacy in decision-making theory, and the dynamics between formal and informal systems in complexity sciences.

4.2 Paper II

Title: Designing work procedures for Project Portfolio Management

Authors: Ernesto Gutiérrez, Jenny Janhager, Sofia Ritzén, Gunilla Ölundh Sandström

The purpose of this paper was to understand the procedural complexity of PPM and what it implied for the improvement of PPM processes in practice. Empirical data was collected in interviews, meetings and activities carried out in companies A, B and C. The analysis was made using different techniques for process analysis.

It was found that different decision-making processes within PPM interplay in a particular way. The different processes run in parallel and decisions made in one process affect other processes. People interact in networks of formal and informal relations; and each person plays different roles in different processes. Decisions made by someone in a certain process can trigger subsequent decisions made by another person in another process. The different decisions are not always consistent with each other and do not always lead to an action. A decision can be a formal declaration about what should be done or a more diffuse collective understanding about guidelines for action that everyone has agreed on. These characteristics of PPM processes are discussed against some assumptions and prescriptions made in PPM literature such as consistency between different decisions, causal relationship between decisions and actions, etc.

Contribution to the thesis: It contributes to understanding the way in which resource allocation process and other decision-making processes interplay. Besides, it suggested the intertwining between the processes of idea generation and the evaluation and selection processes as an important aspect to be taken into account. It also guided later studies to investigating informal interactions and ambiguous situations.

4.3 Paper III

Title: What's a good idea?: Understanding evaluation and selection of new product ideas

Authors: Ernesto Gutiérrez, Ingrid Kihlander, Joakim Eriksson

It aimed to investigate how ideas for new products were evaluated and selected in industrial companies. It is based on a combination of open and selective coding of interviews in companies A, B and C; and insights from observation study in workshop I carried out in company B.

The findings described the social and cognitive aspects of idea evaluation and selection. The social aspect is about interaction between people that makes possible to combine formal and informal processes, and rational and non-rational approaches for developing and evaluating ideas with different grades of ambiguity and uncertainty. The cognitive aspect refers to how ideas and company's context are interpreted, in individual and collective levels, for making evaluations on ideas. A new idea implies that the organisational context must be reinterpreted but different people might interpret it in different ways. This individual and collective interpretation process is determining if the idea is evaluated as good or bad.

Contribution to the thesis: This paper contributes with identifying that the interpretive aspects of decision making are relevant despite they have been not thoroughly addressed in PPM literature. It guided later studies to integrate sensemaking theory in the analysis. It also discusses the exercises defined in workshop I as a way that companies might use for supporting cognitive aspects of decision making in companies. This insight guided the further development of workshops II and III.

4.4 Paper IV

Title: A method for designing processes for Project Portfolio Management

Authors: Ernesto Gutiérrez, Jens Hemphälä, Aref Abedi, Jakob Wallsten

This paper aimed to propose and evaluate a method for analyzing and improving PPM processes. It is based on the finding from earlier papers, a literature study about the requirements stated on PPM processes, the supervision of the application of the method in company B by two master students, an observation study of workshop II, and an interview to a manager in company B.

A method for designing processes for PPM was proposed. The method does not impose any generic model for PPM process, but gives guidelines for generating one. It is organised in a project form, and it involves company's staff in the design and implementation of the process. It proposes a matrix-based analysis for mapping and designing the process; and simulations of decisions for choosing decision criteria. Although the method was easy to be applied and it provided a clear guide about how to proceed for designing the PPM process more research is needed for testing its applicability and impact for improving PPM processes.

Contribution to the thesis: The initial issue that this paper focused on, namely, the development of a method for guiding the design of PPM processes, has not been addressed in this thesis. However, several results reported in this paper contributed to significantly guiding the focus of the following studies. In particular, the observations made in workshop II and the experience of participating in it that provided the manager that was interviewed contributed to the further development of the workshops. Simulation of portfolio decisions seemed to work both for research and practice. For PPM research, it contributed by observing how sensemaking processes are manifested in PPM. For PPM practice, it contributed to the further development of an effective way to achieve awareness of how the decision criteria are interpreted by different people and how they should be used for evaluations of ideas and projects.

4.5 Paper V

Title: When sensemaking meets resource allocation: an exploratory study of ambiguous ideas in Project Portfolio Management

Authors: Ernesto Gutiérrez

This paper explored the evaluation of ambiguous ideas in PPM. It is based on a combination of selective and open coding of interviews carried out in companies E and F; and in observations made at workshop III in company E.

It was found that when people experience ambiguity they take small steps in the further development of an idea for giving to it the clarity that it was lacking before. This process for making sense of the ambiguous situation is conditioned by the resource allocation process which has its own logic and dynamic. It explains why some ideas are not evaluated according to the evaluation models proposed in PPM literature; and why the resource allocation process within PPM does not work as management planned it to.

Contribution to the thesis: This paper integrates sensemaking theory to the analysis of the empirical data contributing to an understanding of how the interpretive aspects of decision making are manifested in PPM. It also suggests the importance of sensemaking processes for PPM decision making and its interplay with resource allocation processes for allowing the management of certain types of ideas and projects. Those insights guided later analysis to focus on the management of ambiguous situations in PPM and its influence on achieving a balance between different types of ideas and projects.

4.6 Paper VI

Title: Dealing with legitimacy: a key challenge for Project Portfolio Management decision makers

Authors: Ernesto Gutiérrez, Mats Magnusson

The purpose was to explore how decision makers in PPM combine different decision-making approaches when facing different decision situations. This paper is based on integrating, to the results initially reported on paper I, insights from decision-making theory and complexity sciences in organisations.

It was found that the decision-making process proposed in PPM literature, based on formal and rational decision-making processes, hierarchical decisions and a logic of planning and scheduling, are not suited to handle certain types of PPM decisions that are characterized by uncertainty, ambiguity and complexity. The dominant rational approach could benefit from being complemented with other decision-making approaches, but this, in turn, leads to an issue in terms of legitimacy of decisions and decision-making approaches. Decision makers must deal with legitimacy for putting into practice the approaches that they consider more appropriate, and for giving legitimacy to decisions that have been made through less accepted ones. Four mechanisms by which decision makers deal with legitimacy were identified, by switching the paradigms by which they understood product development and by approving decisions that have already been made by non-rational, informal and non-hierarchical approaches through a formal, rational and hierarchical decision-making process.

Contribution to the thesis: This paper made a substantial contribution to answering the first research question. It conceptualized a gap in PPM research, in terms of the challenges that decision makers might face for achieving flexibility in PPM decision making and its consequences for the balance among different types of ideas and projects. Furthermore, it integrated the analysis already reported in paper I, with insights from decision-making theory and complexity sciences. This allowed the introduction of the concept of legitimacy and identified its management as a key challenge for PPM decision makers. Complexity sciences contributed to a discussion of the findings in relation to the dynamic in which decisions evolve. It allowed a critical analysis of central issues of PPM literature such as the chaos in resource allocation.

4.7 Paper VII

Title: Managing ambiguity when evaluating and selecting new ideas in Project Portfolio Management

Author: Ernesto Gutiérrez

This paper aimed to investigate evaluation of ideas in situations where PPM decision makers experience ambiguity and how other decision-making processes within PPM influence and are influenced by the way decision makers manage ambiguous situations. This paper is based on integrating, with the results initially reported on paper V, insights from sensemaking theory, decision-making theory and complexity sciences in organisations.

It was found that when experiencing ambiguity, decision makers do not follow the rational process of evaluation and resource allocation defined in the formal PPM process. There is a lack of clearly defined ideas and goals, and decision makers do not take into account different alternatives and their consequences. However, the analysis suggest that it could be considered to be an appropriate behaviour that decision makers first take action and then discover, as a consequence of these actions, both the purpose of the idea and a classification of it in relation to given decision criteria. Those actions allow decision makers to understand purposes, reveal benefits and construct a judgment about ideas.

Contribution to the thesis: This paper contributed to the second research question by conceptualizing the importance of the interpretive aspects of PPM decision making and its influence in the selection of ideas. It also contributed to the first research question by a theoretical framework that allows explaining PPM decision makers' behavior as forms of rationality. In that way, it allows for a discussion of their appropriateness in certain decision situations. Furthermore, it contributed to questioning the assumption that chaos in resource allocation is, necessarily, a consequence of a dysfunctional decision-making process.

5 Results and analysis

In this chapter, the results and analysis of the empirical data obtained in the interview studies are presented. The exposition integrates the results and analysis of the appended papers for answering the two research questions. Furthermore, the original analysis reported in the papers are here further developed by relating to theoretical literature. Section 5.1 aims to answer the first research question, and section 5.2 the second one.

5.1 How decision makers combine different approaches

The theoretical exposition presented in section 2.2 indicated that the challenge of evaluating and selecting different types of ideas and projects imply a flexible decision-making process in which different approaches are allowed to be used. Therefore, it is needed to investigate how decision makers combine different decision-making approaches and what influences that decision makers approach decisions one way or another. That is what the first research question aimed to explore: how PPM decision makers combine formal and rational decision-making processes with alternative decision-making approaches. Two aspects that influence this dynamic were identified. First, the organisational acceptance of different decision-making approaches. Second, the interaction between informal patterns of decision making and the resource allocation process. In the following, are described and analyzed those two aspects: dealing with legitimacy and dealing with resource allocation.

5.1.1 Dealing with legitimacy

In this section, the focus is put in the nature of the decision-making approaches that are used for evaluating and selecting ideas and projects. It is based on the study made in companies A, B and C, reported in papers I and VI, and it aims to explore what challenges decision makers might face when combining ways of making decisions that are of different nature or logic, and what the consequences are of making a decision in a way or another.

The first part of the analysis consisted in classifying the descriptions that decision makers gave about how they made decisions. Four dimensions were identified in which the described decision making approaches could be classified. The first dimension is related to the paradigm through which innovation is understood, the second one is related to the use of rational decision making, the third one is related to the grade of formalization of decision processes, and the fourth one is related to the influence of high hierarchies in decision making. *Paradigms for understanding innovation* means that decision makers alternated between two alternatives to explain how innovation occurs or should be managed. Sometimes they understood it as something that was possible to forecast and plan. Other times they talked about innovation as an emergent and unpredictable process, in which changes were considered to be unavoidable. *Rationality in decision making* implied that decision makers described decision making as using rational and analytical procedures that aim to optimise

decisions. At the same time, they told about approaching decisions by non-rational means, such as intuition or “gut feeling”, or when decision making was influenced by particular interests that prevailed over optimal decisions. *Degree of formalization* refers to when decision makers talked about decisions taken in formal processes with structured and documented procedures, as in stage-gate models. They also described informal processes, as spontaneous meetings and discussions and decisions made without any written procedure. *Exercise of power* relates to when decision makers described the decision-making process as hierarchical, being strongly influenced by higher levels of organisational hierarchies. Simultaneously, non-hierarchical decisions were described as what happens when middle managers act without higher approval.

Decision makers described what appears to be opposite ways of approaching decisions along each dimension. However, the way in which they talked about the different ways of approaching decisions, indicate that some decision-making approaches are experienced by decision makers as more accepted than others. For example: “*It must be approved anyway. And perhaps it is something that I, as a product manager, do not like. But that’s the way it is,*” (Product Manager), or, “*It started with me and one person from the development department when we were together on a training course. We sat there and we thought about how ... this (product) should work It was, so to speak, illegal work. And it is not the way it should work. It is the business unit that should evaluate if this product should be developed.*” (Sales Manager). It also indicates that decision makers were aware that different approaches encounter different levels of acceptance, despite how appropriate they actually might be in a given situation. What could also be seen is that the planning paradigm, rational decision making, formal processes and hierarchical decision making all benefit from a higher level of organisational acceptance than the emergent paradigm, non-rational decision making, informal processes and non-hierarchical decision making.

Accordingly, previous research have pointed out that not all decision-making approaches have the same legitimacy, that is, the extent that they are accepted within an organisation. Furthermore, that a particular decision becomes accepted is influenced by the legitimacy of the approach by which this decision was taken. March (1994) states that an appropriate, or legitimate, behaviour for making decisions tends to be socially constructed by interpretations of how other decision makers proceed. Practices and rules become more legitimate as more decision makers use them. Brunsson (2007) asserts that organisations need to gain legitimacy among external and internal stakeholders. For example, rational ways of thinking are regarded as proper practice partly because they are highly valued at a societal level. Legitimacy is also affected by internal power relations, in the sense that the ability to influence what is considered to be proper decision-making procedures and proper justifications for decisions is a fundamental source of power (March, 1994).

In the context of product development, Engwall et al. (2003) assert that sequential and formal models for managing projects are considered to be legitimate practices, despite not being suitable for managing all types of projects. Christiansen and Varnes (2005) observed that decision makers sometimes use formal decision points in order to justify decisions that have already been made and to display rational behaviour. Furthermore, Sundgren and Styhre (2004) state that even though intuition is considered to be useful for making decisions without complete information, it is still controversial to use it as the basis for decision making. Thus, not every way of approaching decisions is expected to have the same legitimacy in organisations.

Furthermore, decision makers seemed to experience the presence of legitimacy in a conflictive way, in the sense that the less accepted approaches are used, but decision makers must also, in some way, deal with their more limited level of acceptance. The question that arises is: How do decision makers manage legitimacy when trying to apply a certain decision-making approach? It was observed that decision makers put in practice different mechanisms that allow them to avoid drawing exclusively on the highly accepted approaches when they are not considered to be suitable, and to giving legitimacy to the decisions that have been made by the lower accepted ones. Four different mechanisms for handling the issue of legitimacy could be identified: switching paradigms, appearing rationality, late formalization and hidden start. These mechanisms, and the indicators in the empirical data that led to these interpretations, are described as follows.

Switching paradigms

Decision makers described product development as a context in which information about markets, ideas and projects is clear and certain. Forecasting, planning and controlling are described as ideal ways of working. Reprioritization and changing plans are presented as undesirable and experienced by respondents as a failure. However, they also stated that sometimes plans are not fulfilled and prioritizations must be carried out. Respondents switch to the emergent paradigm for describing the context as dynamic, giving reasons for not being able to foresee certain events and being forced to change. It seemed to serve to mitigate anxiety and frustration when plans cannot be fulfilled.

Appearing rationality

Decision makers told about rational means as the right way to make decisions. Rational decisions become accepted internally, by showing that an optimal decision is made and by communicating the grounds on which it was made. However, they gave examples about early stages of an idea in which non-rational means, such as intuition, allow estimations and decisions to be made. Non-rational means are allowed to contribute, but legitimized by the use of rational means. For example, some ideas are first evaluated by intuition and then developed further avoiding formal decision points. Then, when the ideas reach a certain level of development, a formal decision is made based on rational means.

Late formalization

Formal processes were described as the desirable way to manage decision making by ensuring that crucial aspects are taken into account and preventing strong personalities from forcing their opinions through. However, when information on new ideas is unclear, incomplete or uncertain, formal procedures, such as stage-gate models, are often not used in practice. Furthermore, they mentioned that discussions for gaining the support of key actors are often carried out in informal ways. As a consequence, many decisions have already been made, and some actions, that imply allocation of resources, have already been done before a formal decision is made. Later, at some point, informal activities are forced to undergo formal processes, for example, when a formal decision for starting a project is made.

Hidden start

It seemed to be accepted that higher levels of organisational hierarchies make strategically important decisions. They apply a perspective that goes beyond particular interests and

ensure that decisions are made according to overall organisational goals. One common example given by the three companies was that they could resolve the conflict arising when two business units are competing for the same resources. However, examples were given about decisions made by lower hierarchies. Non-hierarchical decisions are made when new ideas are considered to be promising and to allow a more rapid further development, without having to wait for higher-level authorization. Middle managers initiate the action without waiting for higher-level approval, and then the project is made official when the higher approval is decreed.

5.1.2 Dealing with resource allocation

In the study made in companies A, B and C, reported in paper II, is described how the resource allocation process interplays with other decision-making processes within PPM. The short term resource allocation process, that is, the almost daily decisions about in which projects or activities each person is going to work, is often a negotiation between a portfolio manager, technical managers and project leaders. This implies that there is not a necessary consistency between the decisions made in other processes and the effective allocation of resources. In other words, resource allocation often works as an independent process with its own logic and dynamic. For example, a product manager told about a project that never started in spite of had been formally approved, because of later considerations made in other processes determined that there were not enough resources for financing that decision *“Some things are not made, because there are no resources, despite having decided in the Product Council that they were good things and that they were going to be done.” (Product Manager II)*. Other times, a decision group (usually product managers or a project portfolio management group) decide which projects should receive the highest prioritization. However, often nothing is said about the relative prioritization between the rests of the projects in the portfolio, a decision that is actually made by other people *“Until now...we have said what is highest prioritized...that means that something falls down. Often are the right things that fall down...but it is rarely we pick something out.” (Product Manager I)*.

In the studies made in companies E and F, reported in papers V and VII, it was indicated that, sometimes, the evaluation of a project or idea implies carrying out informal development activities. Since it might be understood as an alternative pattern of decision making, a question that arises is how the interplay with the resource allocation process happens and what it implies. In fact, to carry out those development activities, some people may have to dedicate time to it at expense of other activities. The main resource that is involved in this process is often time that people dedicate to different development tasks. This resource allocation process can vary in formality and might involve more than one person, depending on the amount of resources to be assigned: *“I can give permission for a few days’ extra work for proving the concept of the idea” (Technical Manager)*.

However, decision makers also talked about the problems they experience for allocating people’s time to these activities. Regardless of the actual amount of time required, people must consider their participation in relation to the other activities that they are supposed to do: *“To make drawings you can also get help from your colleagues who make the drawings. It is not always easy to make the time, that’s the problem” (Project Portfolio Manager)*. At the same time, the resource allocation process has its own dynamic in which reprioritisations and changes are constantly under negotiation at different levels. In these negotiations, project managers and business unit managers often act with the logic of defending the resources of their own projects: *“My task is to defend the team” (Project Leader)*.

Thus, the occurrence of patterns of decision making in which development activities outside of the formal planned and scheduled work are carried out, is conditioned by the interaction with the formal resource allocation processes. Stacey (2007) asserts that relationships between people are enabling and constraining, at the same time. People enable or constrain by selecting one action rather than another in response to the actions of others. In the analysis presented above, for performing the activities that make sense of an idea, decision makers need that other people are able to allocate time away from their current activities. As people are already assigned to different tasks or have specific management roles, their willingness to spend time developing a certain idea is partly influenced by the subjective importance that they, and other people, give to the particular idea.

Thus, there is a mutual interaction between local patterns of decision making and formal resource allocation processes. Stilling and Eskerod (2008) found that companies have often some minor projects that have not undergone the formal decision-making process, and that use resources that affect the formal PPM resource allocation process. However, here another interaction between self-organised activities and formally planned activities is observed. That is, the resource allocation process might condition the occurrence of local patterns of decision making because the two processes displays different decision-making logics and stakeholders have different interests.

5.1.3 Summary of findings related to the first research question

The first research question enquired how PPM decision makers combine rational and formal decision-making processes with alternative decision-making approaches and what it might imply for the patterns of decision making that evolve along ideas and projects are further developed. The findings indicate that decision makers are conditioned in the way they approach decisions by two aspects: the organisational legitimacy of the different approaches and the interaction with the resource allocation process.

Different decision-making approaches display different levels of legitimacy in organisations, e.g. planning paradigm, rational decision making, formal processes and hierarchical decision making all benefit from a higher level of organisational acceptance than the emergent paradigm, non-rational decision making, informal processes and non-hierarchical decision making. Furthermore, decision makers put into practice some mechanisms that allow them to avoid drawing exclusively on the highly accepted approaches when they are not considered to be suitable, and to give legitimacy to the decisions that have been made by the lower accepted ones. Four mechanisms for handling the issue of legitimacy could be identified: switching paradigms, appearing rationality, late formalisation and hidden start.

At the same time, the occurrence of informal patterns of evaluation of ideas and projects depends on some people allocate time away from their current activities. People's willingness to participate or allow others to participate in those interactions is conditioned by a resource allocation process in which resources are under constant negotiation between different stakeholders, and people often display a logic of defending the resources of their own projects. Thus, the resource allocation process might condition the occurrence of informal patterns of decision making because it implies the interaction between people that display different decision-making logic and have different interests.

Bessant et al. (2011) stated that the existence of different approaches may create tensions and conflicts across the organisation, and more research is needed to explore the nature of these tensions. The findings presented before indicate that a flexible PPM decision-making process that simultaneously allows, approaches that are of a different nature and based on different logics to be put into practice is conditioned by how decision makers deal with the organisational legitimacy of the different approaches and how they deal with the interactions for acquiring resources. How they deal with legitimacy influences how the decisions made through less-accepted approaches evolve to a point where they become accepted by other actors and groups. How they deal with resource allocation influences the occurrence of informal patterns of decision making by allowing people to participate in informal interactions.

5.2 How decision makers manage ambiguity

The first research question contributed to understand how different approaches are combined when facing different types of ideas and projects. In this section, it is considered one particular decision-making situation and is explored how it is approached. Thus, the second research question aims to investigate how PPM decision makers manage the evaluation and selection process of ideas and projects when they experience ambiguity.

5.2.1 Making sense of ideas, projects and decision criteria

In the study made in companies A, B and C, reported in paper III, people involved in PPM decisions were asked to tell about how they evaluated ideas and projects and to tell stories about when ideas or projects were considered to be good. Interviewees evoked certain criteria for arguing why an idea or project was judged as being promise. Furthermore, they evoked a limited number of criteria and different people referred to different criteria. For example, while some of them told that an idea fell into company's core competence; others told that other ideas contributed to maintain a competitive position in the market; or provided a certain financial return; or there was a customer willing to finance its development, or it was possible to predict customer's future needs.

They also described situations in which the evaluation of an idea gave opposite results when different criteria are used. In some cases, respondents described that a certain criterion was chosen over others for building a judgment. For example, in company C, an idea that had been considered to be poor according to a financial evaluation was finally approved because it contributed to defend the company's market position from newcomers: *"...this is ROI (Return on Investment) that is the most important ... but there are other aspects: to keep competitors in check. It is may be not a fantastic market to be, but we consider that we have to be there anyway."* (Product Manager III).

Moreover, respondents often describe the process of making a judgment according to a certain criterion as difficult. For example, a Project Leader described the difficulties that he experienced when estimating the financial value of a component that was part of a whole complex product: *"One is able to see that some things are profitable while others are very unprofitable, but even unprofitable things may be necessary to have done. This (component) that we have spent, and are still spending, a lot of man-hours on, we give it (to customers) for free ... (this component make) people think that our machines are good and then they buy more...so, you'd better ask someone else about what is profitable or not"*.

In papers V and VII, it was explored thoroughly those situations in which decision makers experienced difficulties for judging ideas and projects according to decision criteria. For example, respondents in companies E and F felt that some ideas fell into a grey area, or that there were different opinions about how to classify them. *"Strategic alignment"* was one criterion that several respondents told stories about difficulties in classifying ideas according to it: *"You can probably get into a discussion with individual project proposals, if it is within our core, or is within the boundaries, or if it is something completely new. This distinction is not always easy, very easy to make."* (Project Portfolio Manager).

Another particular criterion that several respondents referred to be problematic was what they labelled as *"innovation"*. Companies E and F had created groups to identify, evaluate and assign resources to the development of ideas that presented a relatively higher grade of

innovativeness. Several respondents felt that it would be difficult to judge if an idea was innovative, and others stated that there often were different opinions when evaluating the grade of innovativeness. For example, a developer told about an idea that consisted of a function that already existed which would be provided to customers via a technology that had not been previously used for this function. A discussion arose as to whether the idea would be considered to be an “*improvement on an existing product*” or as a “*new user experience*”. There were different opinions and it was not possible to reach a common judgment. The distinction would determine how the idea would be classified in an internal idea competition, and the respondent said that it would impact on its chances of being selected.

Respondents talked also about situations in which it was difficult to understand what an idea for a new product was about. For example, a respondent was faced with evaluating an idea that was not within her technical area, and she considered herself unable to evaluate whether the idea had potential or not: “*It depends on ... how much I know in the specific technological area. Some things I do not understand when people come and start to talk about something. They usually put a lot of paper in your hand that does not contain any pictures, just a lot of words. And other things I have found easier to understand or see the direct benefit or value*” (Project Portfolio Manager). Some talked about difficulties in understanding the technical aspects, and others talked about not understanding the purpose of the product or what value it could give to the customer. Sometimes the difficulty arose because of the existence of opposing opinions between people.

The results indicate that the criteria that decision makers evoke for telling why an idea or project was considered to be good is limited in the sense that each person evoke just a few criteria and subjective in the sense that different persons choose different criteria or understand it in different ways. According to Weick (1995) people often consider limited parts of reality (extracted cues) from which they develop a larger sense of what may be occurring. Managers also often favour speed against accuracy, filtering overwhelming information. Furthermore, Weick (1995) asserts that which aspects to consider for making sense of reality are determined by the identity that people adopt. Who people understand they are, or represent, influences the parts of reality they consider for understanding it, and how they interpret them.

Furthermore, the results also suggested that people might also experience the existence of different opinions about what an idea or project is about or about how it would classify in relation to certain criteria. As Bergman et al. (2007) assert, since sense making is influenced by individuals’ prior knowledge, preferences and heuristics the same innovation may be interpreted differently by different people. There are not automatic answers to questions such as: Is this development project aligned to our business strategies? Is this new product idea to be considered a radical or incremental innovation? Is the development of this technical component profitable? Which decision criterion is more important than other? Does this new product idea give value to our customers?

According to Weick (1995), a situation is affected by ambiguity when people experience a subjective state of confusion created by difficulties in interpreting information. The results indicated that sometimes people experienced the existence of different opinions about what an idea or project was about or how to classify it in relation to certain criteria. Furthermore, in those situations in which they experience ambiguity, it was difficulty for decision makers to build a judgment about a project or an idea. Since PPM literature argues that organisations

should try to deploy different routines to deal with different types of innovations (Bessant et al., 2011) it raises the questions of how decision makers approach a decision situation when they are not able to build a prior judgment on an idea or project.

5.2.2 Managing ambiguity in PPM decision making

The empirical data indicated that, when experiencing difficulties for building a judgment, decision makers often recommend that the person presenting the idea should carry out some activities to develop the idea a bit further: *“In some way it must fit into the strategy....But even if it does not, and it is interesting enough, I, as a Technical Manager, do not close the door too early... we let it in, for it to go one more turn. It can end up fitting in somewhere else, although I do not see it just in the moment.”* (Technical Manager). Decision makers might recommend explaining the idea to a technical expert when they find that it contains a new technical solution, its feasibility is not clear or when it relates to a specific technical area. They suggest talking to someone from the marketing department when they find it difficult to judge the value for the user. Sometimes, the recommendation is to talk to other people in order to just get the idea known within the organisation. Other times they suggest carrying out tests, building prototypes, searching for information or developing different ways of communicating the idea, such as drawings, plans and presentations.

Allowing the idea to be further developed might lead to understanding a purpose of the idea, making many people to find out about the idea and developing a view on it. Sometimes these actions might lead to discovering opportunities that were not in the original definition of the idea – as one respondent told when he presented an idea to a board of experts. The experts discovered a technical problem that was not solved in the proposal. They asked him to think about how to solve it and to come back some days later. When he came again, now with the technical solution of the specific problem, the board felt that the idea was still not good enough, but the technical solution was very interesting. So the solution became a new idea that was further developed, but the original idea was not developed any further.

Thus, when decision makers experience confusion, difficulties or the existence of opposite opinions when evaluating an idea, then they allow the idea to be further developed, making sense of the original situation of confusion and conflict. However, to develop further a product idea with the purpose of making sense of it, implies to taking action before being able to make a judgment and making a decision. But if action precedes judgment and decision, how is this pattern of decision making to be understood?

5.2.3 The intelligence of action

March (1994) asserts that, in traditional visions of decision making, meaning is created with the purpose of making decisions. People interpret their situations and experiences in order to make decisions. For example in logic of rationality people make interpretations when predicting future consequences and future preferences. In logic of appropriateness, interpretation helps to identify appropriate identities and rules. However, there is another perspective that considers that decisions are made and actions are taken with the purpose of achieving meaning. Meaning is not established to make decision; instead decisions are made to establish meaning.

The results suggested that when experiencing confusion, decision makers are not able to make judgments on ideas or projects. They found it difficult to judge if something was good

or bad, had potential or not, fell inside strategies or outside them, or was to be considered as innovative or incremental. Weick (1995) asserts that in ambiguous situations, more objective information may not resolve any misunderstandings. Instead, taking action (enactment) is what might allow to derivate new kind of information from which to make sense of a confusing situation. This is the reframing activity that Bessant et al. (2011) suggest for approaching the selection of ideas with a higher grade of innovativeness.

Thus, when decision makers allow the idea to be developed a bit further, it could be seen as taking action before achieving a decision on the idea. Intentions do not precede decisions because of the emergent and informal nature of the development process. Preferences are not known because decision criteria have no clear meaning when the idea is related to it. March (1978) states that in this pattern of behaviour, choices are justified because of their posterior consistency with goals that have themselves been developed under the same interpretation process. If the choice was right, it would be discovered afterwards.

5.2.4 Decision making as patterns of local interactions

The results indicate that, sometimes, the process in which decision makers build an understanding and a judgment of an idea or project, it is difficult to be detached from the process in which the idea or project is developed. Sensemaking, decision-making and development processes are intertwined. Accordingly, Bragd (2002) observed that in the development of a new car, instead of a conscious choice between alternatives of action, decision making occurred when the project team found a “direction” towards which actions would be started. Stacey (2007) states that in the self-organised interactions between people, they choose their next actions in response to others. He argues that from this perspective, choices, decisions and intentions are inseparable from other forms of action. Bessant et al. (2011) argue that radical innovations may emerge in a process of co-evolution, that is, with the active participation of decision makers and other stakeholders in the development process. As a synthesis, Kijkuit and van den Ende (2007) assert that whether an idea is selected or not depends on a process in which both the idea and the decision criteria are interpreted and refined.

But, how are small steps in the development of an idea related to the whole process that lead to the final selection of an idea? How do those patterns of decision making evolve in a general organisational-wide pattern of selection, resource allocation and complete development of a new product? And how are those small sensemaking and development processes related to the realization of an intended overall business strategy? Griffin et al. (1999) assert that new knowledge can be understood as emerging in local interactions between people. When people interact with each other, new patterns of relationships emerge. Nonaka (1994) states that it is in the social interactions that the tacit and explicit knowledge created by individuals becomes amplified and as more actors become involved it crystallizes as a part of the knowledge of the organisation. In other words, organisation-wide patterns of action emerge in the local interactions (Stacey, 2007).

Accordingly, the descriptions that respondents gave about developing further an idea for overcoming an ambiguous situation, could be considered as a pattern of local interaction. Taking action for making sense of an idea or project, it would be understood as one step in the evolving process of developing a new product idea. Thus, PPM decision making can be viewed as local patterns of decision making that arise in the self organising interactions between people and will evolve along the idea or project is further developed.

5.2.5 Summary of findings related to the second research question

The second research question intended to explore how decision makers approach situations of evaluation and selection when they experience ambiguity. The findings indicate that when decision makers experience PPM decision situations as ambiguous, they might find it difficult to choose which decision criterion is more relevant for evaluating an idea or project; or they might find it difficult to place ideas or projects in pre-defined categories, such as alignment to business strategies, potential profitability, radical or incremental levels of innovativeness, etc. In those situations, they decide to take action in order to extract information that makes it possible to overcome a state of confusion and conflict. Decision makers engage in local interactions with other people, in which the idea or project is developed a bit further. It is a decision-making logic in which actions are taken first and intentions and preferences are discovered afterwards. This sensemaking process gives meaning to purposes, extracts relevant criteria, classifies projects and ideas according to criteria and makes judgments according to preferences.

The findings presented before allow for explaining how the interpretative and subjective aspects of social experience manifest in PPM decision making and how they influence the way in which decisions are approached. That is, from the perspective of the decision maker, it is the experience of a decision situation, which influences which steps are taken to make sense of ideas and projects in order to build a judgment about them. That implies that the classification of ideas and projects in certain categories, is rather an output of the decision-making process than a variable that determines how the process is approached. The understanding of ideas and projects in terms of different types is constructed by decision makers in an intertwining process of decision making, sensemaking and product development. Thus, when experiencing ambiguity, decision makers display a pattern of decision making that is based in informal activities and a logic that is different from the rational one. This pattern is a first step in a sequence of patterns of decision making that evolve along the idea or project is further developed.

6 Supporting the evaluation and selection of ideas and projects

The findings from the analysis of the interview studies presented in the previous chapter, allow identifying some challenges that decision makers experience when evaluating and selecting different types of ideas and projects. Dealing with the legitimacy of different approaches, participating in self-organised interactions between people, and cognitive processes of interpretation, are some of the aspects that characterize the way in which decision makers face the presence of different types of ideas and projects. The question that arises is what these findings might imply for the daily practice of PPM. That is, how companies could support decision makers when evaluating and selecting ideas and projects. But, to what extent is a process affected by legitimacy, spontaneity and cognition able to be supported? What is supposed to be supported? And how?

This chapter aims to explore how companies can support decision makers when evaluating and selecting different types of ideas and projects in product development. It integrates the analysis and findings from interview studies presented in Chapter 5 with the analysis of the observation studies carried out in workshops I, II and III. First, a theoretical discussion of whether it is possible to manage different aspects of PPM decision making is made. Then, the activities carried in workshops I, II and III are presented and analyzed. Finally, a supporting method based on activities of reflection that would enhance decision maker's capabilities to make PPM decisions is discussed.

6.1 How can PPM decision making be supported?

As discussed earlier, a flexible PPM decision-making process in which different approaches are allowed to be used implies a dynamic interaction between local patterns of decision making and formal PPM structures. Local patterns are informal and self-organising activities in which small steps are taken in the development of ideas and projects in order to make sense of them. Rowland (2004) argues that viewing knowledge from a social constructionist perspective, in which it arises in a self-organised process of interpretation and social negotiation through which shared meanings are developed, it raises the question of management influence. Although several scholars agree that knowledge creation involves self-organised interactions between people, opinions diverge when it comes to discussing how companies might promote and control those interactions. Therefore, in this section, the discussion focuses on which aspects of PPM decision making might be supported in order to acquire a flexible decision-making process.

Nonaka (1994) understands innovation as a process of knowledge creation that starts with individuals' tacit knowledge. In self-organised social interactions, new knowledge is created through a continual cycle between tacit and explicit knowledge. In this process, the new knowledge is also amplified to other people within the organisation. This self-organised process, at some point, interplays with a process of justification of knowledge, that is, the

decision-making process in which new knowledge is screened according to what is worthwhile for the organisation. The innovation process is, according to Nonaka, able to be managed by creating the conditions that trigger the process of organisational knowledge creation. For example, leaders might propose challenging goals. It provokes a “creative chaos”; a crisis in which people feel that existing knowledge is not enough to deal with the situation.

However, other scholars argue that those social interactions are not possible to be neither managed nor controlled from the outside. Griffin et al. (1999) state that it is the self-organised interaction of individuals that produces emergent patterns (innovations), and it cannot be provoked by creating structures where individuals are supposed to act, discuss and diffuse knowledge. Accordingly, Stacey (2007) states that self organising means that human agents choose and intend their next actions in response to others. In that way, general patterns of action cannot be chosen by anyone, but, rather, these emerge in the interplay of individual intentions and choices in local interactions. In relation to Nonaka’s (1994) suggestion, Griffin et al. (1999) argue that it is not an “externally created chaos” but the characteristics of the relationships between individuals that generate the dynamics determining the results of the interaction. The only way of influencing those interactions is through an active participation within them.

In this thesis, there is no intention of taking one or another position regarding the management of self-organising social interactions in innovation processes. However, it is assumed that formal PPM structures and local informal interactions are two different systems that paradoxically coexist (Stacey, 1998, 2007). Then, the focus is placed on the interplay between informal interactions and formal structures and how it influence PPM decisions. Therefore, as an implication on the management of PPM it is explored how decision makers’ awareness regarding their participation in self-organising interactions can be enhanced.

6.2 The reflective decision maker

Reflection is considered to be fundamental for the improvement and increasing quality of any activity. According to Argyris (1976, 1977), people are, to some extent, unaware of the way in which they act. There is a difference between the theories of action that people report and the theories in use, that is, how people actually behave. Becoming aware of theories in use might contribute to detecting deficiencies and correcting them. In the context of decision making in innovation processes, Nonaka (1994) states that it is indispensable that managers maintain a continuous self-reflection about those standards that are used to screen new knowledge in order to increase the quality of the innovations.

Thus, in workshops I, II and III that were carried out, respectively, in companies B, D and E, supporting activities for PPM decision making were explored. The purpose of the workshops was to design diverse decision scenarios that could enhance decision makers’ awareness about their own way of making decisions and to critically reflect on them. Following Kolb’s (1984) learning model, the workshops intended to combine simulating decision situations (concrete experience), giving feedback from research results and theoretical studies (abstract conceptualisation), with discussions about how decisions are made (internal reflection) all of that would increase decision makers’ awareness of certain aspects of decision making and change their way of making decisions (active experimentation). The workshops focused on three main aspects of PPM decision making: matching decision-making approaches with

decision situations, participating in local patterns of decision making and sensemaking processes in decision making.

6.2.1 Reflecting on matching decision approaches with decision situations

In workshop I, carried out in company A, decision makers were told to rank five ongoing projects. First, they evaluated the projects using only financial estimations, and then they repeated the exercise using qualitative criteria. A similar scenario was created in workshop III, in company E, in which decision makers were instructed to rank five ongoing projects using a scoring model. Then, they had to imagine a situation in which one project from the list had to be eliminated, and they had to decide which of the projects should be chosen.

In both workshops, decision makers reflected and discussed the suitability of different types of criteria and methods to evaluate the projects. In workshop I, decision makers discussed the appropriateness of financial methods to evaluate certain projects. They also reflected on the consequences of applying certain approaches for making PPM decisions without considering their suitability. In workshop III, the scenario in which a scoring model was used to evaluate projects led to a discussion about the appropriateness of a recently implemented software product to support decision making. The software was intended to support decision making in formal meetings by ranking with a scoring model. Decision makers expressed their concern over the lack of flexibility of the scoring model included in the software. They considered that in some complex situations more aspects than the ones included in the model should be taken into account and sometimes only a holistic intuitive view could define which choice is preferable. They talked about gut feelings and intuition as aspects of decision making that would be difficult to include in the scoring model.

The goal of the exercises was to promote a reflection on which type of decision criteria and methods should be suitable to be applied in a certain decision situation. Gustafsson's (2004) study of entrepreneurial decision making shows that experienced decision makers tend to recognise the nature of the decision situation (in terms of grade of uncertainty and structuration) and adapt their decision-making approach (in terms of the use of intuition or analytical procedures) in a more appropriate way than inexperienced ones. What is more, she also asserts that recognising the nature of decisions and matching them with the relevant approaches is a competence that can be learned and developed. Thus, one aspect of decision making in PPM that could be supported is to help decision makers develop capabilities for the recognition of different decision situations and apply the most suitable approaches to each decision.

6.2.2 Reflecting on participation in local patterns of decision making

In workshop III, carried out in company E, one manager was asked to suggest a radical idea. It had to be a new product whose functions, users and markets were different from the ones the company currently developed and sold. The idea was about a new opportunity in the market that could be fulfilled by combining two different bodies of knowledge existing in the company. During the workshop, decision makers were instructed to imagine that they meet a person, in an informal way, who tells them about this new idea. Decision makers had to read the idea and write down the feedback they would give to this person, all in just one minute.

After the exercise, decision makers first discussed what could have happened if this informal meeting had not happened, e.g. what could have been the alternative ways of presenting the

idea. Someone talked about routines to manage those early stages, to avoid forgetting the good ideas. One decision maker argued that it could take years to recover a good idea that had been forgotten in an informal channel. Then they discussed the responsibility that decision makers participating in informal decision situations face. For example, the importance of encouraging the person that present an idea to develop it further was reflected upon, and how they, as decision makers, might facilitate this development. Finally, the ambiguity that might be experienced in those informal situations and what should be done in the situation where they do not fully understand the idea was discussed. The need to facilitate some small steps in the development of the idea, although it was still ambiguous, was also reflected on.

The goal of this exercise was to help decision makers reflect on their own participation in informal decision making and the effect that those decisions might have for PPM. In PPM literature, the focus is mainly placed on formal decision-making situations (Christensen and Varnes, 2007; Steffens et al., 2007). Accordingly, Stacey (2007) states that in rational decision making a decision is normally thought of as a sequence of activities that can be identified by a specific point of time. He says that, however, when focusing on social interactions, choices and decisions are inseparable from other ways of action. In relating to each other, people are always simultaneously constraining and enabling each other's actions. From this perspective, the focus is the responsive manner in which people interact with each other and how those emerging patterns, in local interactions, might escalate to major changes. Thus, another relevant aspect of PPM decision making to be supported is acquiring awareness about the influence that informal local interactions have on which ideas and projects are, in fact, selected and developed.

6.2.3 Reflecting on sensemaking in decision making

In workshop II, carried out in company D, decision makers had to rank a group of six ongoing development projects, choosing the criteria they thought were relevant. After that, they were told to discuss which criteria they used to rank the projects. Then, they discussed the meaning of the decision criteria and the way in which they were supposed to be used when making decisions. For example, they discussed the classification along levels of innovativeness, where some ideas for new products were new to the whole market and others were only new to the company. They also discussed how the criterion of strategic alignment should be used to evaluate ideas that aim to explore new technological solutions and commercial opportunities.

A similar exercise was carried out in workshop III, in company E, but in this case decision makers were instructed to discuss just the meaning of decision criteria, isolated from ideas and projects. For example, they had to give meaning to the expressions: "what we do", "what we should do", "what we would like to do", "what we can do" and the respective negations of each criteria: "what we do not do", "what we should not do", "what we would not like to do" and "what we cannot do". Then they were told to relate some ideas and projects to the decision criteria. Decision makers reflected on the difficulty of giving meaning to decision criteria when there are no ideas or projects to relate them to.

The goal of these exercises was to make decision makers aware of the sensemaking process that is embedded in PPM decision making. According to Fiske and Taylor (1984) cognitive processes are to a great extent unconscious for people. Considering ideas without given decision criteria contributed to discussing extracted cues (Weick, 1995), that is, the limited

portions of reality that are spontaneously taken into account to make sense of a situation. It enabled the comparison of different aspects that each decision maker evoked to make sense of an idea or project in the absence of predefined criteria. Besides, considering ideas and projects isolated from decision criteria allowed the decision makers to experience the relational aspect of sensemaking. That is, according to Weick (1995), the most basic form of meaning creation which is composed by a thing, a relation and another thing. He expresses it in this way: “a cue in a frame is what makes sense, not the cue alone or the frame alone”. In the exercises, the elements of this basic unit of sensemaking were decision criteria and the ideas or projects that were evaluated. The relational activity was to evaluate the ideas and projects in relation to the chosen criteria. Furthermore, according to Nonaka (1994), the use of metaphors, that is, understanding one thing in terms of another one, contributes to converting tacit to explicit knowledge, and to building concepts in conversation with others. In the exercise, instead of the criterion “strategic alignment”, decision makers had to use images that could represent the sense of what a strategy might be (“what we do”, “what we should do” etc). This contributed to discussing the current strategies and how clearly defined they were and how clearly understood they were.

Another exercise carried out in workshop III was to make a decision in a scenario in which some contextual factor was altered. The scenario considered one particular ongoing project that, because of its characteristics, was considered to be extremely strategically important. This project was highly confidential and access was restricted to company employees only. The exercise consisted of evaluating the project, but under the supposition that all the project information was accessible to the public and that the development process should be carried out in collaboration with external actors. Decision makers discussed the potential advantages and disadvantages of this kind of open development alternatives and how they would consider them when selecting projects. After that, they discussed the types of projects in which an open innovation approach could be appropriate. At the same time, they showed an awareness about the existence of a “not invented here” attitude in the company, that is, a tendency to reject proposals that imply a collaboration with external actors.

This exercise intended to force a situation of reframing (Bessant et al., 2010) by changing one established aspect of the organisational context. In other words, putting decision makers in a situation in which their established frameworks, to make sense of the world, no longer work (Weick, 1995). It was called the “not invented here” syndrome, that is, the spontaneous rejection of ideas that are not generated in the decision maker’s own company. Bessant et al. (2010) also pointed this out as a common problem for idea selection.

Summarizing, the observations described above indicate the relevance of increasing awareness of the importance of cognition in the recognition of new innovations and business opportunities (Bergman et al., 2007, Verganti, 2011), and that it is possible to design training activities that contribute to the development of this awareness.

6.3 Supporting PPM decision making

The analysis presented above identified several aspects of decision making that decision makers should be aware of in order to understand how their own participation in decision-making processes influence which ideas and projects are actually selected or rejected. Furthermore, it also suggested that this awareness is able to be developed through training activities. Three main aspects that decision makers should reflect on have been identified. First, the recognition of the occurrence of different decision situations and which decision-making approaches would be most suitable to be applied in each situation. Second, decision makers' own participation in informal decision making and the effect that those decisions might have for PPM. Third, the sense making process that is embedded in PPM decision making, in particular, the limited portions of reality that each decision maker spontaneously evoke to make sense of an idea or project in the absence of predefined criteria; the creation of meaning when decision criteria is connected to ideas or projects; and the reframing process that arise when established frameworks to make sense of the companies context no longer work.

The workshops described above indicate that it is possible to enhance decision makers' abilities to make PPM decisions by designing scenarios in which they experience decision situations and reflect on their own ways of making decisions. Scenarios in which decision makers are told to rank ongoing projects or to eliminate a project from a list, using different methods and type of decision criteria, seemed to help decision makers to develop capabilities for the recognition of different decision situations and apply the most suitable approaches to each decision. Scenarios in which a radical idea has to be evaluated and feedback given, all in a very short time, seemed to help decision makers to reflect on their own participation in informal decision making and the effect that those decisions might have for PPM. Finally, scenarios in which ideas and projects are considered isolated from decision criteria, the use of metaphors that represent decision criteria, and altering contextual factors, seemed to help decision makers to be aware of the relevance of sensemaking process in PPM decision making. Furthermore, because of the workshops are to be understood as training activities, they avoid the problems related to supporting decision making at the moment it happens (i.e. spontaneity, legitimacy, and unconsciousness). Thus, the workshops described above, are to be considered a possible way of operationalizing learning in decision making within organisations.

7 Discussion

In this section, the findings presented earlier are discussed in relation to the main assumptions and suggestions stated in PPM literature, and implications regarding the evaluation and selection of different types of ideas and projects are drawn. First, what legitimacy of decision-making approaches implies for the organisational control of PPM processes is discussed; then, what a flexible PPM decision-making process might imply; and, finally the implications of sensemaking for PPM research and practice.

7.1 Legitimacy and the tensions of flexibility

PPM literature has pointed out that achieving a portfolio with a certain mix between ideas and projects with different characteristics requires a flexible decision-making process to allow the application of the decision-making approach that is best suited to each decision situation (Bessant et al., 2011; Floricel and Ibanescu, 2008; Geraldi, 2008). It is suggested that different tools and approaches for making decision on ideas and projects are used depending on their level of innovativeness, the complexity of the technological and market system, the stage of development, and the grade of uncertainty and ambiguity in information (see section 2.2.2).

Previous research has pointed out that not all decision-making approaches have the same legitimacy, that is, the extent to which they are accepted within an organisation. Accordingly, the results indicated that decision makers put into practice some mechanisms that allow them to avoid drawing exclusively on the highly accepted approaches when they are not considered to be suitable, and to give legitimacy to the decisions that have been made by the lower accepted ones. Thus, how decision makers deal with legitimacy would influence their capability to embrace a flexible decision-making process.

However, PPM literature has not thoroughly considered the issue of legitimacy as a conditioning factor to achieve flexibility in PPM. Furthermore, PPM literature has mainly considered decision-making approaches to be neutral in relation to their organisational acceptance, or displaying a legitimacy that is able to be controlled by formal PPM structures. For example, it is suggested that informal activities might be managed by quasi-formalised approaches in which, at the same time, formal and informal approaches are allowed (Olausson and Berggren, 2010); or by loosely coupled resources, that is, resources that are formally assigned but that decision makers are allowed to allocate to informal activities (Stilling and Eskerod, 2008).

Accordingly, Aubry et al. (2007) argue that one missing link between the complexity of the reality in PPM and the current research literature is related to the continuous process of imposing rules to manage processes. The development of an innovation might be facilitated or constrained depending on how decision-making rules are made and how they are followed.

Furthermore, Aubry et al. (2007) state that rule making might cause tensions between PPM and other functional units, or even between different structures within PPM, such as portfolio managers and project managers. Thus, PPM literature has not thoroughly taken into account the organisational complexity that makes some approaches more accepted than others.

Legitimacy is affected by internal power relations that allow some groups to influence what is considered to be proper decision-making procedures and proper justifications for decisions (March, 1994), by epistemological assumptions about the value of objective knowledge (Jankowicz, 2001), and by what is regarded as proper practices among external and internal stakeholders and by values rooted in a more general societal level (Brunsson, 2007). This means that individual decision makers, groups and organisations in general do not totally control all the factors that might influence the legitimacy of particular decision-making approaches. Furthermore, Stacey (2007) argues that some innovations might affect the current power relationships within an organisation. That explains why, sometimes, it is not possible to start projects and other activities in an open and explicit manner, and because of that people act in informal ways. Thus, both the factors affecting legitimacy and the organisational dynamics to manage innovations, question the assumption that legitimacy of decision rules can be completely controlled and designed by formal PPM structures.

Achieving balance in PPM requires managing a decision-making process through different approaches, something that might create tensions and conflicts across the organisation (Bessant et al., 2011). The issue of legitimacy, and the way decision makers deal with it, suggest that achieving flexibility in PPM is not as simple as combining different decision-making approaches. Rules and methods for decision making are influenced by the acceptance of multiple actors across the organisation. The fact that an innovation becomes selected and developed in the form of a project depends on how decision rules are negotiated and accepted. The mechanisms presented in this study, by which decision makers deal with the legitimacy of the decision approaches, might be viewed as a manifestation of how PPM decision makers try to manage the tensions that a flexible decision-making process implies.

7.2 The paradox of flexibility

As it was stated before, a flexible PPM decision-making process, in which different approaches are allowed to be used, might create tensions and conflicts across the organisation. The findings presented in sections 5.1 and 5.2 identified one of the possible consequences of a flexible PPM process. That is, when decision makers experience a decision situation to be ambiguous, to make sense of it, they allow the idea to be developed further. In social interactions people decide to take action in order to make sense of a confusing situation. It implies taking action before being able to make a judgment regarding the worth of the idea or project in relation to organisational goals. The analysis of this pattern of decision making leads to the identification of an underlying logic, through which it is possible to consider this way of proceeding as appropriate.

However, this pattern of decision making presents important implications when taking into consideration its interaction with formal and rational decision-making processes as they are defined in the main body of PPM literature. First, the heuristics that people use to adapt their rationality (Eisenhardt and Zbaracki, 1992), making estimations (March, 1994) or choosing which logic of decision making to rely on (March, 1978) is not free of biases. That means that although the local patterns of decision making, as described earlier, might be considered

to be appropriate in relation to a particular decision situation, nothing ensures that the idea or project that in fact is further developed contributes to fulfilling organisational goals. Second, local patterns of decision making might imply informal activities that affect the formal resource allocation process. Stilling and Eskerod (2008) had already observed that projects driven in informal ways might use a considerable amount of resources, affecting the planning and allocation of resources in PPM.

This takes us back to the PPM literature and the main problems that a PPM process aims to solve. In fact, two of the principal organisational needs that PPM research aimed to address are how to select a group of ideas and projects that contributed to portfolio balance, value and strategic fitting and how to solve the chaos in resource allocation among projects (Cooper et al., 1998; Engwall and Jerbrant, 2003). Thus, a flexible PPM decision-making process in which people are able to act within formal processes and use rational approaches, at the same time that they may act in informal ways and use non-rational approaches, implies a paradox. On the one hand, it enables the achievement of balance between different types of innovations by allowing certain ideas and projects to overcome a state of ambiguity. On the other hand, it implies, at the same time, the risk of bias in decisions, a lack of transparency in the decision-making process and activities that alter the planning of resource allocation. The risk of biases and the interferences in the resource allocation process seem to be unavoidable consequences of the dynamics by which decision makers achieve flexibility.

One factor that might explain the occurrence of this paradox is that a flexible PPM process implies applying decision-making approaches with different logics. Relying on March's (1994) distinction of intelligence, it could be said that from a logic of consequences one would see intelligence in a decision process that, after some years, provides successful products in the market. While from a logic of appropriateness, one would see intelligence in the fitting between a decision situation and a decision approach. In other words, different logics mean different ways of understanding what a good decision is and different ways of considering the consequences of patterns of decision making on resource allocation.

This way of viewing the chaos in resource allocation, which often affects multi-project organisations (Engwall and Jerbrant, 2003), as related to flexibility in PPM decision making suggests that it seems to be more difficult, than has earlier been discussed in PPM literature, to discern whether a pattern of decision making is considered to be intelligent or dysfunctional. In other words, whether the resource allocation chaos is considered to be a problem to be solved or an unavoidable consequence of a flexible process.

7.3 A sensemaking perspective of PPM decision making

PPM literature has mainly considered decision-making situations and the objects of decision making from an objective perspective. That is, ideas and projects are viewed as objective entities, reified in written definitions or prototypes (Fonseca, 2002). Decision criteria are already defined at the moment the decision is made, and is embedded in decision routines, methods and processes. Moreover, the heterogeneity among ideas and projects also seems to be considered from an objective perspective. Ideas and projects are mainly presented in PPM literature as being incremental or radical, low-risk or high-risk, based on exploitation or exploration, etc. As a consequence, from this perspective, the problem of how to manage decision making in order to achieve an intended mix of projects is reduced to fitting a certain type of idea or project with a certain type of decision-making approach.

However, the findings presented in section 5.2 suggest that this objective perspective is not enough to understand how an idea or project evolves to the point at which decision makers are able to classify them according to a given criterion and build a judgment on it in relation to its selection or rejection. What is missed by this view is how decision makers make sense of ideas, projects and decision criteria, and as a result of this, how a certain pattern of decision making evolves. The facts that an idea is an incremental or a radical innovation; falls inside the strategies or outside; is worthy in spite of being unprofitable, it is the result of a collective process of interpretation. In other words, the process of evaluation and selection does not start with an objective idea or project that might automatically be classified in a pre-defined category. Instead, it is the results of a sensemaking process where ideas, projects and decision criteria are understood at the same time they are created.

Weick (1995) argues that there is a sensemaking process that precedes rational decision-making processes, in which are defined what the decision is about and people's understandings of cause-effect linkages and preferences. Thus, a sensemaking perspective would contribute to a critical view of those aspects that have been considered in PPM literature mainly from an objective perspective. Such view would also contribute to a better understanding of what Berger and Luckmann (1967) describes as the interrelation between objective realities and the subjective and social process of construction of those realities. It would allow PPM research to expand its focus and consider decision making from a more complex and complete perspective. For example, not only investigating how to select new ideas, but also how an idea becomes what we call "an idea". Not only focusing on how to tell bad ideas from good ones, but also how an idea comes to be understood as good or bad. Not only exploring how incremental or radical innovations should be handled, but also how an idea comes to be understood as incremental or radical.

Some PPM research has already started taking this approach, e.g. focusing on reframing and coevolving for the selection of ideas in innovation (Bessant et al., 2011), creating new meaning as a way of discovering new applications of technological opportunities (Verganti, 2011), managing ambiguity in product development (Brun et al., 2008, 2009), intertwining decision and development processes (Kijkuit and van den Ende, 2007) and sensemaking of decision-making rules (Christiansen, 2008). It is the shift on the research focus that Burrell and Morgan (1979) assert implies when a subjective view is taken on certain phenomena: some conceptual categories that were considered to be tools of analysis now become the object of analysis.

7.4 Managerial implications

The findings indicate that a flexible decision-making process implies that decision makers might put in practice certain approaches that are less accepted within the organisation, they might participate in informal and self-organised activities, and that they might engage in processes of interpretation that are, to some extent, unconscious. Thus, managers should be aware that, some aspects of the evaluation and selection process might be difficult to be designed from the outside or managed at the moment it happens.

This implies that only building up formal structures for organising and supporting decision making as it is suggested in PPM literature is not enough for facing the challenge of evaluating and selecting different types of ideas and projects. Instead, in order to acquire a dynamic decision making that allows different types of projects to be selected, companies should actively improve the quality of participation in the social interactions in which ideas, projects and decision criteria are interpreted in an intertwined process of sensemaking, development and decision making.

The findings of the analysis of the observation studies indicate that decision makers should benefit from developing awareness of their own participation in decision-making processes. Three main aspects that decision makers should reflect on have been identified: the recognition of which decision-making approaches would be most suitable to be applied in each situation, decision makers' own participation in informal decision making, and the sense making process that is embedded in PPM decision making. Training activities in the form of scenarios that simulate decision situations, as the ones described in Chapter 6, seem to be a way for improving the quality of decision-making processes, by enhancing decisions makers' awareness of crucial aspects of PPM decision making.

8 Towards a framework for PPM decision making

This chapter aims to elaborate a synthesis of the findings and discussions presented before. Additional theoretical insights are integrated to the analysis made before for building a framework that allows describing the process of evaluation and selection of ideas and projects from the perspective of the decision maker; and the dynamic through which this process evolves along ideas and projects are further developed.

8.1 PPM from decision makers' perspective

The framework that describes PPM decision making from the perspective of decision makers, focuses on the interactions between decision makers and other actors, how those interactions influence the way in which the processes of evaluation, selection and resource allocation are approached, and how those patterns of decision making evolve over time determining which ideas and projects become actually selected or rejected.

It has been identified three types of interactions whose interplaying influences PPM decision making (see figure 8.1). The first one, are the interactions in which people make sense of ideas and projects. The second one, are the interactions in which people aim to acquire resources in order to carrying out development activities. The third one, are the interactions by which decision makers try to deal with the organisational acceptance of decisions.

From the perspective of the decision maker, a decision situation starts when an idea or project is communicated in some way to the decision maker. How the decision maker experience the decision situation influences the way in which it is approached. If decision makers experience ambiguity, they might display a decision-making logic in which actions are allowed to be taken within self-organised social interaction, in order to making sense of the idea. This approach contributes to identifying purposes, relevant decision criteria, and connecting the idea to the selected criteria in order to make a classification that allows a judgment to be built.

Furthermore, the occurrence of these local patterns of decision making is conditioned by other people's willingness to participate or allow others to participate in those interactions. Decision makers have to negotiate resources with different stakeholders that often display a logic of defending the resources of their own projects. Thus the occurrence of self-organised interactions for making sense of ideas and projects is conditioned by how decision makers deal with a resource allocation process with stakeholders that display different interests and decision-making logics.

In addition, the way in which decisions and interactions occur is influenced by how decision makers deal with the legitimacy of the different approaches they put in practice. Decision makers put into practice some mechanisms that allow them to avoid drawing exclusively on

the highly accepted approaches when they are not considered to be suitable, and to give legitimacy to the decisions that have been made by the lower accepted ones.

Finally, the outputs of the interplaying of the three types of interactions are the negotiated meaning of the new knowledge, its classification along criteria, a judgment about its value for business and the decision on the next steps in its development.

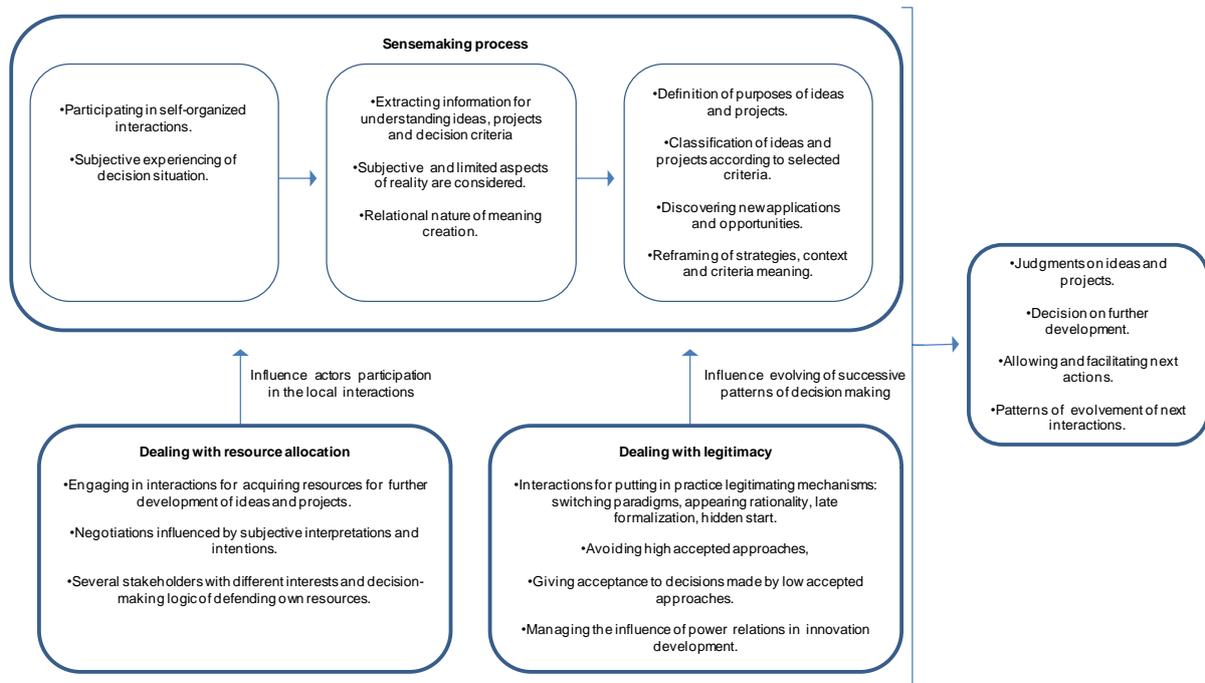


Figure 8.1. PPM decision making as the interplaying of three types of interactions.

8.2 The dynamics of PPM decision making

Project portfolio management can be viewed as a set of challenges produced by contradictory demands (Geraldi, 2008). In particular, the need of both short term profit and long term competitiveness, leads to a need of managing heterogeneous portfolios with different types of ideas and projects, and to achieving a balance between them e.g. incremental and radical ones. Furthermore, Stacey (1998) argues that organisations might be able to manage contradictory demands by a dynamics of interactions that produces patterns of change that are, paradoxically, unpredictable over time at the same time that order and predictable in the short-term. A fundamental characteristic of this dynamics is that interactions produce positive and negative feedback, that is, simultaneously reinforces or constraints the occurrence of changes.

The three interactions described before, implies viewing the management of project portfolios as contradictory demands that are managed through paradoxical interactions that simultaneously enable and constrain each other. Figure 8.2, inspired by Morgan (1997), illustrates this dynamics showing with plenty lines the positive feedback effects and with dashed lines the negative feedback effects. That is, the self-organised nature of sensemaking

8.3 Evolvement of ideas and projects as patterns of interactions

The continuous interplay of those three types of interactions influence the evolvement of an idea or project by determining the approaches that are put in practice in its further development and the legitimacy that the new knowledge finds in different actors within the organisation. As Fonseca (2002) describes it, if the acceptance of the new meaning that arose in self-organised interactions spreads among different groups in the organisation, then activities are taken in which the new meaning is integrated in information, experiments, prototypes, products, services, projects, activities in R&D settings, or any other artefact.

That an innovation evolves until it is formally selected and developed through an organised project in which resources are committed is the result of the interplay of a sensemaking process in which understandings and judgments are built, a negotiation about resources that influences the participation of people in informal interactions, and the way in which decision makers deal with legitimacy for influencing that the decisions made become accepted by other actors within the organisation (see figure 8.3).

Thus, the way in which decision making evolves, that is, the successive patterns of decision making that are going to occur along the idea takes further steps in its development, is influenced by how decision makers participate and interact with others in the three different types of interactions. It is the dynamic in which those interactions occurs that would influence which ideas and projects overcome a state of experience of ambiguity, and which ones would evolve to the point in which they become selected, acquiring a formal status, and resources are allocated to them to completing their development. In other words, those interactions and their interplaying over time influence that the current portfolio of projects displays an emphasis on a particular type of ideas or projects, and a certain mix between them.

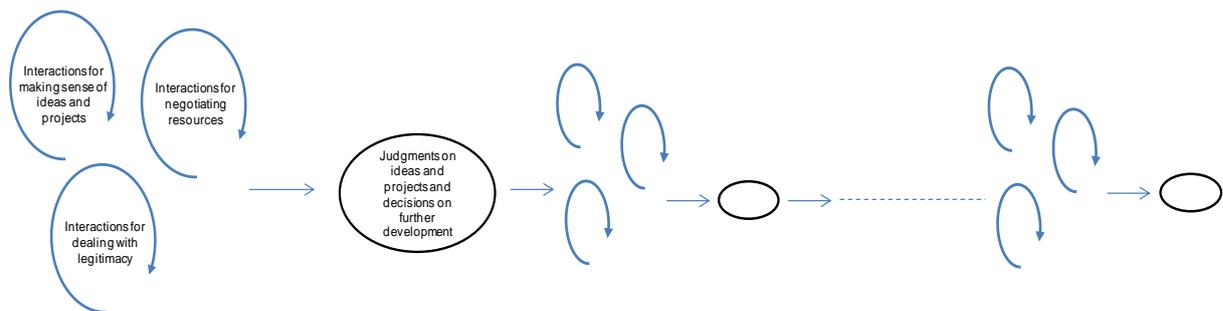


Figure 8.3 Evolvement of ideas and projects viewed as a result of pattern of interactions.

9 Conclusions

Product development has become an important competitive factor for most companies, contributing to an increase in profitability; the ability to cope with shortening product life cycles; and preparing the firm to be aware of what will be in demand in tomorrow's business. In most companies, product development is carried out in multi-project organisations, that is, through several simultaneous projects that are somehow dependent on each other. Thus, a central task for companies is to select which projects, often from a large number of ideas for new products, are to be developed in order to achieve strategic objectives. Project Portfolio Management (PPM) is the research discipline which focuses on the decision-making processes for evaluating, selecting and prioritizing projects.

Previous research has stated that since each type of project plays a different role and provides a different competitive contribution, companies must be able to identify, select, prioritise and commit resources to different types of ideas and projects. However, it is considered that PPM literature has not sufficiently investigated the challenges that companies might face when putting into practice different approaches to select different types of ideas and projects.

This thesis addresses the challenge of evaluating and selecting different types of ideas and projects through a flexible decision-making process in which different approaches can be used. The aim of the thesis is to investigate the process of evaluation and selection of ideas and projects from the perspective of the decision makers, focusing on how they combine formal decision-making processes with alternative decision-making approaches, and how decision makers manage the evaluation and selection process of ideas and projects when they experience ambiguity.

9.1 Main findings

It was found that different decision-making approaches display different levels of legitimacy, that is, encounter different levels of acceptance within an organisation. Therefore, the dynamics by which an idea evolves is affected by the way in which decision makers deal with the legitimacy of the decision-making approaches that they plan to put into practice. Thus, the fact that an idea becomes selected and developed in the form of a project depends on how decision rules are negotiated and accepted. However, the level of acceptance of decision-making approaches is affected by some factors that are outside the control of decision makers. As a consequence, decision makers put into practice some mechanisms that allow them to avoid drawing exclusively on the highly accepted approaches when they are not considered to be suitable, and to give legitimacy to the decisions that have been made by the less accepted ones.

Furthermore, in the process of evaluation and selection, decision makers engage in a sensemaking process where ideas, projects and decision criteria are understood at the same

time they are created. In other words, the fact that an idea is considered to be an incremental or a radical innovation; good or bad; something that the company should develop further or reject; is the result of a collective process of interpretation. This implies that the classification of ideas and projects in certain categories is actually an output of the decision-making process rather than a variable that determines how the process is approached. This questions the objective view by which PPM literature has treated decision-making situations and the objects of decision making, which assumes that ideas and projects are already defined at the moment the decision is made and able to be classified in pre-defined categories.

If decision makers experience ambiguity, they might display a decision-making logic in which actions are allowed to be taken within self-organised social interactions, in order to make sense of the idea or decision criteria. This approach enables the purpose of an idea to be identified, relevant decision criteria to be chosen, and the idea and the selected criteria to be connected in order to make a classification that makes possible a judgment to be built. However, the occurrence of self-organised interactions for make sense of ideas and projects is conditioned by how decision makers deal with a resource allocation process, in which they negotiate resources with stakeholders that display different interests and decision-making logics.

Both the self-organised nature of social interactions and the subjective nature of the interpretation process imply the risk of biases and alteration of how the resource allocation of product development is planned. It questions the way in which PPM literature has viewed the “chaos” in resource allocation that often affects multi-project organisations, as a problem related to poor practices. It seems to be more difficult than has been previously discussed in PPM literature, to discern whether a pattern of decision making is considered to be intelligent or dysfunctional, in particular, whether the resource allocation chaos is considered to be a problem to be solved or a probable consequence of a flexible process.

9.2 Contributions and implications

This thesis contributes to the research field of PPM by shedding light on issues that are relevant when trying to understand the challenge of evaluating and selecting heterogeneous ideas and projects in product development, and by integrating established theoretical areas to the analysis of empirical data. Three main theoretical areas were integrated: decision-making theory, sensemaking theory and complexity theory applied to organisations. In the following it is stated which contribution the integration of those theoretical areas gave to building an understanding of the evaluation and selection process, and the implications that those contributions imply for PPM as a research area and as a management practice.

Decision-making theory allowed behaviours that deviate from rational decision making to be understood as forms of rationality and to discuss their appropriateness in certain circumstances. In particular, when decision makers experience an ambiguous decision situation they display a decision-making pattern in which they allow the idea to be developed further before being able to make a judgment regarding the value of the idea in relation to organisational goals. This pattern of behaviour might be considered to be appropriate in ambiguous situations in which appropriateness is considered in relation to a pattern’s ability to create meaning. Furthermore, by introducing the concept of legitimacy, it was possible to conceptualise the observation that the levels of organisational acceptance of decision-making approaches were a key challenge for decision makers. It also contributed to interpreting four

patterns of behaviour as mechanisms that decision makers use to handle the issue of legitimacy: switching paradigms, appearing rationality, late formalisation and hidden start.

Sensemaking theory helped us to understand empirical data (e.g. observations of decision makers evaluating ideas and projects) as a manifestation of cognitive processes of interpretation of information. In that way, it was possible to describe sensemaking processes in PPM and discuss its relevance for the process of evaluation and selection. Furthermore, it also contributed to giving a theoretical ground to the suggestions that support the practice of PPM decision making. In particular, some aspects of the sensemaking process, such as its relational nature, extracted cues, enactment and reframing, lead to the definition of relevant issues that could be supported in practice. For example, the limited portions of reality that each decision maker would spontaneously evoke to make sense of an idea or project; the creation of meaning by relating decision criteria to ideas or projects; and the reframing processes that arise when established ways to make sense of the business and technological context no longer work.

Complexity theory applied to organisations enabled an understanding of the connection between informal interactions between people and the process of creation of innovations. Furthermore, it also contributed to understanding the process of selection and evaluation as the interplaying of different types of interactions: the interactions in which people make sense of ideas and projects, the interactions in which people aim to acquire resources in order to carry out development activities, and the interactions by which decision makers try to deal with the organisational acceptance of decisions. Through this viewpoint, the issues that PPM literature has considered as isolated problems to be solved appears here as interconnected consequences of a dynamic interaction, contributing to a dialectical and paradoxical view of the process of evaluation and selection. In particular, the problems for fulfilling plans in resource allocation, the risk of biases in decision making, and the possibility that poor ideas are developed further for too long are understood as manifestations of a dynamic in which decision makers participate in interactions that influence how some ideas and projects become selected and prioritised and others are rejected and suspended.

Finally, in Chapter 8, a framework that synthesises the analyses and discussions of this thesis is presented. The framework aims to make sense of the evaluation and selection process from the perspective of the decision maker. It contributes to understanding the dialectical interaction between the objectively perceived world of ideas, projects and decision-making processes and the subjective and social processes in which this objective reality is constructed. At the same time, it tries to provide a view of the legitimatisation process expressed in the way in which decision makers deal with the levels of organisational acceptance of the different decision-making approaches. The framework also considers a dialectical view of the paradoxes that the management of product development implies, through a model that shows the mutual feedback effects between different processes (e.g. evaluation and selection, resource allocation) and the possible outcomes depending on the dynamics of their interaction.

9.2.1 Implications

The implication of the findings presented in this thesis for PPM research is the need to broaden its focus of attention, integrating certain issues as objects of investigation. In particular, the processes in which decision makers extract and interpret information, the legitimacy of decision-making approaches and the way decision makers deal with it. Furthermore, it also implies the need to investigate PPM from different perspectives in order to allow a critical view of the way in which PPM has been understood. For example, investigating decision-making from the perspective of decision makers, and integrating theoretical areas such as sensemaking and complexity sciences.

The implication for PPM practice is that a flexible decision-making process, in which different types of ideas and projects are able to be evaluated and selected, requires that decision makers put into practice certain approaches that are less accepted within the organisation. For example, they might participate in informal and self-organised activities and that they engage in processes of interpretation that are, to some extent, unconscious. Thus, it implies that only building up formal structures to organise and support decision making, as it has mainly been suggested in PPM literature, may not be sufficient to achieve a certain mix between different types of ideas and projects. Furthermore, this thesis also suggests that it is possible to enhance decision makers' abilities to make PPM decisions by designing scenarios in which they experience decision situations and reflect on their own ways of making decisions. Three main aspects that decision makers should reflect on have been identified: the recognition of different decision situations and the suitable ways to approach them; the consequences of participating in informal decision making; and the manifestation of processes of sensemaking in PPM.

9.3 Limitations of the study

The limited number of companies that were considered in this study does not allow for stating how certain contextual factors might affect the challenge of evaluating and selecting different types of ideas and projects in product development. For example, certain types of products and technologies, the competitive conditions of particular business, the size and organisational complexity of the companies, are aspects that might imply specific challenges for evaluating and selecting ideas and projects.

The research methods used in this thesis did not allow for observing decision situations at the moment that they happened in reality. It implies that some aspects of the real practice of decision making in product development have not been addressed such as mechanisms of social inclusion and exclusion. Furthermore, it was suggested that the observation studies carried out in the form of workshops could be a way of supporting decision makers. However, this thesis does not enable to state the impact that the use of the workshops would have for the practice of product development.

This thesis aimed to identify challenges in decision making from the perspective of the actors involved. That is, to give a "voice" to decision makers, in order to interpret their challenges. Thus, in accordance to Czarniawska (2008) and Alvesson and Sköldbörg (1994), through stating subjectivity as a source of knowing, this thesis does not claim for general validity and does not state a mirroring correspondence to reality. Instead, it intends to enable understanding within the domain of evaluation and selection of ideas and projects in the development of technologically complex products. That is, to give "words" to what decision

makers do and how they experience it and to allowed further investigation by making possible to talk and write about it.

9.4 Suggestions for future research

This thesis allowed for identifying some issues of PPM decision making that are considered relevant for improving the practice of PPM and that would need further investigation.

9.4.1 Designing methods for learning decision making

Although the workshops described earlier are to be considered a way of operationalize learning in PPM decision making, more research is needed for stating the effect that their implementation might produce in companies. Furthermore, it is needed to investigate how the different variables of its implementation affect its results, for example: the people that participate, the ideas and projects and decision criteria that are chosen for building the scenarios, etc. Finally, different types of exercises might be explored and their contribution to decision- making learning assessed such as the ones presented in Carleton et al. (2008) i.e., different ways of communication as physical prototypes, metaphors and theatrical performance for enhancing the articulation of complex and tacit knowledge, and allowing collective sense making.

9.4.2 Designing alternative formal decision-making channels

PPM literature suggests that ideas and projects that present a higher level of innovativeness should be managed by alternative development and financing processes. However, those alternative pathways have just been described in general terms. In particular, they have not been described as decision-making logics. One suggestion is to explore the design and implementation of a PPM decision-making process based on Sarasvathy's (2001) decision-making logic of effectuation. Sarasvathy states that when people create things that do not already exist, such as technologies, markets and firms, the rational assumption of decision makers with prior goals is not fulfilled. Instead of choosing from a set of alternatives to achieve a given and clearly defined goal, people might use a different decision-making logic. They might start with given means and choose between possible effects that can be created with those means. Some characteristics of the decision-making model of effectuation are: the definition of the affordable loss that the decision maker is prepared to face instead than maximizing potential returns, preference for options that create more options in the future instead of those that maximize returns in the present, focus on the controllable aspects of an unpredictable future instead on predicting and controlling it, exploiting contingencies instead of exploiting current competitive advantages. Thus, it would be interesting to explore how a formal decision-making process based on a logic of effectuation could be designed, implemented and integrated to the formal structure of PPM.

9.4.3 Exploring self-organised interactions

The observation studies were carried out in workshops in which decision-making situations were recreated. Although it helped for studying certain aspects of decision making, other aspects were not able to be grasped by this research approach. This is the case of the dynamics by which self organising social interactions occur. The self-organising nature implies limitations on the way research could be conducted. One suggestion for future research is to carry our studies based on participatory observations (Bryman, 2002). Shaw (2002) gives examples of how a researcher can participate in the informal networks of people

that want to promote change. In this type of studies, the researcher could engage in the interactions between other actors, being one in the group, and in that way being able to experience how the interactions between people might influence which ideas and projects are selected or rejected. It would make possible to understand essential aspects of interactions such as processes of social inclusion and exclusion and the influence of power relations (Stacey, 2007).

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