CHALMERS

Project Categorization Systems and Their Role for Project Portfolio Management

Master's Thesis in International Project Management & Project Management

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Abstract

Considering projects in isolation does not meet today's business requirements anymore. Instead, firms are forced to find new ways to cope with a multitude of single projects or projects grouped together in programs and portfolios. In a multi-project environment management complexity is reflected by the diverse nature of projects. Recognizing commonalties and differences between various types of projects becomes evident to employ efficient management methods. Project categorization systems are utilized for this reason. The research aimed to investigate the nature of project categorization systems and to identify their role for project portfolio management. To fulfil the research goals a conceptual framework was developed through a comprehensive literature review. The research approach was qualitative using a multiple case-study design. Data collection was multifaceted including semi-structured interviews and organizational documents. A total of six interviews were conducted within three companies. The findings demonstrate that organizations employ project categorization systems to adapt project management practices and assign the right competence of project manager to the right type of project. However, purposes of categorization systems can be extended to the strategic level for project selection and prioritization, balancing the portfolio and resource allocation.

Key words: project categorization, project classification, project portfolio management, program management.

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List of Abbreviations

PPM	Project portfolio management
PMO	Project management office
GPM	Group project model
GHC	Global hygiene category

Preface

In this study the use of project categorization systems for project portfolio management has been investigated. Interviews have been conducted from April 2011 to June 2011. The dissertation is a part of a M.Sc. Program in International Project Management at Chalmers University of Technology, Sweden and Northumbria University, England.

The work was completed with the assistance and support of many people, whose contributions with valuable ideas was much appreciated. Special thanks go to Inger Bergman for providing necessary support in the preparation and completion of this research. The author would like to thank Torben Grut for his recommendations in the initial stage of the research and for his help in contacting companies interested in this study. Appreciation and gratitude are granted to all participants of the research, who shared their expertise and knowledge and took time from their busy schedules to answer the interview questions. Finally, the author would like to express her thanks to her family and friends for their moral support and encouragement.

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Göteborg, September 2011

Nga Dao

1 Introduction

1.1 Background

Organizations today face a highly competitive environment characterized by rapid changes, increasing complexity, and threats from global competition. In their attempts to secure their own position and more essentially to improve their competitiveness, adequate strategies must be developed and implemented in the organization. From the corporate level, strategy can be deployed by portfolio management using programs and projects of different types and sizes as powerful tools. Projects are of diverse nature depending on the needs they serve. They might be categorized based on type or meaning of the project, the technology uncertainty, or on some format that fits the specific organizational tasks and character (Crawford et al., 2006; Fricke and Shenhar, 2000). Additionally, a variation in importance, urgency, and completion stage of projects exists (Fricke and Shenhar, 2000; Patanakul and Milosevic, 2009). There is common agreement in academia and among practitioners, that recognizing project diversity to adapt management practices and assign appropriate competences are key success factors. For this reason, project management literature offers manifold categorization frameworks to group projects with similar characteristics. The widespread use of projects to realize strategic objectives creates a multi-project environment within organizations. New challenges emerge and the concept of portfolio management evolved. According to PMI (2008) the categorization of projects is embedded in the portfolio management process. Several studies in the discipline of portfolio management (Cooper et al, 2000; Archibald, 2001) acknowledge the importance of project categorization referring to project selection, prioritization and resource allocation based on priority. However, there is a clear lack of research in organizational application of categorization systems.

1.2 Statement of Problem

Literature's attention has been shifting from merely project management to the broader set of portfolio and program management. It is well documented that the interest of industry in portfolio management is relatively young, but increasing. For now, the application of portfolio methods is more or less experimentally (Cooper et al, 2000) and still organizational performance suffers from poor portfolio management.

1.3 Statement of Purpose

The purpose of this exploratory research is to investigate the role of project categorization systems for project portfolio management. The unit of analysis will be firms using a methodology to classify projects in a multi-project environment. However, this area is quite broad therefore research aims to understand how project categorization systems are applied in reality and how these systems impact project portfolio performance.

1.4 Research Questions and Objectives

The research questions can be described as guidelines of the study and are posed to gain deeper knowledge in a specified field. The questions are 'How do firms approach project categorization?' and 'What is the role of project categorization in a multi-project environment?

To fulfil the research purpose and achieve the aim of the study the researcher identified following objectives:

- Understanding the nature of categorization systems
- Identify formal and informal project categorization systems
- Understanding the field of portfolio management, its main objectives and problem areas
- Identify the implication of project categorization for portfolio management

1.5 Research Methodology

The research commenced with a review of relevant literature in project portfolio management, project portfolio performance, project categorization systems, and project typologies. From there, a conceptual framework has been developed that guided the entire research process. That is followed by a qualitative approach designed as a multiple case study. This enabled the researcher to obtain open ended data and results have been tested against the conceptual framework. The selection of companies was driven by the need to ensure a wide range of project types. Three companies have been contacted rooted in different industries: telecommunication, consumer goods and technology equipment and machinery. In each case company two informants have been interviewed. The research stages are illustrated in Figure 1.1.

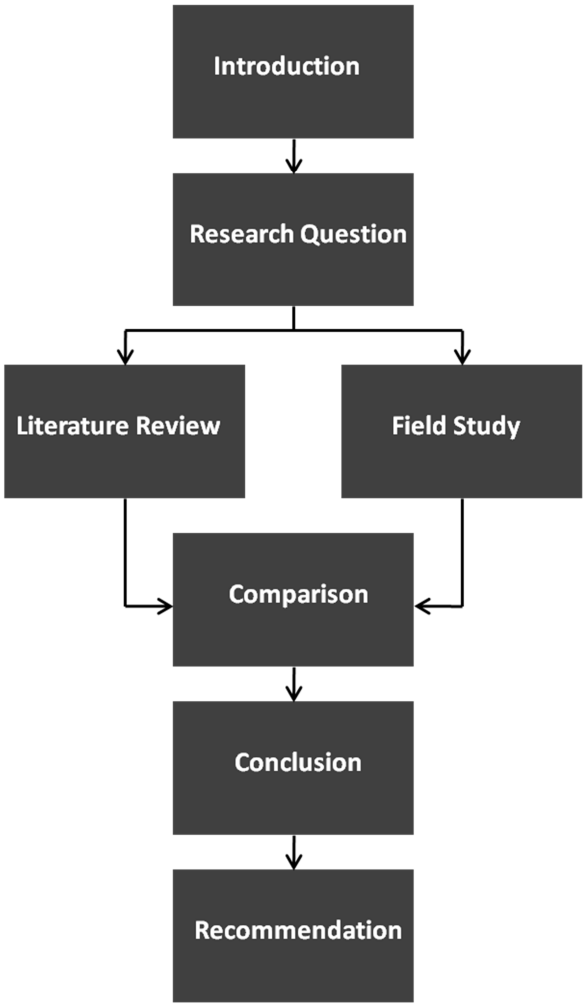


Figure 1.1 Research stages

1.6 Research Limitations

Some critic towards multiple case studies have been mentioned by Dyer and Wilkins (1991, cited in Bryman and Bell, 2003), in which it is assumed that the researcher pays more attention to the outset of the study with the focus on comparisons rather than on the specific context. A more open end approach is therefore recommended. Crawford et al., (2006) describe project categorizations systems as rather abstract concepts, that might be used implicitly and people are not aware of. This fact could be observed in some interviews and influenced the way questions were posed.

1.7 Organization of Dissertation

Chapter 1: Introduction

In chapter 1 the thesis is outlined and the background of the study is briefly described.

Chapter 2: Literature review

Chapter 2 contains the relevant literature reviewed in order to gain a basic understating of the research topic.

Chapter 3: Research Methodology

This chapter introduces the approach to research methodology involving issues that are crucial to undertake the thesis. Also the background of the cases is elaborated.

Chapter 4: Results

Data collected and findings drawing from data analysis are presented in chapter 4.

Chapter 5: Discussion

A discussion of research findings with regards to the research questions and literature is provided.

Chapter 6: Conclusion and Recommendation

Conclusion of the research study and recommendations for future work are stated.

2 Literature Review

This chapter introduces the main concepts of project portfolio and program management. The nature of categorization systems and the need for a systematic categorization of projects are then illustrated. Relevant project categorization systems are highlighted. Deriving from the literature review a conceptual framework is suggested to visualize the research.

2.1 Project Portfolio and Program Management

2.1.1 The Multi-Project Environment

In a multi project environment, single projects might be composed to portfolios and programs to facilitate their management. Some projects are managed individually depending on their scope and size. Based on the concept of Patanakul and Milosevic (2009, p. 217), the term multi-project or multiple projects management is defined as an *'organizational-level environment in which multiple projects are managed concurrently.'* also referred to as project portfolio management. Consequently, multi-project management is not an additional tool or method used for steering projects; moreover it provides structures and provisions to integrate projects and to create synergies. Patanakul and Milosevic (2009) demonstrate a possible organizational setting of multiple projects in Figure 2.1. The framework comprises of single project management (SPM), management of a group of multiple projects (MGMP) and program management all embedded in a portfolio. Commencing with SPM, this component is represented by a number of large projects mostly strategic in nature undertaken to achieve competitive advantage. Due to their scope and size a full time project manager is assigned to bear full responsibility. MGMP includes several smaller projects of tactical nature. These are grouped together and handled in parallel under the umbrella of one manager. The degree of mutual dependency is rather low as projects have different purposes and objectives. In a program projects are mutually dependent and share a common goal. To avoid repetition a discussion of program management is omitted at this point and detailed in section 2.1.5.

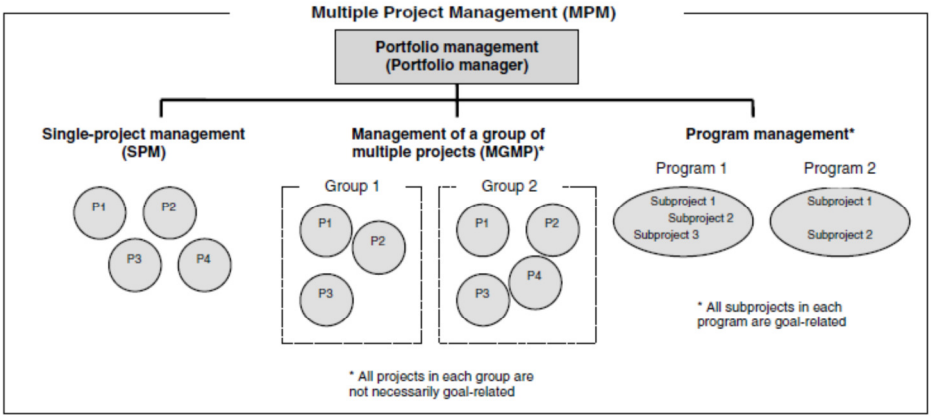


Figure 2.1 Multiple project management setting

The more divers the nature of projects carrying out simultaneously the more complex becomes its management (Gareis, 1991). The author suggests to define the overall project network and to consider the management of this network as an additional management discipline. A careful analysis of the network scope and relationships among projects is required when new projects are selected, benefits are evaluated, synergies need to be managed or competition exists.

2.1.2 Project Portfolio Management

Archer and Ghasemzadeh (1999, p. 208) define project portfolio as *'a group of projects that are carried out under the sponsorship and/or management of a particular organization'*. Similar a project portfolio is explained as *'a collection of projects or programs or other work that are grouped together to facilitate effective management of that work to meet strategic business objectives.'* by PMI (2008). Turner and Müller (2003, p.7) specify a portfolio as *'an organization (temporary or permanent) in which a group of projects are managed together to coordinate interfaces and prioritize resources between them and thereby reduce uncertainty'*.

The well-known objectives of project portfolios identified by work of Cooper, Edgett, and Kleinschmidt (2000) are value maximization according to business objectives, strategic direction, and portfolio balancing in alignment with strategy. Programs are initiated and projects selected by portfolio management according to criteria that allows the highest strategic fit (APM, 2006). Elonen and Artto (2003, p. 395) propose that portfolio management is about *'doing the right projects, creating a link from the projects to organization's strategy and, simultaneously adopting the long-term view*.' The PMI (2008) considers success of portfolio management as the portfolio's contribution to the strategic measures of the organization. *Project portfolio management*

as a managerial activity relates to the initial screening, selection and prioritization of proposals, the concurrent reprioritization of projects in the portfolio, and the allocation and reallocation of resources to the projects according to priority (Blichfeldt and Eskerod, 2008, p. 358). The process is dynamic and involves a continuous scanning of active and new entry projects. In doing so, a framework for decision making might be establish to do the right projects and to commit resources to them (Cooper et al, 2000). The PMI (2004, p. 367, cited in Dinsmore and Cooke-Davis, 2006) claims portfolio management process as a *'centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling of projects, programs, and other related work to achieve specific strategic business objectives'*. Figure 2.2 shows the process according to the PMI (2008), in which the process is claimed as a set of interconnected processes reacting to changes of the strategic plan by reviewing the aligning processes. Likewise, Thiry (2004) assumes a periodic and analytical portfolio management process.

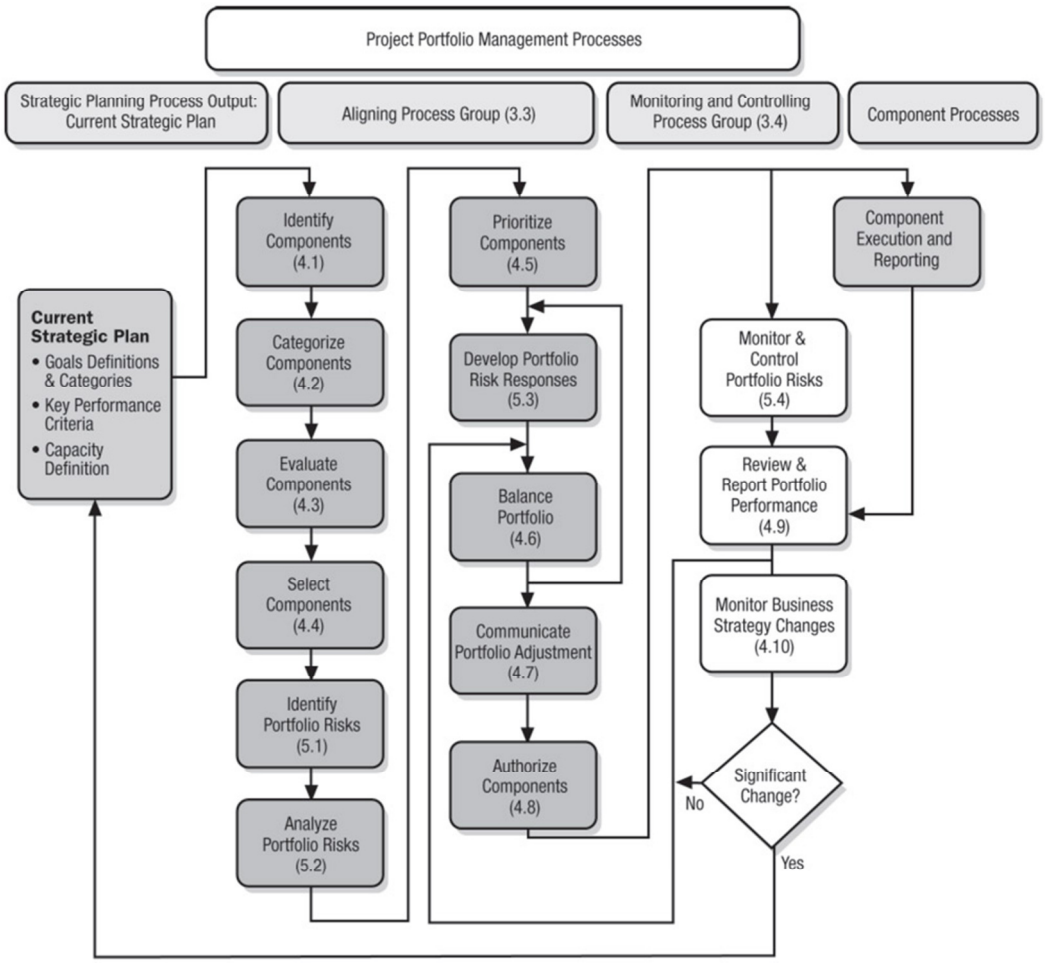


Figure 2.2 Portfolio management process

2.1.3 Project Selection and Prioritization

Several studies emphasize the importance of strategy conform project selection for portfolio success (Archer and Ghasemzadeh, 1999; Cooper et al., 2000; 2006; Killen, 2008, Müller, Martinsuo, and Blomquist, 2008). Archer and Ghasemzadeh (1999, p. 212) outline portfolio selection as '*the periodic activity involved in selecting a portfolio, from available project proposals and projects currently underway that meets the organization's stated objectives in a desirable manner without exceeding available resources or violating other constraints.'* They acknowledge the persuasiveness of high scores in project evaluation, thus picking the projects that have the highest value until all resources are consumed. However, this approach does not compose the optimal portfolio. A decision to start a project should be grounded in an analysis of the network of projects rather than considering projects in isolation (Gareis, 1991). This view is shared by Chien (2002) who argues that selecting of individual strong project does not lead to an optimal portfolio mix. Moreover the overall objectives of the portfolio have to be considered in the selection process. The author further notes that existing selection tools do not address the issue of interrelationships among projects and are deficient to evaluate nonmonetary variables like project diversity. Chien (2002) differentiates between four types of interrelation: outcome or technical, cost and resource utilization, impact and benefit, and serial. His research is limited to R&D projects.

Müller in cooperation with Martinsuo and Blomquist (2008) verify a positive correlation of portfolio selection with achieving portfolio results and achieving project and program purpose. Thereby, portfolio selection is about aligning projects with strategy and prioritizing them. Organizations identified as best performers tend to rely on strategy when selecting projects rather than on mere financial methods (Cooper et al., 2006, Killen et al., 2008). This approach includes allocating resources to different types of projects and leads to increased portfolio performance.

Organizations have in general two alternatives when deciding which projects to start Firstly, treating all projects equally the decision can be aligned to a scoring matrix. Secondly, creating categories and grouping projects in a meaningful way. Organizations might allocate a fix percentage of their annual resources to each category and selection process would occur within a category. The second option is supported by Archer and Ghasemzadeh (1999), who suggest higher level management to allocate resources to certain project categories ideally before selection of projects. Mikkola (2001) recommends five criteria to rank R&D projects: strategic fit, ability to increase revenue, ability to create market share, degree of product differentiation, and technology advancement.

2.1.4 Balancing

A project portfolio is well balanced in case that it '*enables a company to achieve the growth and profit objectives associated with its corporate strategy, without exposing the company to undue risks'* (Hill and Jones, 1992, cited in Mikkola, 2001, p. 426). High performing portfolios consist of the right mix of projects (Cooper et al., 2000) while the goal of value maximization is subordinate. This aspect focuses on non-monetary variables related to project selection and decision to balance the portfolio with regards to project type, risk level, and resource adequacy (Killen et al., 2008). The relevance of the dimensions project size and short-term versus long-term project is added by Archer and Ghasemzadeh (1999). Meskendahl (2010) elaborates that these dimensions might be mutual dependent e.g. long-term projects are correlated with large project size whereas a higher degree in innovation involves more risks. A balanced portfolio would limit the number of projects in a meaningful way, so that the resource bottleneck can be avoided (Adler et al., 1996).

2.1.5 Program Management

A program, according to the PMI (2008) is '*a group of related projects, managed in a coordinated way to obtain benefits and control not available from managing them individually*.' It refers to the interconnectedness of various project objectives in order to maximize accomplishment of combined project outcomes. Pellegrinelli (1997, p. 142) defines a program as '*a framework for grouping existing projects or defining new projects, and for focusing all the activities required to achieve a set of major benefits. These projects are managed in a coordinated way, either to achieve a common goal, to extract benefits which would otherwise not be realized if they were managed independently*.

The main emphasis of program management is efficiency and effectiveness through better prioritization, planning, and coordination in the management of projects (Pellegrinelli, 1997). In a program, projects can be decomposed into subprojects and activities are reasonably sequenced to facilitate the management, which is then centralized and coordinated. Similar to portfolios programs embrace a strategic facet. Through programs organizations are able to obtain a business focus by adapting project objectives to their requirements (Lycett et al., 2004; Dinsmore and Cooke-Davis, 2006). Thiry (2004) mentions two main features of a program, cyclic processes and interdependabilty that make a program an ideal tool to link projects to business objectives. The cyclic process involves stable periods in which benefits can be harvested and decisions to reduce ambiguity are made. The second characteristic allows strategic alignment. The program environment faces high uncertainty and complexity (Pellegrinelli, 1997; Thiry, 2004; Dietrich, 2006). It involves multiple stakeholders with conflicting needs, is subjected to emergent changes (Pellegrinelli, 1997) and requires integration of knowledge across various disciplines (Dietrich, 2006). A successful

implementation of strategy is ensured as program management is a methodology that can react to these dynamics (Thiry, 2004). Although programs are on-going and entail a long-term aspect, their life cycle is temporarily limited (Dietrich, 2006).

Lycett et al., (2004) constitute program management needs to address cultural, political and organizational challenges. Pellegrinelli (1997) suggests that the rational for and the benefits generated from programs will greatly impact the program structure. He therefore differentiates between three types: portfolio program, goal-oriented program, and heartbeat program. In the first case, the main issue is to manage projects with efficient resource utilization and to optimize knowledge and skills. Projects are relatively independent from each other. A goal-oriented program is initiated to cope with a high degree of uncertainty and involves learning within the process. It translates vague business strategy into tangible actions and new developments. Finally, heartbeat programs deal with incremental change. They add functionality to or improve existing infrastructure, systems, or business processes.

2.1.6 Program Management Process and Life Cycle

Different opinions exist regarding the program life cycle and the congruent phases. The PMI (2008) program life-cycle comprises: pre-program preparations, initiation, set up, delivery of program benefits, closure. The main task in the pre-program phase is to define a program that is as far as possible linked to increase value for the company, followed by planning activities, and creating the required structure and processes in a second step. Projects should be formulated in compliance with program objectives, project deliverables managed, and benefits assessed. Finally, at closure an appraisal based on the outcome of predetermined project objectives is carried out and lessons learnt. Similar to the PMI, Thiry (2004, p. 252) proposes five phases, which are formulation, organization, deployment, appraisal, and dissolution (Figure 2.3).The formulation and appraisal phase demonstrate strategic features by developing concepts. Organization and deployment induce learning and incorporate systematic aspects of management.

- **Formulation**: sense-making, seeking of alternatives, evaluation of options, and choice
- **Organization**: strategy planning and selection of actions
- **Deployment:** execution of actions-projects and support operational activities, and control
- **Appraisal:** assessment of benefits, review of purpose and capability, and repacing, if required

- **Dissolution:** reallocation of people and funds, knowledge management and feedback

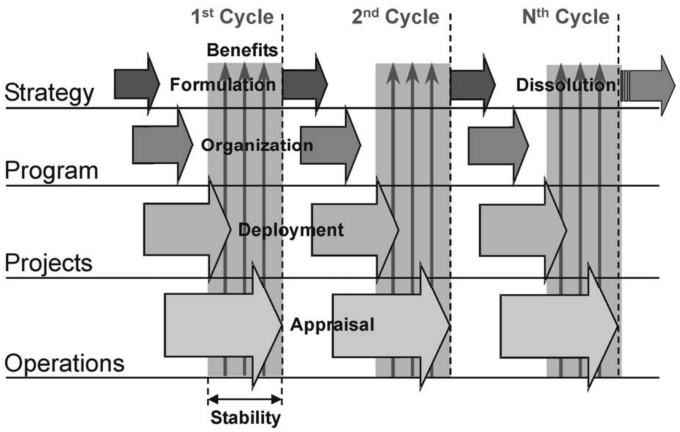


Figure 2.3 The program life-cycle

Pellegrinelli (1997) illustrates the program phases as a spiral (Figure 2.4). The main concept includes five discrete phases: initiation, definition and planning, projects delivery, renewal, and the dissolution. With the formulation of a program, projects will be defined and sequenced to deliver their objectives. The program organization can then after the evaluation of project deliverables decide if the program still adds value in which the mandate will be renewed. If not justified, dissolution will be the next step. A program life cycle supposes to be rather iterative ensuring periods of stability and learning. The program spiral demonstrates well its cyclic characteristic mentioned earlier and in general reflects the nature and content of the projects.

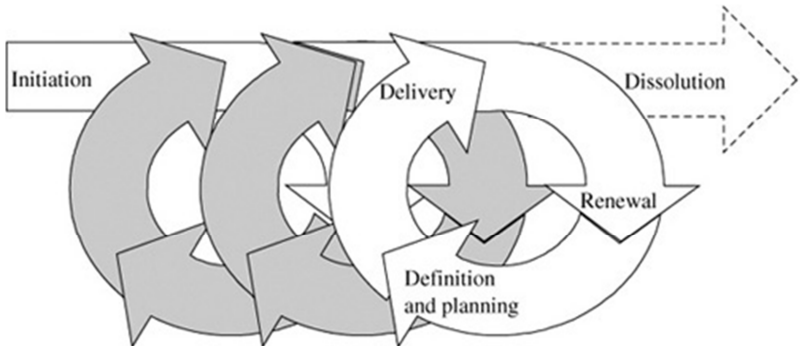


Figure 2.4 Program spiral

2.1.7 The Role of Project Portfolio and Program Management for Strategy Implementation

Portfolio and program management are considered to be powerful organizational tools to align projects with corporate strategy and to improve overall business results (Partington, Pellegrinelli, and Young, 2005; Morris and Jamieson, 2005). Rather than being alternatives these approaches need to be supplementary for successful strategy implementation. Corporate strategy, easily formulated but difficult to implement, is a concept how an organization intends to achieve its goals and objectives (Morris and Jamieson, 2005). A means to operationalize strategy is by cascading it to the business level clustering projects to programs and portfolios. Dietrich and Lethonen (2005) reveal empirical evidence that project as well as program and portfolio management are pivotal devices of the organizational strategy process. Organizations successful in implementing strategic concepts tend to review project performance linked to strategy formulation while program and portfolio performance evaluation are a part of the strategy follow up process. However, their study is limited to product development and internal development projects. Partington et al. (2005, p. 87) describe corporate program management as *'the structures and processes that are used to co-ordinate and direct the multiple interrelated projects that together constitute an organization's strategy.'* The link between business strategy to project strategy is illustrated in Figure 2.5 by Morris and Jamieson (2005). However, they admit the model fails to integrate corporate strategy and to display the dynamics of the strategic process.

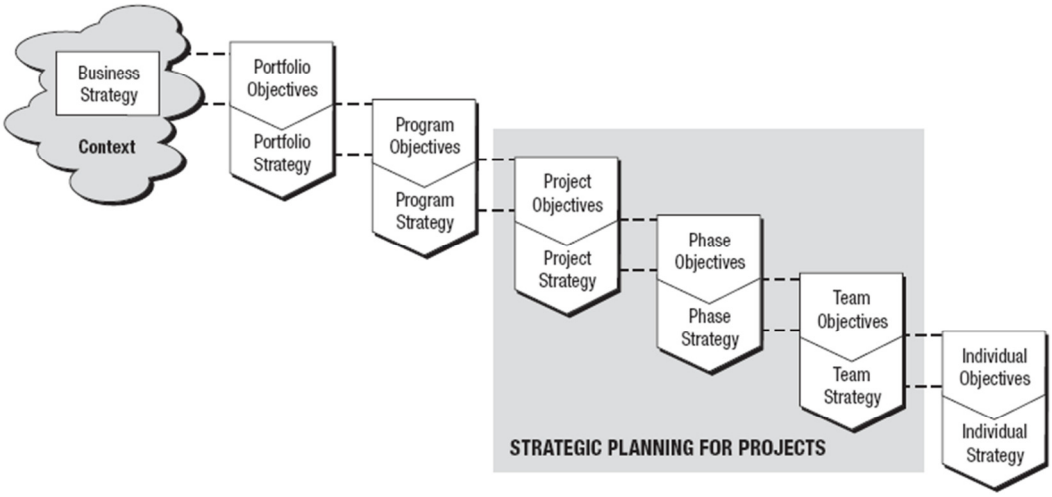


Figure 2.5 Linking corporate and project strategy

Several authors promote a contingent approach to program and portfolio management (e.g. Pellegrinelli, 1997; Blomquist and Müller, 2006a) suggesting an alteration to the specific organizational environment and business type.

A main difference between portfolio and program management exist in their approach to change, control, and evaluation processes (PMI, 2008). While portfolio is directed towards corporate strategy which is stable, deliberate, and long-term, program management is concerned with business strategy. The first involves clear objectives and therefore performance indicators are predefined. The second needs to capture the dynamics of business environment and is highly responsive to changes. These are also expressed in the specification of their manager's roles and responsibilities. Managers engaged in portfolios or programs need to commit and participate in a steering group to best deliver the benefits to the organization and the client. Portfolio managers accomplish their tasks with regards to optimize organization's results, which require portfolio coordination, and providing access to reliable information (Gareis, 2000). Program manager's role is opportunity driven and they need to possess the ability to improvise rather than to implement, to deal with uncertainty and change, and demonstrate attention to on-going business processes (Pellegrinelli, 2002 cited in Blomquist and Müller, 2006a). The role of single project managers is simplified or restricted to achieve project goals. This perspective bears the risk that project managers are not aware of the 'whole picture' leading strong managers to push their projects regardless of overall sense making and to the expense of value adding projects. From a single project level, interdependencies play a tangential role, but project manager needs to be aware of this aspect (Fricke and Shenhar, 2000). A summary of key differences between project, program, and portfolio management is presented in Table 2.1.

Table 2.1 Comparative overview of project, program, and portfolio management (PMI, 2008)

	PROJECTS	PROGRAMS	PORTFOLIOS
Scope	Projects have defined objectives. Scope is progressively elaborated throughout the project life cycle.	Programs have a larger scope and provide more significant benefits.	Portfolios have a business scope that changes with the strategic goals of the organization.
Change	Project managers expect change and implement processes to keep change managed and controlled.	The program manager must expect change from both inside and outside tile program and be prepared to manage it.	Portfolio managers continually monitor changes in the broad environment.
Planning	Project managers progressively elaborate high-level information into detailed plans throughout the project life cycle.	Program managers develop the overall program plan and create high-level plans to guide detailed planning at the component level.	Portfolio managers create and maintain necessary processes and communication relative to the aggregate portfolio.
Management	Project managers manage the project team to meet the project objectives.	Program managers manage the program staff and the project managers; they provide vision and overall leadership.	Portfolio managers may manage or coordinate portfolio management staff.
Success	Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the program satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of aggregate performance of portfolio components.
Monitoring	Project managers monitor and control the work of producing the products, services or results that the project was undertaken to produce.	Program managers monitor the progress of program components to ensure the overall goals, schedules, budget, and benefits of the program will be met.	Portfolio managers monitor aggregate performance and value indicators.

2.2 The Need to Differentiate between Projects

Within a corporate context it is most likely that several projects are managed concurrently. Since success factors for individual projects have been widely discussed in project management literature the question then arises: What are the factors of success when managing a group of projects? Considering the objectives of portfolio management stated by Cooper et al. (2000), portfolio effectiveness can be defined as the '*degree to which a portfolio has succeeded in fulfilling its objectives'* (Cooper et al., 1997 cited in Müller, Martinsuo and Blomquist, 2008, p. 29).

There is common agreement that project level success is positively associated with portfolio level success (e.g. Fricke and Shenhar, 2000; Martinsuo and Lethonen, 2007; Müller, Martinsuo, and Blomquist, 2008). Reaching of project goals is a mediator of single project management success and portfolio management efficiency, which is demonstrated by the study of Martinsuo and Lethonen (2007). One factor leading to effective management in a multi-project environment is the realistic assignment of project manager to a project considering complexity and project phase (Patanakul and Milosevic, 2009). They elaborate that with appropriate skills and time availability the project manager would be more successful. Their findings imply that having standard processes is important to manage individual projects, though the degree to which they are contingent to project types will impact effective multi-project management.

Inspired by classical contingency theory interest in studying variations in projects considering contextual factors has drawn growing attention. In collaborative work, Payne and Turner (1999) report more success in projects in which procedures have been modified according to resource type and project size. The emphasis of small and medium size projects is on resource prioritization whereas for large projects the coordination of activities and the allocation of resources gain more importance. Certain characteristics of projects require different procedures of planning and monitoring e.g. data management and information availability is of greater importance for large projects. The use of a common approach throughout all project categories increases the risk of failure (Payne and Turner, 1999). Although their study is limited to program management and has not gain statistical significance their findings are supported by several other researches (Fricke and Shenhar, 2000, Dietrich and Lethonen, 2005, Patanakul and Milosevic, 2009).

Investigating practices of 288 organizations in managing strategic intensions by projects, Dietrich and Lethonen (2005) find that successful organizations apply a flexible management style to accommodate different types of projects. Bresner and Hobbs's (2008) empirical survey of project management practices reveals the variable use of tools and techniques for certain project types, project size, and project customer. The comparison e.g. between IT, and engineering and construction (B&C) projects demonstrates contrasting differences in tools used for planning and control. While in B&C projects tools for cost and estimating find more frequent usage, IT projects centre more around schedule and resource allocation tools. Project size obviously impacts the number of tools used with more tools used in larger projects (greater than $1,000,000). However, their study does not explain causality between applied tools and project success.

Though, organizations explicitly evaluate project characteristics to assign them into categories, project management scholars do not incorporate these practices into their textbooks yet ignoring that different life cycle models are relevant for different types of projects. The governance varies then in: prioritizing, authorizing, planning, executing, and controlling (Archibald, 2004).

2.3 Project Typologies as Theories

In their article Doty and Glick (1994) suggest a typological approach to theory building and provide arguments that outweigh the general criticism towards organizational typologies. Unlike classification models that basically differentiate phenomena or objects to assign the same into mutual exclusive classes, typologies are complex theoretical constructs developed as *'…interrelated sets of ideal types*' (Doty and Glick, 1994, p. 232). Another view on project theory derives from Söderlund (2004, p. 186), who asserts that these are *'…conceptualizations and models that explain and predict the structure and behaviour of projects…'*

The concept of ideal types enables measuring the deviation of a real organization from the ideal type. Thus, the variance can be used to predict a dependent variable for example organizational effectiveness. The justification of typologies being theories is deeply rooted in their potential to meet three criteria of theory. Doty and Glick (1994, p. 233) constitute the proper development and specification of typologies involves: 1.) identifying constructs, 2.) specifying relationships among these constructs, and 3.) testing of these relationships. The differentiation between classification or categorization systems and typologies is necessary and diminishes the confusion between these terminologies. Nevertheless, building a typological theory in the context of project management requires classifying real projects based on a set of pre-specified parameters within a structured framework. In a wider scale, a comprehensive model of project taxonomies and typologies as theoretical framework might result into standardization and increases professionalism in a relatively young area (Crawford et al., 2005). Therefore, general consensus is a precondition for developing concepts, tools, and methods that are applicable to the multifaceted characteristics of projects (Evaristo and van Fenema, 1999, Shenhar and Dvir, 1996). Other 'typologies' found in project management literature are merely categorization models that offer a set of guidelines to differentiate projects from each other. These are deficient in providing evidence of causal relationships within each type (Doty and Glick, 1994) or developed constructs or are not specified appropriately as stated by Söderlund (2004, p. 187): *'The problem is….also that these [contingency] factors are not explicitly critically reviewed.'*

2.4 The Nature of Categorization Systems

2.4.1 Classification or Categorization

Classification is a part of human nature (Bowker and Star, 1999) and involves sorting items to certain classes based on set of criteria within a hierarchical structure (Jacob 1991, p. 78 cited in Crawford 2002, p. 182). The term class implies a distinct and absolute order while categories are more flexible and creative in their application. The process is concerned with recognizing, differentiating items, and placing them in different categories for a specific purpose. Unlike classes, categories are not mutually exclusive, which allows an item to be allocated to more than one category. In practice, mutual exclusivity does not exist (Bowker and Star, 1999). The authors relate classification systems to standards, but note that *'...standards are crucial components of the lager argument'* (Bowker and Star, 1999, p.13). This implies that standards exhibit a wider scope and are accepted by more than one community. Thus, they represent idealized dimensions and set objectives that never can be achieved in practice. Classification systems are a precondition for a successful standardization.

In some sense, categorization is a simplified representation of reality. Considering work practice, categorization allows building a commonly accepted language and a body of knowledge within a specified community (Bowker and Star, 1999). Political issues have to be considered when developing a system. The process entails *'negotiation or force'* (Bowker and Star, 1999, p. 44) as decisions about selection of categories and the level of detail has to be taken. Objects that are excluded from the system are not visible to its users. Defining entities that make a difference is a strongly subjective task. The persons involve in the development would relate the design to the organizational context the system would be embedded in. A complex system offering an extensive number of categories causes confusion among the users and validates itself as impractical (Crawford et al., 2005). It will remain unused. Careful decisions about demarcation lines between categories are required in the design.

2.4.2 Designing a Categorization System: Purposes and Attributes

The purpose of a categorization system forms a primary policy of shaping it. By involving multiple users conflicts potentially arise, which might diminish the functionality of the system when trying to find alternative solutions. Rather than being theory driven the development of a system should best ensure focus group participation (Crawford, et al. 2002). Designing a practical framework involves hierarchical levels and multiple dimensions. Within a categorization system projects need to be placed in classes that impose an unambiguous order and is guided by a limited number of attributes (Archibald, 2004). In defining the level of categories he suggests to follow the same hierarchical systematic when breaking down a project into manageable bits.

Archibald (2004) promotes a global model for project differentiation and assumes following key benefits within the project management discipline:

Purposes and Uses of a Global Project Categorization System:

- Definition of strategic project portfolios and their alignment with growth strategies
- Selection and development of the best project life cycle (or life span) models
- Identification and application of best practices for
    - Project selection and prioritization
    - Planning, executing and controlling methods and templates
    - Risk management methods
    - Governance policies and procedures
    - Development of specialized software applications
- Building of specialized bodies of knowledge
- Selection and training of project managers and project management specialists
- Focusing and improving PM education and training
- More effective individual PM certification and career planning
- More focused research efforts

There is no relationship between purpose of the categories and the attributes used to describe the projects in it (Crawford et al., 2006). The authors define attributes as '*the underlying characteristic that is being used to categorize projects'* (Crawford, 2005). Their results show that organizations have three main purposes:

- **Alignment with strategy**

  Assign priorities, track efficacy for investment, create strategic visibility.
- **Capability specialization**

  To develop project delivery capability, assign appropriate resources and tools.
- **Promote the project approach**

  Differentiate projects from operation; differentiate projects, program, and portfolio, provide a common language.

In general organizations employ eight attributes to classify projects into distinct groups. Minor variations between the ten most common and ten most important attributes are identified by Crawford et al. (2006) and listed in Table 2.2. A discussion about project characteristics and attributes will be provided in section 2.5.

Table 2.2 Comparison of most common and most important attributes

Most common attributes	Most important attributes
Organizational benefit	Application area
Cost	Nature of work
Client, customer	Client, customer
Application area	Complexity
Complexity	Cost
Strategic importance	Size
Risk level	Strategic importance
Nature of work	Risk level
Resources	Organizational benefit
Size	Deliverables

2.4.3 The Golden Triangle: Comparability, Visibility, Control

Categorizing within a work setting is constrained by three parameters identified by Bowker and Star (1999): comparability, visibility, and control.

Comparability

This factor describes the ability of a system to enable comparison across defined entities. As categorization is about semantics (Bowker and Star, 1999) the creation of a model provides a common language consistent throughout the community using it. Standardization of language will affect communication positively and creates a shared understanding of the items included in the system.

Visibility

An item excluded from the system which is designed for a specific purpose cannot be used for that purpose. It is so to say invisible or unclassifiable for the user. Visibility is the precondition for comparability (Bowker and Star, 1999). The difficulties in creating

visibility are the lines that need to be drawn between the categories. What should be in/ excluded? What attributes are significant to differentiate items? (Crawford et al, 2006).

Control

'The devil is in the detail': In this sense a balance between flexibility and structure will determine the number of categories and sub-categories (Bowker and Star, 1999). Too strict and complex involving too many categories will decrease the effectiveness of the system. Too much freedom will increase the probability that important items are not considered and rendered invisible. A certain degree of discretion when interpreting the rules of categorization is defined by the level of control.

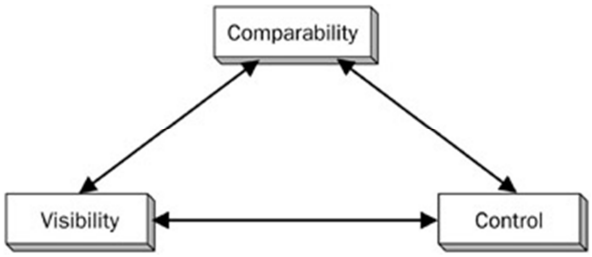


Figure 2.6 Three challenges of categorization systems (Crawford, 2005)

An ideal balance between these three parameters is illusive in practice. A decision has to be made which factor should be predominant (Bowker and Star, 1999). Increasing visibility enhances comparability across entities, but control is then limited. A high level of control increases the number of dissimilar items within a category, which means less comparability.

2.5 Key Concepts for Project Categorization

2.5.1 Categorization – Focus on Engineering and Technology

The most notable research in this area has been conducted by Shenhar, either individually or in collaboration with colleagues (Shenhar and Dvir, 1996; Shenhar, 1998; Shenhar and Dvir, 2004). The authors acknowledge the insufficient progress in building project management theory that significantly lags behind the pervasive utilization of projects in various industries. A reason for the discrepancy between theory and practice might be the generic approach to project management ignoring project diversity. In alignment with the work of Doty and Glick (1994) they introduced a multidimensional framework that matured from two dimensions involving technology and systems scope (Shehar and Dvir, 1996; Shenhar 1998,) to four dimensions (Shenhar and Dvir 2004) known as the NCTP-Model. The model, illustrated in Figure 2.7, is a central framework to select an appropriate management approach and encompasses: novelty, complexity, technology, and pace.

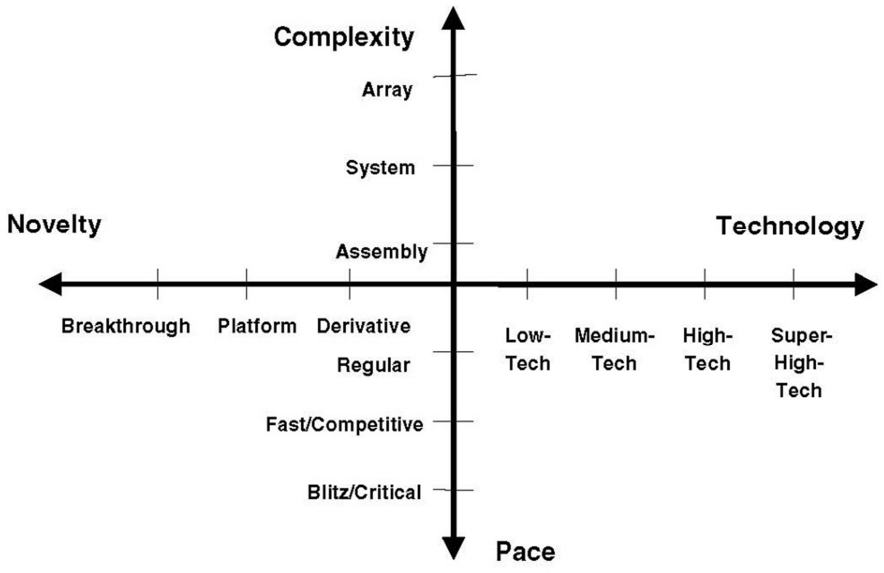


Figure 2.7 NCTP-Model

- **Product novelty**

This dimension relates to the framework developed by Wheelwright and Clark (1992) that will be explained below and concerns the degree of innovation integrated in the product. With respect to project management product novelty will impact market related

activities and product specification e.g. for derivative products requirements are well known and marketing emphasis is on the benefits of the newer product. On the other hand, breakthrough products are new to the market and need to be launched relying more on intuition, guessing, trial and error rather than using intensive studies.

- **Technological uncertainty**

The newness of technologies involved in the manufacturing process or in the product is specified by this scale. Here, the authors developed four distinct levels:

1) Low-tech: existing and well established technologies,
2) Medium-tech: mainly existing or base technologies combined with new features,
3) High-tech: new but existing technology,
4) Super-tech: new technology, well defined project goals.

- **Project complexity (System Scope)**

Different levels of complexity can be depicted as a hierarchy of systems, whereby a lower scope represents a lower system of the one of the next higher level. Assembly, system, and array projects are the types found in the study.

1) Assembly: a set of various devices is combined into a single unit serving for a single function
2) System: consistent of elements or sub-system that together builds a complex interactive construct. It offers various functions for a specific operational performance.
3) Array: a network of large, detached systems that combines all functions for a common goal.

- **Pace**

This scale will determine how much time is available for the project and what happens if the time goal is not met. There are three different types of urgency:

1) Regular: time is not critical for success.
2) Fast-competitive: time driven as they are initiated to capitalize on market opportunities, strategic advantages.
3) Critical blitz projects: time is key factor to success; projects are a result to emergent events that have the potential to deter the organization.

These dimensions represent ideal types and as first order constructs subjected to empirical testing. Managerial variables are specified to describe these types and are used to predict project success as the dependent variable. Differences are found in: management style, project organization, and operational practices (Shenhar, 1998). Due to the research findings organizations are recommended to apply a contingent and project-specific approach. The authors exert a critical view on their framework and argued that other parameters like industry, size, customer, contractor and other factors could be utilized to classify projects.

2.5.2 Categorization – Focus on Product Development

The categorization of product development projects by Wheelwright and Clark (1992) has gained considerable attention in the project management community. The writers suggest building an aggregate project plan to best meet business objectives and deal with capacity constraints. The primary activity in creating mentioned plan is to identify and map various types of development projects. The fundamental criteria to classify the projects in their model are the degree of change in the product and the manufacturing process. This system is useful to determine the resources required and is an input to the allocation process. Projects containing greater change in general bind more resources. Project differentiation comprises of five types, whereby the first three types are described as commercial projects.

Derivative projects: This type of project is likely a modified version of an existing product, the degree of innovation in product, process or material is minor or incremental. There is little management involvement and resource usage is low.

Platform projects: Platform projects are the precursor of derivative projects. The development work focuses on cost reduction, quality and performance improvement involving familiar technologies or materials. They entail a higher degree of change than derivative projects and require extensive up front work prior to project start. A network of specialists from several departments like marketing, manufacturing, engineering and senior management needs to be established for these kinds of projects. Platforms deliver competitive advantage for organizations bearing great potential for market penetration.

Breakthrough projects: Breakthrough products revolutionize the market and create a whole new product category offering radical innovation. These products incorporate unknown technologies or materials and manufacturing processes have to be reinvented.

R&D projects: R&D investments and activities involve high risks and compete for resources with commercial projects.

Alliances and partnerships: These can take the form of any kind of project either commercial or development.

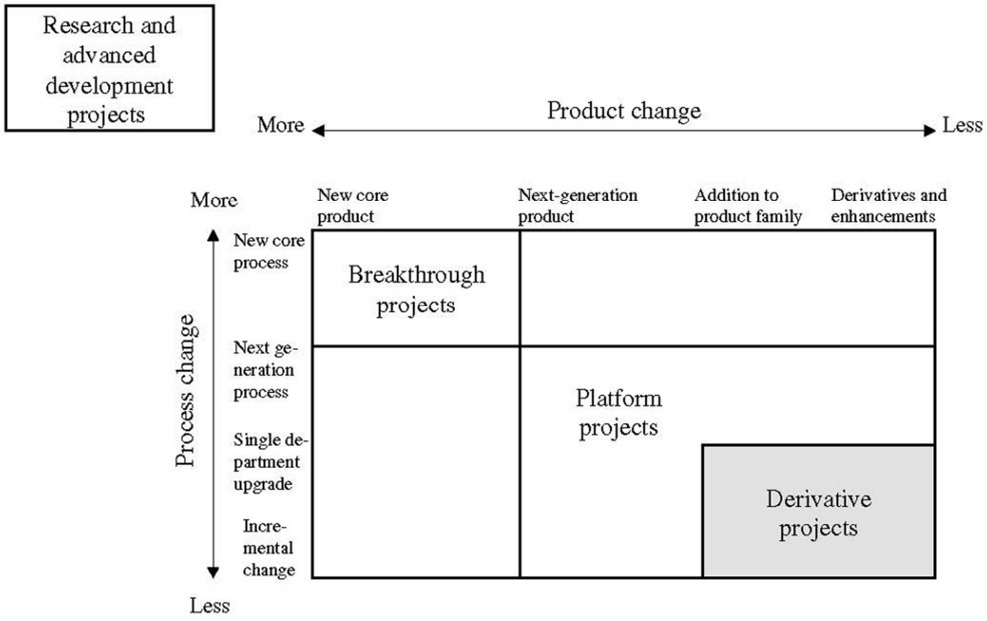


Figure 2.8 Mapping types of development projects

Every project category requires a particular approach to its management and specified resource types. Mapping projects to one of these categories will help the organization to maintain a strategic focus having the right mix of types. In a long-term the organization can improve its development capabilities e.g. by offering a career path for project managers.

2.5.3 Categorization – Focus on Project Goals and Methods

Turner and Cochrane (1993) have developed a matrix including two parameters to cluster projects at their initiation stage: clarity of goals, and clarity of methods to achieve these goals. The authors lament that traditional literature assumes well defined and understood objectives and methods prior to project execution. Yet, some projects demonstrate ambiguity in at least one of these dimensions. Likewise, an assessment of projects along the two axes results into four types (Figure 2.9):

- Type-1 projects: goals and methods of achieving the project goals are well defined e.g. large engineering projects.
- Type-2 projects: goals are well defined but the methods are not e.g. product development projects.
- Type-3 projects: goals are not well defined but the methods are e.g. soft-ware development projects, where specification of user requirements is an uncertain process.
- Type-4 projects: neither the goals nor the methods are well defined e.g. organizational development projects.

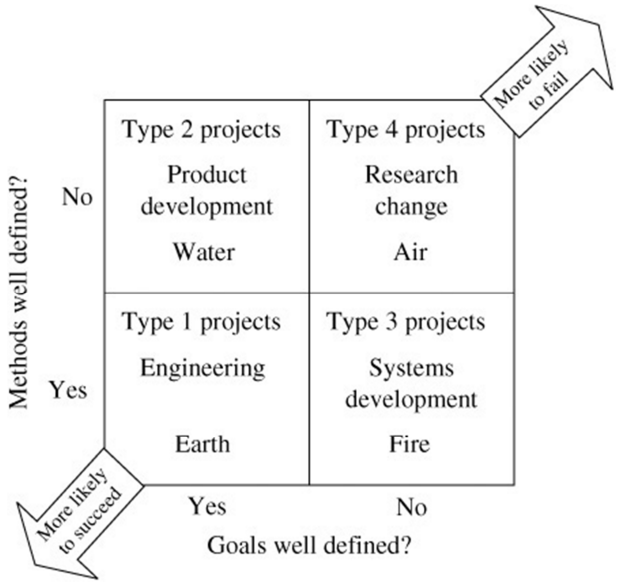


Figure 2.9 Goals and Methods Matrix

The value of the model is twofold. Firstly, project start up techniques differ outlining a bottom-up or top down approach to project planning. Projects with well-defined goals and methods, which are familiar to the organization, imply a bottom up approach to project start up while with increasing uncertainty in both dimensions a top down approach is more likely. Projects with ill-defined goals require a person that is strong in stakeholder management to negotiate agreement. In the case of methods uncertainty, the involvement of multi-disciplinary teams in project start up brings the best results. Secondly, project implementation techniques differ as the use of milestone planning and configuration management for monitoring and control varies among the project types.

2.5.4 Other Trends

Youker (2002) highlights four main attributes that are useful when generating a practical categorization model: geographical location, industrial sector, project life cycle, and product of the project. The differentiation of projects by type of product or project deliverables bears the highest benefit as these projects share more common characteristics and thus provide a better guidance for several purposes. The dimension single versus multiple projects enriches project management research and reflects the relevance of program management in academia (Evaristo and van Fenema, 1999). Emanating from trends of globalization, the authors suggest a grouping of single or multiple projects by number of sites involved. The multi-site criterion adds complexity especially to program management due to the difficulties faced in allocating resources. The model calls for attention to the problems and criticalities altering among these levels. A way of ordering projects might be based on the level of structure, defined as the degree the client determines process, control and communication channels, and the level of collaboration between client and project manager as noted by Turner and

Müller (2004). Thereby, project performance is highest when the collaboration between client and project manager is high at a medium level of structure.

2.5.5 Criticism

Dierig, Witschi, and Wagner (2007) note that organizations preferably apply a differentiation of projects by industry sector or project deliverable. Although models need to be simple in their design to be at all applicable, some models are extremely simplified and do not meet the requirements of increasing project complexity respectively interconnectedness of economy. Other models like the goal and method matrix by Tuner and Cochrane (1993) do not give clear direction for meaningful demarcation or explain causal relationship between management approach and project type. In general, the vast number of frameworks using an even higher number of attributes reveals a lack of systematic in approaching categorization, not to speak of theorizing. There is no agreement in parameters that make a difference (Archibald, 2004) and no real added value for organizations. Benefits are limited to match the right management approach to the right project and capability development. These might be the reasons why no framework has become a standard so far. Despite the paradigms emerging from the school of contingency, some writers (Söderlund, 2004; Archibald, 2004, Crawford et al., 2006) promote a universal approach to categorization and state that theorizing in some general project aspects is necessary.

2.5.6 Project Categorization Systems for Strategic Level

A wider scope including the strategic level would justify the existence of such systems and might enable a universal approach to project differentiation as advocated by afore mentioned researchers. Little attention and thus little research have been devoted to the use of project categorization within a multi-project environment yet. On the other hand, professional organizations such as the PMI (2008) include categorizing of projects as a component in its portfolio management process (Figure 2.2, section 2.1.2). The integration is confirmed by researchers like Cooper et al., (2006) and Archibald (2001). According to Archibald (2001) an organization is supposed to define the portfolio and the categories within it, identify projects and assign them to the categories by a set of agreed criteria.

If categorical systems are shaped by their purpose, the organizational use for such systems at the strategic level will impact the design significantly. In consequence, the frameworks described above might be inadequate for portfolio management. Purposes for higher level management centre around: project selection, allocation of financial and other resources, the alignment of the portfolio with organizational strategy, monitoring and controlling the attainment of strategic goals, balancing the portfolio, maximizing value to the organization, and providing visibility (Crawford et al., 2005). In their

attempt to establish a generic model, Crawford et al. (2006) develop a framework based on three main purposes: strategic alignment, capability specialization, and promoting a project management approach. The strategic alignment level contains two sub-levels with in total twelve different purposes to maintain a healthy portfolio.

With regards to the strategic portfolio categorization Shenhar and Dvir (2004) propose two dimensions resulting into four types of projects: strategic goals and the customer. This model forms a policy for more objective project selection. Firstly, projects are discriminate into operational and strategic entities based on their strategic importance, and secondly into internal and external customers. While integrating the aspects of portfolio management into their models, the authors miss to outline the practices, roles, and tools associated with each specific project group. Blomquist and Müller, 2006a) have shown in their study that roles of program and portfolio managers correspond to the nature and content of projects they manage and an adaption to the context correlates to high performing portfolios.

2.5.7 Categorization in Practice: Multidimensional Systems

In general, organizations apply a multi-dimensional system to categorize their projects as shown in the study of Crawford et al. (2006). They introduce three models that are either hierarchical or parallel systems, or composite attributes. In the first case, the primary categorization might base on one parameter for example size with a differentiation in small, medium, and large projects. For each category other means of categorizing are then applied. Parallel system offer a few sets of attributes like complexity, technology, and strategic importance to group projects. The use of both systems results into a composite system, which is shown in Figure 2.10. Composite attributes like complexity are used to describe a dimension. For this dimension several attributes are defined to describe a project.

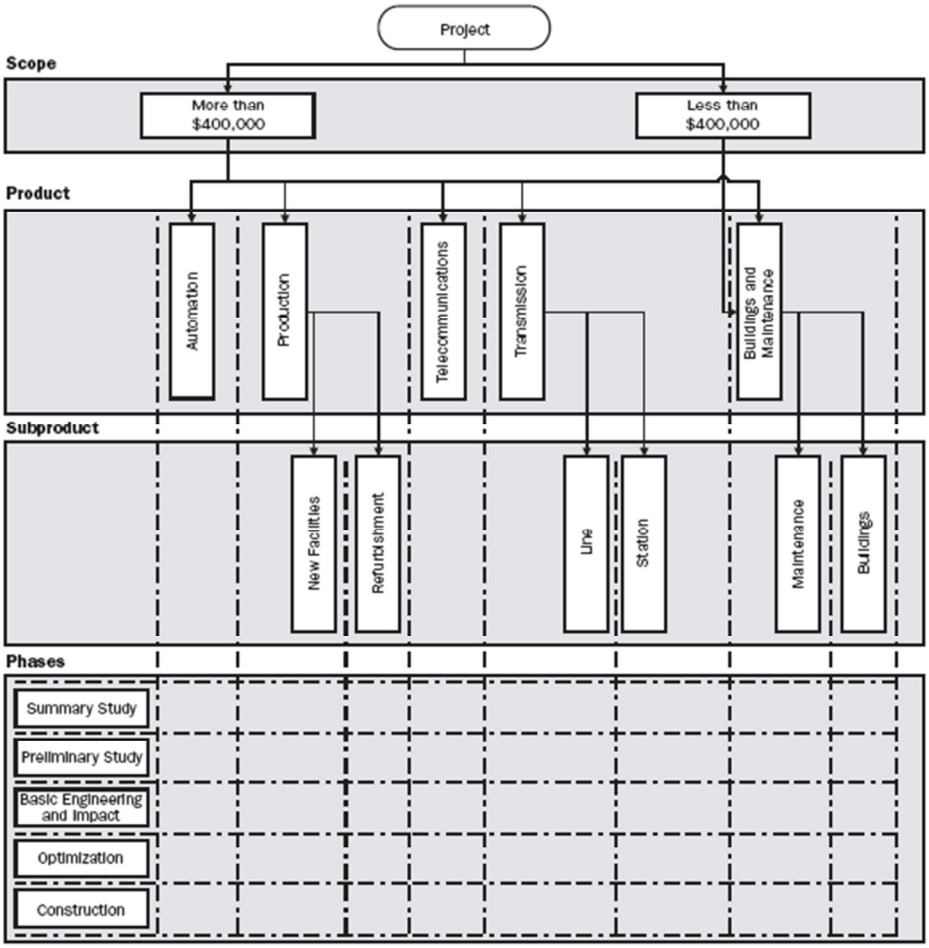


Figure 2.10 Composite categorization system

2.6 Conceptual Framework

The necessity to classify projects according to specific attributes is evident. The literature above leads to the assumption that a variety in managerial approaches, ranging from management style, processes, tools and techniques, partly explains the variance in project outcomes and contributes to portfolio performance. Building project delivery capability particularly competence is another variable positively associated with portfolio management success. Categories for mentioned purpose have been introduced to the project management community. Nevertheless, the functionality of such systems can be expanded to the strategic level when re-designed. The literature indicates the use of such systems to align the portfolio with business objectives by a systematic and purposeful evaluation and selection of projects. Categories might also be used to balance the portfolio to achieve the right mix of projects that brings the maximum value. Visibility, comparability, and control are the three critical constraints when designing a suitable system for organizational application. Figure 2.11 illustrates the conceptual framework of this research.

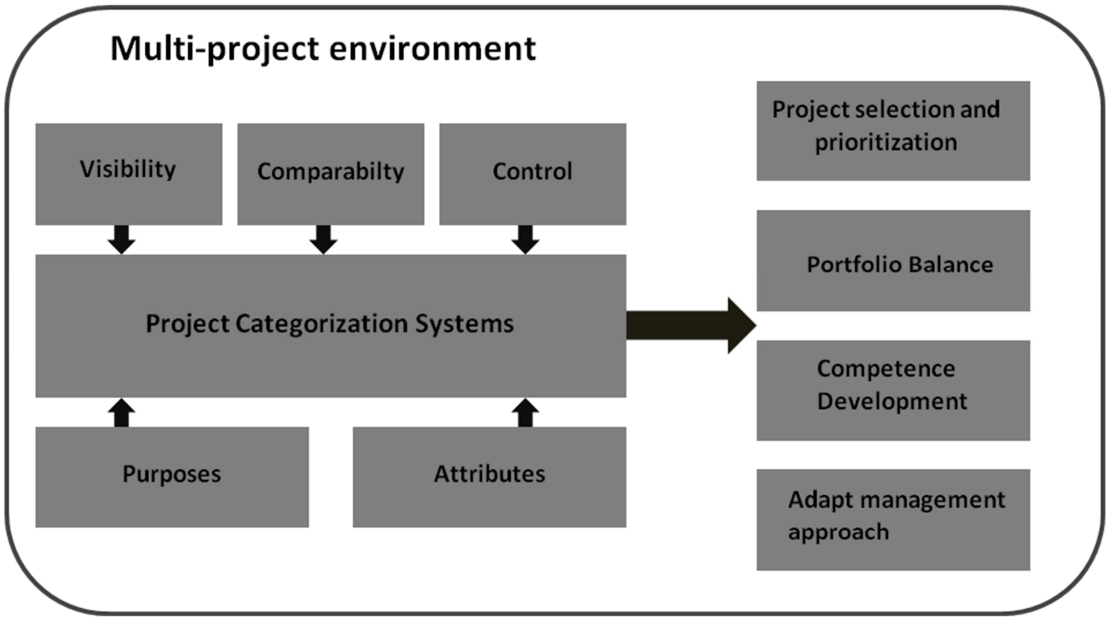


Figure 2.11 Conceptual framework of research

3 Research Methodology

In this chapter the underlying philosophy and the research strategy resulting from it will be discussed. The research commenced with a literature review to give a solid basic understanding about the research topic focusing on the nature of categorization systems and the discipline of portfolio management. In the process of reviewing relevant literature involving academic journals, articles, conference proceeding of professional organizations, and academics' and practitioners' literature a conceptual framework was developed and refined in the on-going progress. Designing a conceptual framework is practical especially for novice researcher as it will function as a guideline to relate the philosophical stance to the final process of data collection and analysis (Creswell, 2003). This section will also go into detail of data collection procedure, instruments, the constraints facing validity and reliability, and briefly introduce the background of the case companies.

3.1 Underlying Philosophy

The philosophical ideas, strategies of inquiries, and the methods build the three main elements of research (Creswell, 2003). The philosophical assumptions corroborate the general approach to inquiry, which then determines the implementation of methods (Creswell, 2003). According to Bryman and Bell (2003) business research is influenced by five issues which are: epistemology, ontology, practical considerations, theory and values. It is important to understand these factors within the discipline of business research.

The concept of epistemology elaborates what is considered as acceptable knowledge in a field of study (Saunders et al., 2009). The authors claim three basic philosophical beliefs: positivism, interpretivism, and realism. The positivist approach relies on quantitative data transforming to statistical results. Researchers use existing theory to develop testable hypothesis, which are then confirmed or refuted based on the results of data analysis. The final outcome is generalizable. Researchers critical to adopt the positivist approach in the field of management, which is characterized by high complexity are likely to involve social actors to gather qualitative data. Their view emphasizes the tendency of humans to interpret their own and others role in a social context. The results are context specific and not subjected to generalization (Saunders et al., 2009). Lastly, realism relates to positivism in the sense that it takes a scientific approach to knowledge development and a belief in reality independent from our perceptions (Bryman and Bell, 2003).

Another part of philosophy is concerned about ontology described as the nature of reality (Saunders et al., 2009). Ontology contains two aspects that are objectivism and

subjectivism. In the first case, it is assumed that social entities exist regardless of the social actors within them while subjectivists believe in the relationship of social actors to social phenomena as a result of their perceptions and consequent actions. The third major component mentioned by Saunders et al. (2009) is axioloy that studies the judgments of values. These refer to the personal beliefs or the feelings of a researcher (Bryman and Bell, 2003) and accompany the research throughout all stages (Saunders et al., 2009).

Based on the reasons discussed above this research takes the stance of subjectivism and interpretivism. The research is conducted in a business environment, whereby the role of human actors is central. Humans interpret their role in a social context, which impacts the way how they see realty. These beliefs form the strategies of inquiries.

3.2 Research Strategy

The researcher's purpose is to investigate how firms approach project categorization in reality and how these systems are used or might be used for project portfolio management. Within this frame objectives have been identified to help the researcher fulfilling the aim:

- Understanding the nature of categorization systems
- Identify formal and informal project categorization systems
- Understanding the field of portfolio management, its main objectives and problem areas
- Identify the implication of project categorization for portfolio management

A qualitative approach along with an explorative case study design is considered as most appropriate to answer the research questions. Qualitative research begins with specific observations and moves towards the development of general patterns that emerge from the case study (Creswell, 2009). This process is useful as it will provide in-depth knowledge about the main characteristics of categorization systems and allows comparison to existing literature. Bryman and Bell (2003) argue qualitative research relies on words in contrast to numbers in data collection and analysis. Saunders et al. (2009) state, that an exploratory study is appropriate when a problem is not clearly defined at start and the researcher aims to get an understanding of the situation. Creswell (2003) suggests several strategies that can be applied in a qualitative research:

- Ethnographies
- Grounded Theory
- Case study
- Phenomenological research
- Narrative research

According to Robson (2002, p. 178 cited in Saunders et al., 2009, p. 145) a case study is *'a strategy which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence.'* Yin (2003) adds that the boundaries between the phenomenon and the context in which it occurs are not clearly evident. In general, case studies allow a more thorough study of the context of research. Because of the exploratory approach and the need to study a wide range of categorization systems a multiple case study was selected as the best way to achieve the research goals. This is in alignment with Bryman and Bell (2003), who state that a comparative design can also be applied in a qualitative research strategy. There are several arguments in favour of a multiple case study design. Yin (2003) constitutes that involving more than two cases would improve the process of theory building, enables theory testing, and is applicable for descriptive research. This refers to the fact that evidence found in multiple sources is more robust and compelling.

For this study the focus is on qualitative data collection and analysis based on the approach suggested by Prasad (1993, cited in Bryman and Bell, 2003):

- General research question
- Selecting relevant sites and subjects
- Collection of relevant data
- Interpretation of data
- Writing up findings/conclusions

3.3 Research Method

3.3.1 Selecting of Relevant Sites and Subjects

Based on purposeful sampling effort was made to contact large size companies located in Sweden. It was assumed that with an increased number of projects, systematic categorization of projects is of higher importance and these companies can provide deeper insight. This is supported by Maxwell (2005) whereby he recommends selecting particular settings, individuals, or activities that are able to provide the information that is needed to answer the research questions and address the research objectives. This sampling technique is applied when the sample size is rather small like in case studies (Saunders et al., 2009). However, the samples are not intended for generalization to a whole population. The design of multiple case studies needs to follow replication logic (Yin, 2003). Therefore careful selection of cases is required *'...so that it either predicts similar results (literal replication) or predicts contrasting results but for predictable reasons (a theoretical replication)'* (Yin, 2003, p. 47).

To cover a wide range of projects aiming for diversity, companies from different industries have been contacted. The companies and their context will be described in section 3.5. The study of three cases enables the researcher to make detailed analysis. In total six informants were interviewed whereby two informants stem from each company.

3.3.2 Data Collection

Data collection technique in case studies is multifaceted by means of interviews, observation, documentary analysis, or even questionnaires (Saunders et al., 2009). Yin (2003) highlights the use of documents to confirm and supplement evidence found in other sources. Relevant data have been accessed through sources like the company website or have been provided by respondents while or before the interviews. Documents concerning project and program/ portfolio management methodologies, project categorization systems, organizational structure have been useful in this study.

For primary data collection the researcher had to select between three types of interviews: structured, semi-structured, and unstructured or in-depth interview (Saunders et al., 2009). Structured interviews are conducted by means of a predetermined and identical set of questions referred to as questionnaire while unstructured interviews are used to explore an area of interest in depth. Unlike the first type, unstructured interviews are not guided by predetermined questions; instead the interviewee has the possibility to speak freely. Semi-structured interviews are based on an open framework and a list of questions on some fairly specific themes, which allows a rather flexible interview process (Bryman and Bell, 2003). The sequences of questions or questions may vary in the interview process depending on the conversation flow (Saunders et al., 2009). The authors outline that some questions might be skipped when

the interviewer is challenged by a particular organizational context. This is supported by Bryman and Bell (2003) claiming that the interviewer may additionally ask unanticipated questions. Since project categorization systems are assumed to be unfamiliar concepts, the interview structure should allow certain flexibility. Therefore, data was collected by semi-structured interviews. The conceptual framework was utilized to create an overall structure including a list of themes and questions to be covered. The questions asked involved the nature of the company and the department, basic issues about project and project portfolio management, and the systems to differentiate projects. A list with interview questions is given in Appendix A. The exact number of interviews could not be determined in advance as the theory originates from the data. Moreover, data gathering needs to be conducted until a meaningful theory can be established and validated (Rudestam and Newton, 2001).

3.3.3 Data Collection Process

Company contacts have been provided by the thesis supervisor and by personal initiatives. Before conducting the interviews an introduction letter was emailed to the participants in order to explain the research purpose and methods, as well as issues of confidentiality. The interviews were carried out face-to-face at the company site and were of 1-2 hours length. Notes were taking during the interviews to complement the recorded data. Participants agreed on the recording process at the start of the interviews. In a next step, the interviews were transcribed and sent to the interviewees for clarification and adjustments. Follow-up interviews were conducted to verify and clarify points of particular interests. It was of importance for the research to conduct the interviews with persons that has deep insight and experience in managing projects, programs or project portfolio/s in the organization.

3.3.4 Qualitative Data Analysis

Creswell's (2003) view on qualitative data analysis requires making sense out of text and image data, which take the form of being rather open-ended. A deductive approach as proposed by Yin (2003) was utilized to analyze the collected data. Existing theory was used to formulate the research questions and develop a conceptual framework. This outline assisted in arranging and carrying out data analysis. Furthermore, a matrix table allowed identification of patterns, which was applied as analytical technique. This involves comparison of empirical derived patterns with a predicted one (Trochim, 1989, cited in Yin, 2009, p. 136). Data analysis comprised within-case and cross-case analysis. Cross-case synthesis is applicable in particular if the research includes numerous cases (Yin, 2009). Yin (2009) argues that multiple case studies can be regarded similar to multiple experiments in which a previously developed theory can be tested against the empirical evidence of the cases. This form of generalization is analytic

and if the theory is confirmed by two or more cases replication can be claimed. The analytic framework offered by Saunders et al. (2009) was considered as helpful for further progress. This contains following steps:

- Summarizing data
- Categorizing data
- Unitizing data
- Recognizing relationship and developing categories
- Developing testable propositions

3.4 Credibility Criteria

Three criteria are mentioned in evaluation of business and management research: reliability, replication, and validity (Bryman and Bell, 2003). Reliability concerns if results of a study are repeatable. Related to the first criteria is the concept of replicability in which it is assessed if procedures that lead to a result are replicable. Validity addresses the integrity of the conclusions drawn from a research. In contrast, Yin (2009) elaborates on four criteria to evaluate the quality of a study, which will be discussed below along with the strategies to address these issues.

3.4.1 Construct Validity

In the first test the operational measures are assessed with regards to the correctness for the subject being studied. Yin (2009) recommends three tactics to increase construct validity.

- Using multiple sources of evidence

  Two participants from each company were involved independently in the study. Documents were used to triangulate evidence found in the interviews.

- Chain of evidence was established by creating a case study database which enables to track the evidence found and link the findings to the research questions.

- Interview transcripts and part of the analysis were sent to interviewees for final corrections.

3.4.2 Internal Validity

Internal validity is a topic relevant for quantitative studies. However, when doing case study research this issue considers making inferences from interview or documentary evidence (Yin, 2009). Yin (2009) mentioned by applying pattern matching as an analytic technique internal validity is treated correctly. Furthermore, cross-case synthesis assures the consistence of the findings.

3.4.3 External Validity

Case study research has its weakness with regards to generalizability. In contrast to survey research, which relies on statistical generalizability, the aim of case studies is to generalize the findings towards a broader theory (Yin, 2009). This issue has been considered as the research based on multiple cases following replication logic.

3.4.4 Reliability

Robson (2002, cited in Saunders et al., 2009) identifies four main threats to reliability: participant error, participant bias, observer error, and observer bias. In order to address these threats following strategies have been created.

- Interviews were recorded to avoid loss of data.
- Interviews took the form of the semi-structured type ensuring that all relevant topics are covered.
- All collected data were archived in electronic form.

3.5 The Case Companies

The study involved three companies to find evidence and insight into the way how firms approach project categorization and to identify the role of categorization systems for project portfolio management. All informants were considered as experienced in the field of project management and have extended work experience within the parent company. Informants performed various roles and owned several other responsibilities, which entails a deep knowledge about the company's structure and processes and enables a multifaceted perspective. Official titles of the informants were: program manager, project manager, director of PMO, portfolio and resource manager. Table 3.1 summarizes the relevant background information of the case companies.

Table 3.1 Summary of case information

	SKF	Eircsson	SCA
Industry	Industrial equipment and machinery, Industrial	Telecommunication, Service division	Consumer goods
Informants from	Process Development and Six Sigma (Informant 1, Informant 2)	Fulfillment office/ - (Informant 3, Informant 4)	Project management office (Informant 5, Informant 6)
Emphasis on	Time to market	Time to customer	Time to market
Project management structure	Matrix structure, projects are coordinated across functions	Matrix structure, all projects are coordinated across functions	Matrix structure, projects are coordinated across functions
Project management model	Company specific based on Prince 2, project management handbook	Division specific in line with PMI	Company specific, adaptable to product areas
Project management procedures	Standardized, investment projects: project management handbook is in development	Standardized	Standardized
Typical project team	6-10	1-8	5-10
Number of simultaneous projects/ project manager	1-2	1-2	1-3
Number of projects in a portfolio/ program	10-15	20-25	15-30
Source of Project	Management team	Key account manager	Management team
Project portfolio management	division specific, standardized	not standardized	rolling out ppm process to business groups

The first case company **SKF** is divided into three units and five technology platforms. The divisions are mutually dependent as they deliver products, service and know-how to each other in order to offer full service to the end customers. The Group is recognized as the global leading supplier of products, customer solutions and services in the business of rolling bearings, seals, mechatronics, services and lubrication systems. The Industrial Division offers a wide range of energy-efficient solutions partly based on the manufacturing of large assortment of bearings, as well as lubrication systems, linear motion products, magnetic bearings, by-wire systems and couplings. Each division is configured in a matrix structure (SKF, 2010). The informants from the process development and Six Sigma department serve in the factory medium bearings, which physically consists of four factories. Activities and work within the department is mainly organized in project form (Informant 2, 2011).

Ericsson AB is a world leading provider of telecommunications equipment and related services to mobile and fixed network operators globally. The Group is structured in three business segments, whereby in the service division projects are directed to the customer. The service portfolio includes**:** managed service, consulting and system integration, customer support and network roll out. With 45,000 service professionals globally, the company has the industry's largest services organization (Ericsson, 2010). The Group takes profit to a high degree through offering a mix of services, software and hardware content as well as type of projects. Rolling out a new network, increasing coverage, or modernizing a network involves installing hardware on a large scale. Bidding is done in a highly competitive environment. A steady revenue stream is provided by upgrades with software to facilitate higher data speeds and new functionalities/ features. The initial large projects are important to secure further software and service businesses (Ericsson, 2010).

SCA is a global hygiene and paper company that develops and produces personal care products, tissue, packaging solutions and forest products. The focal unit is the Global Hygiene Category (GHC), which is structured in four business groups: Personal Care Europe, Tissue Europe, American organization, and Asian Pacific organization. GHC bears the overall responsibility for creating long-term strategies for all segments in tissue and personal care thus generating global growth (SCA, 2010). To create synergies among the business areas, the GHC activities are also characterized by developing consumer and customer insight, innovation, technology processes, and the brand portfolio. Informants stem from the PMO, which serves with professional and highly skilled resources involving part-time and full-time committed project managers. These are mainly located in Gothenburg while the project team is scattered globally.

4 Results

4.1 SKF

4.1.1 Categorization Systems and Attributes Used

The company follows a platform and segment approach to execute its business. This approach combines advanced technology from the platforms and a customer focus from the segments. Therefore each division is organized around customer type and industry category, which are groups of related industrial and automotive products. The industrial division serves around 30 global industry customer segments e.g. general industry, special and heavy industrial machinery, aerospace, railway, energy, off-highway, and others (SKF, 2010). Within the division the process development and six sigma department primarily classifies projects according to their strategic importance. The strategy plan, an important working tool within the department, specifies a number of mandatory projects deriving from external, product and manufacturing strategies (Internal document, 2007). Manufacturing improvement projects represents a further group but projects are on hold, when relevant resources for the strategic projects are lacking (Informant 1, and Informant 2, 2011).

A framework in form of a sizing score card is utilized to classify projects based on complexity. This tool is implemented in the group project model (GPM) and standardized within the company. In total eight other attributes describe the complexity dimension, which are: risk, costs, importance, visibility, single or multiple business units, commercially driven, internal/ external stakeholders, multidisciplinary. The final scores are then linked to four different project types: complex, typical, simple, and stand-alone work package (Internal document, 2007). The category has to be assessed in the need phase before starting a pre-study.

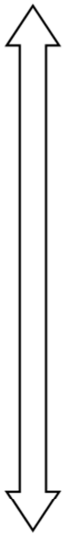
Complexity		Project Scale	Characteristic
LOW  HIGH		Stand-alone Work Package	▪ a task that produces one or more products ▪ the costs may be within the "business as usual" budget ▪ straightforward business justification - e.g. authorized by a line manager
		Simple project	▪ lower risk, cost, importance, visibility ▪ affects a single business unit or organization ▪ commercially driven ▪ internal and/or external stakeholders
		Typical project	▪ medium risk, cost, importance, visibility ▪ affects multiple business units or organizations ▪ commercially driven ▪ internal and/or external stakeholders
		Complex project	▪ high risk, cost, importance, visibility ▪ affects multiple business units or organizations ▪ commercially driven ▪ internal and external stakeholders ▪ multi-disciplinary (e.g. manufacturing, IT and - business change)

Figure 4.1 Project complexity dimensions

4.1.2 Purposes

When asked about the purpose to distinguish between various project types several aspects have been considered by the informants. Others have not been explicitly mentioned at this specific point, but emerged while the interview processes in relation with other questions or in the conversation flow. This was observed in all three case companies.

4.1.2.1 Comparability of Projects

With the segmentation into customer or industry type, products with similar characteristics are clustered into groups. This allows comparability within and across the segments as different markets demonstrate different features (Olsson, 2006). The company sees the benefits in being able to develop strong customer insight and to utilize its platform capabilities to create tailored customer solutions (SKF, 2010). Within the process development and Six Sigma department various incoming needs are evaluated based on a set of criteria and the end effects are then compared as stated by informant 1:

'*When you write down your need, if you solve that problem you need to fill in what effect it will have. And then we compare the effects of the different kind of needs'.*

4.1.2.2 Adapt Project Management Approach

The group project management model, shown in Figure 4.2, relates to PRINCE2 standards and is customized to meet the company's specific requirements. The model includes guidelines and templates for project planning and evaluation, for leadership and teamwork. The project complexity is evaluated using a systematic and structured process, the purpose of which is to adapt the group project model to the type of project (Internal document, 2007) e.g. certain tools are mandatory or process gates necessary when handling projects with high complexity. As informant 2 argues: *'I do believe that in the complex projects you need a structured way to guide you through all the issues. There is normally a cross-functional complexity that you need to formalize in a certain way. You have to be very clear with gating to actually move it over.'* and informant 1 claims: '*We have changing out some of the mandatory tools that you need to use for complex projects, but you don't need to use for simple projects'.*

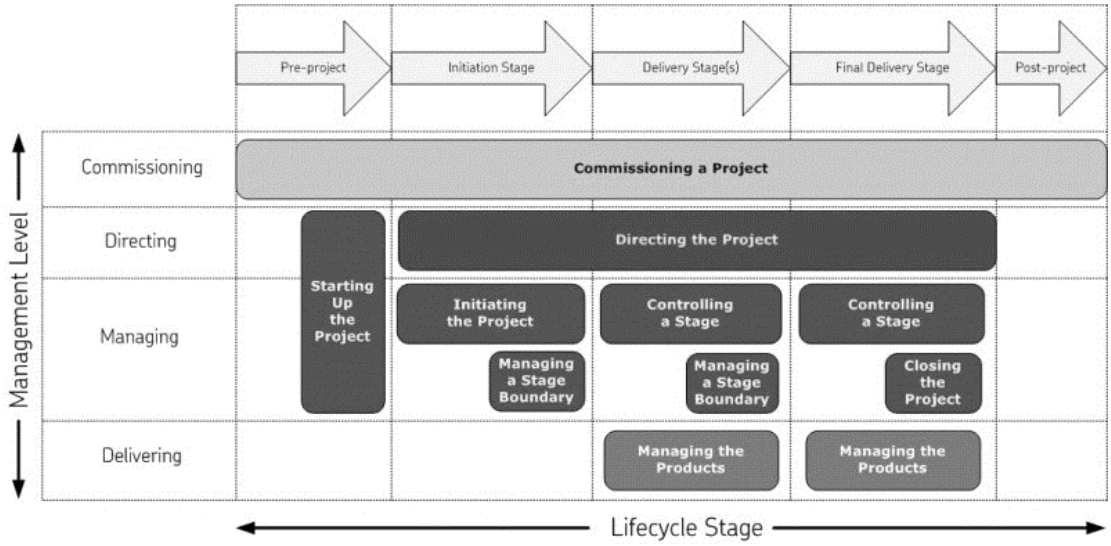


Figure 4.2 Life cycle and management of a project

The project model stipulates further which documents, reporting structure, level of monitoring and control, and interaction with top management are applicable for the type of project. This is revealed by informant 1: *'I know if you have very complex projects you need to report very high up in the organization and different meetings for very complex projects. They need to often report. You have connection always to the top*

management'. Though a company-wide standard for individual projects exists, the company recognized the need to establish a separate framework modified for handling investment projects in a manufacturing environment. A project handbook is therefore currently developed to shape the processes for an effective management focusing on machine investments (Informant 1, 2011).

4.1.2.3 Competence Requirement and Development

The company offers an internal education for project managers and other specified work roles. The training program covers project related topics ranging from level 1 to level 4 such as GPM foundations, change management, advanced risk management, program and portfolio management. It is specifically construed involving the four types of project complexity, which implies the knowledge areas that need to be covered. The benefit of having the different categories is to assign the project manager with the right competence level to the right type of project. Both informants agree that among other variables competence of the project manager is important in this decision. One interviewee constitutes: *'Knowledge, competence. Also personality is important. Maybe you have the knowledge and the competence strictly regarding projects, but its more things like that...Different projects need different personalities.'*

Table 4.1 Training modules

Training modules needed by work role		Level 1 Modules	Level 2 Modules		Level 3 Modules (under development)				Level 4 Modules (under development)				
General work role	**Specific work role**	**1** GPM2 Foundation	**2a** Managing projects, Level 2	**2b** Directing projects, Level 2	**3a** Managing projects, Level 3	**3b** Directing projects, Level 3	**3c** Project Operation (key business processes)	**3d** Portfolio Management	**4a** Managing projects, Level 4 (Leadership and coaching)	**4b** Portfolio and Programme management	**4c** Change Management	**4d** Legal/IP	**4e** Advanced Risk
Team member		M											
Work Package Manager		M	M										
	Simple projects	M	M				O						
	Typical projects	M	M		M		M		O		O	O	O
Project Manager	Complex projects	M	M		M		M		M		M	O	M
	Steering group member	M		M		O	O	O		O			
	Sponsor - Simple projects	M		M		O	O	O					
	Sponsor - Typical projects	M		M		M	M	O		O	O	O	O
Line Manager	Sponsor - Complex projects	M		M		M	M	O		O	M	O	M
Local Project Management	PMO/Mgmt team member	M		M		O	M	M		O			O
Offices/Management	PMO/Mgmt team support ro	M					M	O					
Teams	Portfolio Manager	M		M		O	M	M		O	O		O
	Committee member	M		O		O	M	M		M	O		
PMC	Reference Group	M		M		O	M	M		O			

Key: M = Mandatory, O = Optional

4.1.2.4 Set up of Project Organization

Furthermore, the various categories build a guideline for the constellation of the project organization. Figure 4.3 shows a potential project organization within SKF. With greater complexity more personnel is involved that exert different roles and responsibilities. Project roles and responsibilities are defined in the group project model and vary from: steering group, reference group, receivers, clients, line manager, project group, and project sponsor. In contrast to complex projects, simple project do not always involve an experienced project manager but might be as well executed by technical experts (Informant 1, 2011). Stand-alone work package can be managed by work package manager and the sponsor is typically the line manager (Internal document, 2007).

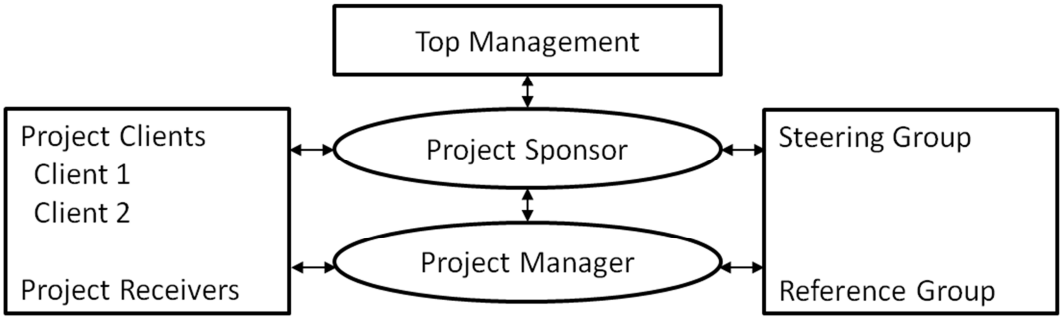


Figure 4.3 Project organization SKF

4.1.2.5 Assigning Priority for Resource Allocation

When managing projects in a multi-project environment resources are usually rare and allocation of critical resources to projects is an important factor (Informant 1, 2011). The efficient use and appropriate allocation is an issue of higher level management. Based on the proposal and preparation work of the ppm group concerning resource planning, the ppm committee gives its final approval. In the process development and Six Sigma department resources are committed based on their strategic relevance. Mandatory projects deriving from external, product, and manufacturing strategies receive resources prior to other incoming needs (Informant 2, 2011). This is confirmed by informant 1, who replied: '*There are the strategic projects that we need to do. It's more a question about resources. If we don't have enough resources we will not do any improvement projects in the production.'*

4.2 ERICSSON AB

4.2.1 Categorization Systems and Attributes Used

There are various dimensions for project differentiation that enables different project categories and create congruent project profiles. Firstly, project categorization is determined by customer, which consequently results into a demarcation between internal projects and external projects. Typically internal projects include organizational development and R&D projects, whereas external are labelled customer delivery projects (Informant 3 and 4, 2011; Lungu, 2008). An important fact is that the company, respectively the service division, is organized around the product solutions that comprise four main product groups: managed services, consulting and systems integration, customer support and network rollout services, each of which involve sub-products (Ericsson, 2010). The systematic demonstrates a deliberate distinction of projects by project deliverable or type of product or service and configures the company into respective business units.

Furthermore, there is a specific division of projects including four differently weighted dimensions using attributes like: complexity, size, risk, and environment. These attributes are further specified as below (Internal document, no date):

- **Complexity:** Level of project certainty/ clarity, architectural complexity, number of sites with independent customer interface, technology, number of stakeholders, partner, Subcontractor, management, operator business process (change management), consultancy involvement
- **Size:** contract value, man-hours, number of staff, project scope, project duration
- **Risk:** Technical, finance, time, procurement, resource
- **Environment:** ease of cooperation with customer, attractiveness (language, culture, hardship)

The evaluation takes the form of a questionnaire using a scoring system to determine the project types, which range from Type T, Type A, Type B, Type C to Type D. While Type T projects are in general very simple and small, Type D project could include *'huge turnkey projects'* (Informant 3, 2011). The scoring is done before a project tollgate 2 decision either by the project manager or by the project office manager, who needs to understand the project scope in order to assess the required competence level of the project manager.

Business opportunities within the Global Service Business unit are directed towards the customer with the consequence that they might follow three different sales tracks. Depending on size in terms of contract value and complexity, the sales processes are:

full track, fast track and small value track and are decided on ideally at sales decision point 1 (Informant 4, 2011). Full tracks concern opportunities above a certain contract value or stem from a certain product portfolio like managed service, systems integration and frame contracts, while opportunities that are below this value and have well understood risks or relations to customer follow the fast track. Of even lesser value are projects intended for the small value track; these often occur within a frame contract and involve very low uncertainties. However, with on-going specification of the project scope sales track might vary *'You start something like a small value track and after a while you find out this will be a little bit more expensive. Then we have to lift it up.'* (Informant 4, 2011)

4.2.2 Purposes

4.2.2.1 Adapt Project Management Approach and Sales Track

The differentiation between internal and external customers makes sense as organizational development, R&D, and customer delivery projects exhibit various different characteristics for example in project life cycles that have a fundamental impact on their management. The company states in its annual report (2010, p. 19): *'When developing new technologies such as…the project cycles have normally been longer, up to ten years. However, when developing new services or applications other project models have been created with shorter lead-times, sometimes only a few months.'* The project model for external projects is in line with the PMI principles (Lungu, 2008) and is standardized globally for all service activities. Standardization in methods, processes, and tools is mainly driven by the need to create synergies and cost efficiencies (Ericsson, 2010). The project process for customer projects is a part of the business process and is closely linked to the sales process as illustrated in Figure 4.4. Tollgates as the *'pre-defined business decision during a project'* (Lungu, 2008, p. 15) are interconnected with the sales decision points.

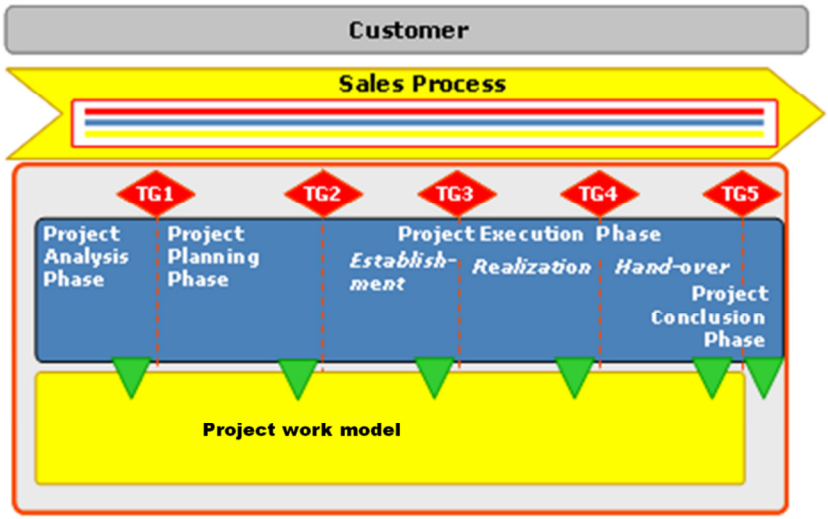


Figure 4.4 Project management model for customer delivery projects

The adaption of the project model includes the set of tools available for each project type: '*Each project is an individual, but they follow the same process. We have different tool boxes for those three different types [internal, R&D, customer delivery] where we have templates or checklists on the project process part'* (Informant 4, 2011). Likewise, the various sales tracks entail different formal decisions and documents for projects e.g. full track projects require a formal 'handshake' between the sales process and the project management process, which is not necessary for small value tracks (Informant 4, 2011). Due to the fierce competitive environment and being time driven the company must be highly responsive to changes in customer orders or newly placed orders (Ericsson, 2010). Informant 4 sees following benefits in having a project categorization system in place:

> There is no real key, but there are several aspects. The first important aspect is you like to empower the project organization. This means that you don't need to have top management dealing with detail decision in the projects. You like to have people dealing with the right subjects at the right time. By differentiating project levels you definitely can have much more projects going through the organization.

4.2.2.2 Differentiate Project from Operational Work

A Type T project does not require a full set up of a project work form due to its simplicity, size and contract character; neither does it warrant the engagement of a professional project manager. Therefore it can be executed by a team leader or similar (Internal document, no date). This statement points out that the framework involving multiple dimensions differentiates projects from operational work or simple activities, which is then classified as Type T.

4.2.2.3 Competence Requirement and Development

Due to growing complexity in business and technology the demand for professional service shows an upward trend (Ericsson, 2010). The company's focus is shifting from a product-led to a solutions-led sales approach, which involves offering customers the full breadth of hardware, software, and service. The competence and capabilities of the company's employees focus increasingly on service and software (Ericsson, 2010). The requirements to project management are obviously changing with an increasing number of projects cross functionally coordinated and with greater involvement of personnel from several specialist departments. Within this context it is essential to match the right project manager to the right project, whereby competence and availability are two key criteria to consider in this decision. When asked about the factors of importance when assigning a project to a project manager informant 4 said: '*You do consider the kind of project you have. Since we grade our project managers - the skill in different areas - we take the person with the right skill.'* For this reason the company offers mentioned framework consisting of multiple dimensions: complexity, risk, size, environment, to determine the competence level that is needed for the required project manager in order to manage a certain project (Figure 4.5).

> This categorization [Type T-Type D] will tell you which kind of competence you need and will also show you on a longer term what kind of competence you have to build up. In our portfolio we have 10 B-projects, and 4 C-projects which means that we should hire 10 experienced project manager and 4 senior project managers. If you only have 2 senior project managers then we have to develop some from the experience to the senior (Informant 3, 2011).

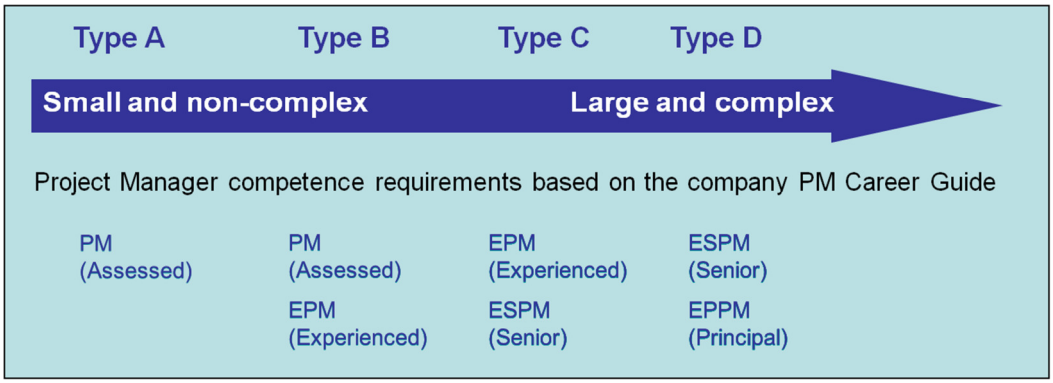


Figure 4.5 Project manager competence level

The statement of informant 3 involves also a long-term perspective considering future recruiting or competence development. The framework is therefore used as an individual career path for project managers. The internal education involves 30 knowledge areas, whereby each area is graded from A-D. A certification for e.g. senior manager requires a verification of experience in Type B-C projects and corresponding grades in project management skill areas (Informant 3, 2011).

4.2.2.4 Set up of Project Organization

Within the project model different roles and responsibility are specified for several processes like the steering function (sponsor, steering group, and portfolio owner), the project management function (project manager) and the execution function (subproject manager, resource, work package teams, and receiver), whereby the core 3 team includes: customer account responsible, solutions responsible, and project manager (Lungu, 2008). After assessing the project using the multiple dimensions of complexity, risk, size, environment, the specified type (A, B, C, D) implies the set-up of the project organization.

> A project management team could vary between 1-8 persons. It depends on the size of the project. In small projects the project manager does all work. In huge projects you could have a project contract manager, project control manager, project administrator, and so forth (Informant 3, 2011).

4.2.2.5 Choice of Contract Type and Payment Terms

A major stream of the company's revenues comes from managed service and customer support projects. These contracts are long-term ranging from five to seven years and payments occur usually in advance. Conversely, consulting and systems integration have shorter lead time and are paid only after completion of the customer order. A business with lower margins, though huge turnkey projects might be included, is network roll-out. The reason is that third party sourcing is involved (Ericsson, 2010). Contract types within the company are stated below (Ericsson, 2010):

- **Delivery contracts**
  These types of contracts are applied on the delivery of a product, a combination of products, or a part of a network, whereby medium-size and large types might contain several components such as services e.g. network roll out. Revenue is recognized in accordance with formalized acceptance.
- **Contracts for services**
  Several types of services are noted here: training, consulting, engineering, installation, multi-year managed services and hosting. Payment occurs after the service has been provided or for longer term agreements pro rata over contract period.
- **Contracts generating license fees** are requested when using company's technology or intellectual property rights by a third party.
- **Construction-type contracts**
  Here agreement in supplying a complete network based on a new technology or tailored customer solution is captured. Revenues occur according to stage of completion.

4.3 SCA

4.3.1 Categorization Systems and Attributes Used

The company is organized in five main product groups: personal care, tissue, packaging, publication papers and pulp, timber and solid-wood products. These groups are the primary segments. Within it the GHC serves two segments: personal care and tissue, in which five product categories are developed: tissue, away from home tissue, baby diapers, feminine hygiene and incontinence care. Though the products are rather simple they can involve complex manufacturing processes (Informant 5, 2011), thus project complexity varies from low to very high. There is a division of projects based on product life cycle, which are concept, development, and launch. This segregation is strongly linked to the group-wide innovation process (Figure 4.6) that provides detailed process steps from idea generation in the concept phase towards the launch of products. Innovation activities are grounded in market research that reveals trends in respective business area, customer insight and requirements, and technological progress. The global approach to innovation enables efficient resource allocation and generates cost synergies (SCA, 2010).

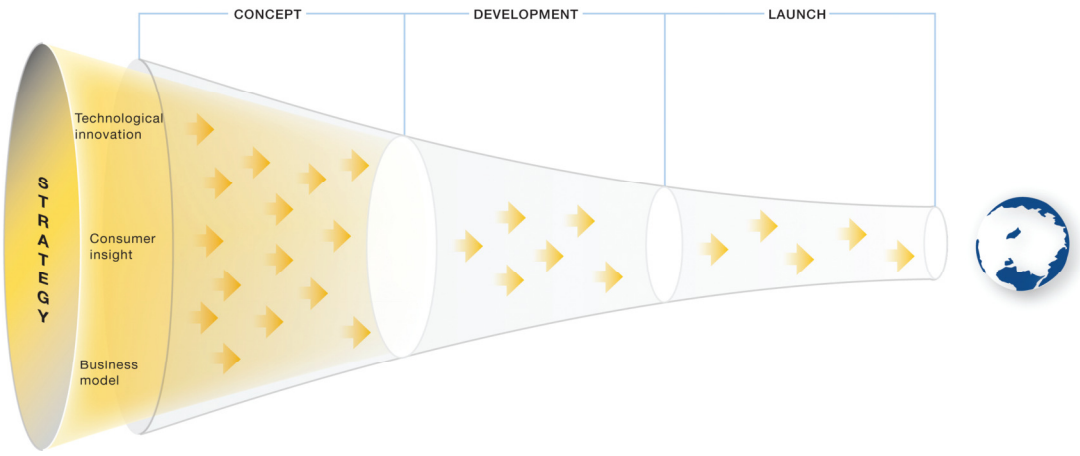


Figure 4.6 Innovation process

Innovation types are specified as follow:

- **Upgrade:** This type of innovation is a based on an existing product or offering, and is necessary to remain competitive.
- **New generation**: Developing an entirely new offer to an existing customer base is defined as a new generation.

- **Breakthrough:** This type of innovation is rare and has the potential to transform the entire industry or market, gain a new customer/consumer segment, or provide a completely new offering to an existing customer segment.

Besides from mentioned concepts, GHC uses further attributes to classify projects: e.g. business type (Branded/ Retail Brand), business segment, project labels (customized classification based on e.g. critical success factors for category, lead market, geographic location of factory, and others (Informant 6, 2011). The company provides a definition for each category as a guideline for users to allocate the projects ideally at the concept phase. Pitfalls in setting boundaries exist e.g. in the differentiation of project by product life cycle. Both informants claim that these phases might overlap in some projects. Additionally, rules for classifying or provided definitions are not unambiguous.

> Not always. 8 times out of 10 it's crystal clear, the 9th you can get it in, and the 10th you need to discuss...Sometimes you would like to do a concept development. At the same time you would like to develop a product. It is not 100% clear if it is a breakthrough or a new generation. There are grey scales in between this (Informant 6, 2011).

4.3.2 Purposes

4.3.2.1 Adapt Project Management Approach

The project management model is standardized within the Group and is a systematic way of managing projects. It provides a common management structure and a common language to facilitate work carried out in an international environment, and supports co-operation between functions, divisions, and partners and finally to enable rapid execution of projects (Internal document, no date). The project model is a generic framework that is applicable to various kinds of product categories including respective process descriptions, checklists and criteria for toll gate decisions (Informant 5, 2011). The set of tools, required documents vary according to the type of project executed: *'We want to emphasize that each project is different. The exact tools and criteria can vary between projects. So we want to allow certain flexibility here.'* (Informant 5, 2011)

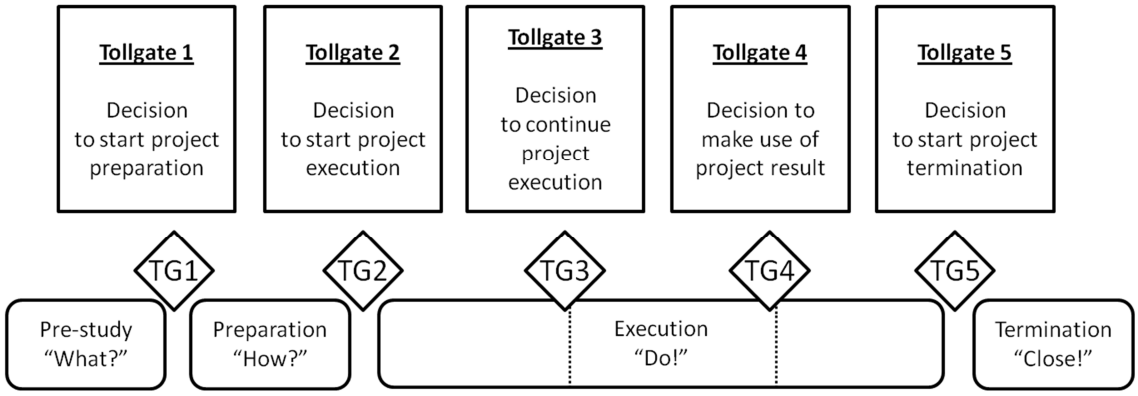


Figure 4.7 Prime model and tollgate decision

4.3.2.2 Competence Requirement

There is project management competence on different levels, e.g. all project managers in the PMO are certified according to PMI regulations. These project managers are authorized to manage development projects. Decision criteria for assigning a project manager to a project are competence and availability (Informant 5, Informant 6, 2011).

4.3.2.3 Set up of Project Organization

The project methodology clarifies project related roles and responsibilities; it emphasizes empowerment of the project team with a strong leader (Informant 5, 2011). A possible project organization build around a project is shown in Figure 4.8. Depending on the product life cycle the project organization requires professional skills from different functional departments. According to informant 6 the concept development of a product involves a greater number of commercial professionals while more personnel with a technical background are joining in the product development phase.

> If you are into development then we have more technical resources. We still have commercial resources, but they play smaller roles. If you are over here [concept phase] we almost have only commercial persons and some technical. It's a bit different depending what phase you are.

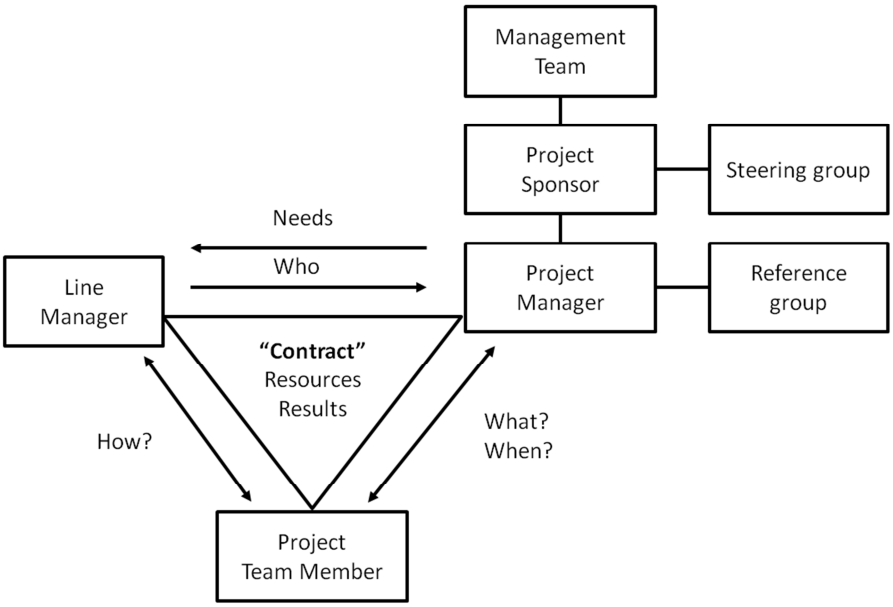


Figure 4.8 Project organization SCA

4.3.2.4 Create Visibility

Ordering projects into a formal or informal system creates visibility and transparency. Informant 6 argues: *'The benefit is when you classify it you put it into the system. We at least have a discussion around it, so it's visible.'* Portfolio management is associated with having an '*overview of what is on-going'*. This issue was raised by both informants. Benefits of greater transparency are manifold. Firstly, strategy can be linked from corporate level to the operational level. This is important to maintain a business focus, investing in projects that are critical to business (Informant 5). Secondly, transparency is needed for project selection. Classifying projects into categories, making them visible to higher management, will support decision making regarding which projects to start.

> By doing this classification you also are sending a signal to the people doing the jobs saying that: 'Don't come back with an up-grade, because this time we want breakthroughs (Informant 6, 2011).

4.3.2.5 Portfolio Balance, Project Selection and Prioritization

The company has not yet established a company-wide methodology to manage their portfolio. A systematic way of handling a larger group of projects have been implemented in the GHC and is now rolling out to the business groups. The purposes in relation to portfolio management noted at this point are rather prospective. Creating

categories to group projects in a meaningful way based on similar characteristics can be utilized to maintain a balance of the project portfolio. Informant 5 constitutes that the governance process of a portfolio includes the assessment of the right mix of projects across various categories, long term vs. short term projects, and type of innovation.

> We can monitor and follow-up the balance in the portfolio. Do we have the right balance between product categories? Do we have the right balance between short-term improvements, cost saves, whatever? Or more long term, more radical innovations? Do we have the right balance between geographies? (Informant 5, 2011)

Additionally, project categories can be used as an input to the prioritization process. Though several criteria like strategic fit or feasibility are used for selection and prioritization of projects, the resulting scores function only as guideline. Projects belonging to a certain product group with lower scores might get higher priority due to the urgency for developing the product group to stay competitive (Informant 6, 2011).

5 Discussion

5.1 Multidimensional Project Categorization Systems and Attributes Used

All three organizations interviewed use multiple dimensional categorization systems. Composite categorization systems are in place combining hierarchical and parallel systems as described by Crawford et al. (2006). The primary attribute to classify projects in a hierarchical structure is by type of product/ service respectively sub-product/service or type of client. This form of categorization seems to be rooted in the way how the companies organize their business. This is in alignment with Crawford et al. (2005) who reveal that the primary level of categorization shapes the basis of the corporate structure. Simultaneously to the primary dimension, the same projects might be further classified based on project complexity, risk, project size, environment or some other attributes that fits the organizational purpose. Informant 5 from SCA states: '*If you say categorization, we can also add the product category, the type of innovation, and geography. These three characteristics at least you can also assign to the project whether it is a development or launch project'*. This indicates clearly the use of numerous parallel systems; a project can therefore be assigned to several categories.

Different types of categorical systems are found at different managerial levels in all three companies. The categorization is then context related referring to a specific work setting e.g. the process development and Six Sigma department at SKF groups projects by their strategic importance suggesting high priority for resource allocation, while other projects or activities are secondary. Decisions concerning resources are made by higher level management. On the other hand, some degree of company-wide or, in a smaller scale, division-wide standardization exists in the context of project management or the operational level. Categorization systems are formalized through the utilization of a scoring model or definitions and are implemented in the project management process, in which it is closely linked to efficiency goals. This demonstrates that project categorization *'...is a means of making things more manageable.'* as Crawford et al. (2002, p. 182) argued. Archibald (2004) wrote in his paper that a practical system should be configured similar to a project work break down structure offering hierarchical levels.

SCA offers an overabundance of attributes to the detriment of the overall effectiveness as claimed by Informant 6: '*I think there are too many… A management team can never utilize all these classifications... You need 3 key things that you would like to split it on and use as input for prioritization'*. This aspect is discussed by Bowker and Star (1999), who mentioned control, visibility and comparability as vital components when designing a categorization system. The execution of control will affect the level of detail when deciding on the categories while high visibility and comparability decreases the level of control. Crawford et al. (2006) argue that systems involving too many

categories and attributes are not applicable. Instead, a limited number of categories with simple rules should be facilitated. A noticeable fact is that in one case company complexity functions as a composite attribute, which is explained by Crawford et al. (2006) as a dimension assessed by means of other attributes. In SKF complexity involves in total eight other project characteristics and the specified project types being: complex, typical, simple projects and stand-alone work package.

5.2 Multiple Purposes

From analysis and corroboration with literature a link can be drawn from the design of a project categorization system to its purpose, whereby one system can serve numerous purposes. The structure and the content of categories are driven by its rational. Evidence found in all three companies lead to this assumption e.g. SKF differentiates projects based on its complexity. On this base the group project model provides guidelines for tools, reporting structure, and interaction with higher level management. Other managerial variables discussed in the literature section may also be included, but have not been mentioned in the interviews. Furthermore, the project organization is dependable on size and/ or complexity of a project which then involves more personnel performing various roles and responsibilities. The third use focuses on building internal project delivery capability. The realistic assignment of a project manager to the right type of project is a key success factor in a multi-project environment (Patanakul and Milosevic, 2009) whereby the competence of the project manager is the most important variable as agreed by all informants. The categorization system can then be used to assess the required level of competence needed to match manager and type of project. The second company, Ericsson shows a similar method like SKF for the same purposes. The difference is that Ericsson uses four attributes: complexity, risk, size, and environment to adapt management approach and build organizational capability. In contrast to the aforementioned cases, SCA does not offer an explicit system for these purposes. However, in the interview process indications emerged showing similar considerations when assigning projects to key personnel. Management approach is modified with regards to product category in SCA. Several other purposes have been identified like choice of contract type and payment terms and distinguishing project from operational work. A contingent approach to project management is strongly promoted by several researchers and discussed in detail in the literature review.

5.3 Strategic Use of Categorization Systems

Purposes related to portfolio management have been addressed by SCA and SKF. Firstly, it must be noted that only SKF has a standardized portfolio management process. In SKF the process entails input, preparation, and decision, whereby portfolio management is basically understood as a framework for project selection and prioritizing, and as an input into resource allocation based on assigned priority. At Ericsson and SCA some method to manage a multitude of projects is in place, but not as a standard within the Groups. The fact that SCA is in the transition to roll out its portfolio management process from the GHC to the business groups was an interesting circumstance. It allows major insight into the nature of categorization systems and their potential use at the strategic level. There might be several reasons why Ericsson has not linked project categories for the use of project portfolio management. One reason could be that projects in the Global Service Business unit serve external customers and therefore the ability to select business opportunities might be restricted.

5.3.1 Visibility

A finding resulting from cross-case comparison is that categorization enhances visibility, which is in alignment with Bowker and Star (1999). By sorting projects into a system they are made visible to the users, projects can then be evaluated, monitored and controlled. Informants in all case companies have emphasized that *'having an overview of on-going projects'* as one major feature of portfolio management. This is outlined by Cooper et al. (2006, p. 8) who argue *'Portfolio management provides visibility of all projects so that people understand why we are working on certain projects'*. Greater transparency of project activities facilitates understanding for strategic decisions, which was discussed at case company SCA. Maintaining a business focus was one key driver for establishing a standardized portfolio process. Drawbacks for projects, that do not fit the criteria to include them into any system, remain invisible (Bowker and Star, 1999). These might not get the attention of top management or relevant resources to be successfully managed. Visibility and comparability are closely connected.

5.3.2 Comparability

In a multi-project environment management complexity is expressed by the diverse nature of projects (Gareis, 2000). Organizations have to implement effective tools to address this complexity. Projects classified based on their similarity and by a set of predetermined criteria enable more objectivity for project selection and prioritization (Cooper et al., 2006). As indicated in the literature review activities like project selection and prioritization as well as balancing require grouping projects into categories. This enables aligning projects to strategy, which has been mentioned as a critical success factor for high performing project portfolios. This is in alignment with

Bowker and Star (1999) whereby the authors reason that categorization systems allow comparability across entities. Having sufficient resources is uncommon across all companies and decisions need to be made to assign resources based on priority. Categories or project groups can function as an additional input to this process. In their survey Crawford et al. (2005) found that organizations value their categorization systems for being able to compare projects, divisions, and organizations.

6 Conclusion

The findings of this research conclude that categorization systems contribute to overall project portfolio performance by 'doing the right projects' and 'doing the projects right'. From the individual project perspective two critical factors mentioned by project management literature and confirmed by the case companies were identified: adaption of project management approach and building project delivery capability in from of a realistic assignment of project manager to the right type of project. The numerous attributes offered by literature have found acceptance in the practical world to some degree. Attributes like product type, complexity, project size, innovation type were used to characterize projects. However, companies build a context-specific categorization model to manage individual projects. On the other hand, key concepts like the NCTP-model are not implemented in any case company. A reason might be that this concept evolved by investigating a high variability of industries, therefore the dimensions are fairly distinctive and do not suit the context of one organization.

A crucial aspect in a multi-project environment considers the overall picture of 'doing the right projects'. It is evident that an effective portfolio management process requires a meaningful and systematic approach to project categorization. Understanding how specific project groups impact management practices, their roles and responsibilities on a strategic level can significantly increase portfolio performance. The findings indicate that project categories benefit project selection and prioritization, balance of the portfolio, and allocation of critical resources by creating visibility and allowing comparability across entities. Therefore, the three constraints visibility, comparability, and control need to be considered carefully when designing a categorization model and a suitable trade off should be attained. No real guidance for project categorization on a strategic level has been found in literature since the concept of project portfolio management is relatively young and its application in industry has not matured yet. Existing categorization systems do not meet the requirements of increased management complexity. Project portfolios as compositions of projects of diverse nature pose new challenges to research and practitioners.

Limitations and Recommendation

The research involved three case companies and was a small scale study. The limited scope requires more empirical validation. The aim was to understand how project categorization systems are applied in the practical world with an emphasis on project portfolio management. The fact that the concept of portfolio management is not standardized in two of the three companies is a major limitation to this study. Responses from managers are partly based on assumptions and experiences or were fairly preliminary, thus bear the risk of participant bias. Lack of access to a second department within a company can be considered as the next limitation. Future research might expand the case study approach to investigate the use of project categorization for

portfolio management in a R&D context. The importance of R&D projects for strategy implementation, the ability to select projects, and the higher maturity of portfolio management practices in this environment are criteria in favour. Another constraint was the length of the interviews. Though the duration have been set for 60-90 minutes, it would have been beneficial in some interviews to allow more time for investigating the research topic in-depth. Limitations exist also in the availability of literature concerning the strategic use of categorization systems. Developing universal categories might be of special interest in this regard.

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Appendix A

Semi-structured Interview Questions

Basic information and interviewee background

1. What is your type of business, your current position and responsibilities?
2. How long have you been working in that position?
3. What best describes the structure of your organization?
4. What is the average number of enacted project portfolios in the company/ the business unit?
5. What is the average number of projects in a portfolio per year?
6. What is the average number of projects per project manager in a portfolio?
7. What are the typical project budget, project duration, and typical number of participants in a project?

Project Categorization Systems

1. What attributes do you use to describe the various types of projects undertaken by your company/ business unit? How are projects, if at all, sorted into groups of programs or portfolios?
2. When are attributes defined during a project life-cycle?
3. Is there a formal procedure to assign attributes to projects? If yes, please describe.
4. Why do you need to distinguish between various types of projects?
5. Do projects categories provide a unique and clear distinction?
6. Are all projects undertaken by your company assigned into portfolios? If no, Why?

Project and Portfolio Management

7. Please describe the portfolio/ project management process in your company.
8. Why do you apply project portfolio management? Benefits?
9. What are the main problems when managing a group of projects?
10. How, if at all, do management tools and methods vary between different types of projects?

11. What are the factors of importance when assigning a project to project manager?

Project Selecting, Prioritizing, Balancing

12. How are projects initiated? Who is involved?
13. How are projects selected? Do selection criteria differ between different types of projects?
14. How are projects prioritized? Do you consider the company's need?
15. How do you achieve portfolio? Link to strategy?
16. What roles are defined for portfolio governance?
17. How do you monitor and control portfolio/ project performance? Do methods and tools vary between different types of projects?

Portfolio review

18. How often do review the project portfolio? Do you consider all projects in the review meeting?
19. Do you check for portfolio balance and rearrange priority?
20. What practices do you have for making Go/ Kill/ Hold decisions? Who is involved?