New Product Development Projects and Project Manager Skill Sets in the Telecommunications Industry

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Certification

This thesis is submitted in fulfilment of the requirements of the degree of DBA, in the Macquarie Graduate School of Management, Macquarie University. This represents the original work and contribution of the author, except as acknowledged by general and specific references.

I hereby certify that this has not been submitted for a higher degree to any other university or institution.

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Abstract

The telecommunications industry ('Telco'), a service provider business, is undergoing significant changes such as deregulations, technology changes and increasing competition. Managers face increased pressure to bring new products with the latest technology into the market faster. Few previous studies have analysed New Product Development (NPD) projects in this hypercompetitive industry. This research addresses this gap by investigating Telco NPD projects and the associated skill sets needed by successful project managers.

The study evaluated how project managers' various skills contribute to project management success. Incorporating clear definitions grounded in the recent literature on NPD, management and leadership, the research proposed a new organising framework of four groups of skill sets: technical, leadership, managerial and administrative. Technical skills are the knowledge of technologies on which the project work is based. Leadership skills involve influencing project stakeholders to deliver a quality product within time and budget. Managerial skills are needed to develop and execute project plans and to get project work done. Administrative skills include understanding an organisation's structure, culture, policies, processes, methods and tools.

Previous classifications for Telco NPD projects have over-emphasised product innovation and undervalued the process aspects. While small projects provide fewer management challenges, this study found that project managers of large and complex projects require all four skill sets. Managerial skills are mandatory. Technical and administrative skills enhance understanding of the technology and business processes. Leadership skills are limited at an operational level. Managerial and administrative skills are essential for developing and implementing project plans; technical skills are important in the initial project stages; leadership skills are needed from the beginning until delivering a new product.

The research outcomes can be used when hiring and developing NPD project manager professionals in the Telco industry to complement current project manager competency standards, which do not cover all the skill sets. Findings may be applicable to Telco companies in other countries new to such market conditions. Furthermore, other industries may adapt the skill set framework to suit their own particular requirements.

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Abbreviations used in thesis

AIPM	Australian Institute of Project Management
APM	Association of Project Management
CIFTER	Crawford-Ishikura Factor Table for Evaluating Roles
CMM	Capability Maturity Model
DIV	Development, Implementation and Validation
EPD	Enhanced Product Development
ERP	Enterprise Resource Planning
F&D	Feasibility and Definition
GAPPS	Global Alliance for Project Performance Standards
HRM	Human Resources Management
II	Initial Investigation
IP	Internet Protocol
IPMA	International Project Managers Association
IT	Information Technology
IT&T	Information Technology and Telecommunications
MS	Microsoft
NCPD	New Customer Product Development
NPD	New Product Development
NTI	New Technology Introduction
OSS	Operations Support Systems
PMAJ	Project Management Association of Japan
PMBOK	Project Management Body of Knowledge
PMCD	Project Management Competency Development
PMI	Project Management Institute
PPM	Project Portfolio Management
R&D	Research and Development
ROI	Return on Investment
SPC	Small Product Customisation
TQM	Total quality management
VoIP	Voice over IP

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INTRODUCTION

2   Need for this research

The telecommunications industry (called Telco for short), as a service provider business, has gone through significant changes in recent years. Rapid technology advances, deregulations and greater competition have increased pressure on managers to bring new products into the market. However, few published studies have analysed New Product Development (NPD) projects in this hypercompetitive industry today (Robertson and Jones 1999; Beardsley et al. 2004). This research aims at filling this gap; it investigates Telco NPD projects, their contemporary challenges and skill sets that enable project managers, who are critical for managing these projects, to be successful.

Technological changes are all-encompassing; in the current space age, advances in information and computing technologies in terms of hardware (microprocessors, storage devices, etc.) and software (computation algorithms, databases, Internet, etc.) have created ripple effects and impacted every industry. Today, information is at everyone's fingertips on a computer screen. Telco systems and networks are connecting far-flung and remote locations in the world, and play a central role in the distribution of information and the progress of knowledge. The demand for different forms of communication, such as telephone, video calls, fax, email and Internet, is steadily increasing and creating new business opportunities. There is a continuous stream of new technologies, especially Internet, adding new combinations in real life applications beyond previous imagination (ITU 1999). Additionally, recent deregulations in the Telco industry in many countries have created hypercompetitive markets (Beardsley et al. 2004). Telco companies are under intense pressure to bring technological advances into the market to keep up with the competition; New Product Development (NPD) is

not an option, but a must (Wheelright and Sasser 1989; Booz et al. 1992; Saunders and Jobber 1994; Moore 2004; Almedia and Miguel 2007). Their project managers especially attract attention, as they are one of key factors contributing to an NPD project's success (Cooper and Kleinschmidt 1987a, 1996; Clark and Wheelright 1992; Zirger and Hartley 1996; Thamhain 2004a).

These rapid changes have transformed the Telco industry, yet the literature contains little about NPD project managers in Telco today. Most studies ignore or do not focus on industry specifics, and the majority investigate the manufacturing sector (Clark and Wheelright 1992; Goodwin 1993; Henke et al. 1993; Cleland 1995; Norrgren and Schaller 1999). The few studies that claim to address Telco have either considered equipment manufacturers for the industry (Barzcak 1994), or were unclear whether they involved companies working on support systems (Zirger and Hartley 1996) or service providers, the core business in the industry. These studies are out-dated, and do not reflect current industry conditions.

Project management can be considered as a relatively new profession, although it may have existed in different formats throughout history. It became more apparent in the scientific management era in the early 1900s, although its formal recognition began only with the remarkable technological changes in the 1950s, when project managers supervised complex defence projects in the USA. The first professional institutions were then formed within a decade: International Project Management Association (IPMA) in Europe (www.ipma.ch), and Project Management Institute (PMI) in USA (www.pmi.org). Shortening technology cycles have gradually increased the importance of this profession, and it is now recognised as a distinguished role in every industry. At a very high level, project managers manage allocated resources (i.e. money and people) in an organisation to produce a new product or service under certain constraints – basically cost, time and quality (de Wit 1986; Atkinson 1999; Baccarini 1999).

To meet the increasing demand for qualified professional project managers, project management institutions have developed standards and certification programs (AIPM 2003; IPMA 2004; PMAJ 2005; ASAPM 2006; GAPPS 2006; PMCD 2007). However, the project manager competency standards focus only on aspects that are common to any kind of project, regardless of what it serves and in which industry it is based. Research is increasingly being scrutinised for its representativeness of actual practices and what is

really required in the field (italics added for emphasis): "Whatever the politics or purpose of those standards, they have at least *some basis* to the claim of the representing 'accepted practice' (though *not best practice*)" (Whitty and Maylor 2007:4), and "The authors suggest…that *future standards development should address the needs of different industries and application area*" (Crawford and Pollack 2007:95). These comments raise doubts that these standards really explain project managers' roles in different contexts, including Telco NPD.

The competency standards, in simple terms, set a number of criteria to check if a candidate can exhibit associated outcomes in their units of competencies. Some standards have already acknowledged the shortage to tailor or extend the existing frameworks to suit specific circumstances. However, there is a need for closer examination of specific circumstances (Crawford and Pollack 2007; Whitty and Maylor 2007). Consequently, this research focuses on project managers in Telco NPD projects, and also closely examines and complements the standards as part of the investigation.

> *"An entity that adopts the Global Alliance for Project Performance Standards (GAPPS) framework should use all of the Units, Elements, Performance Criteria in order to help ensure consistency of application and reciprocity. Additions and modifications can be made as appropriate (and in accordance with the GAPPS 'copyleft' licence) to suit local and regulatory requirements." (GAPPS 2006:10)*

> *"The Project Manager Competency Development Framework (PMCD) does not address industry-specific competence. Individual project managers, or their organisations, may choose to supplement the PMCD Framework with additional industry-specific competencies to meet their needs" (PMCD 2007:3)*

3   Research question

Selecting and developing suitable candidates as project managers has immediate managerial implications to overcome the project challenges, as managers are critical for running successful projects. Current competency standards address general project management; however, this is not the focus of this study, and these standards fail to consider what makes project managers competent. This research study goes deeper and investigates the foundations of project manager competency in Telco NPD. It therefore contributes to professional practices and the body of knowledge by providing further

insight into project managers in the Telco industry. The overarching research question is:

> ***What makes project managers successful in Telco NPD projects in today's dynamic competitive business environment in Australia?***

Australia is a specific example; more than a decade ago it was one of the first countries to deregulate its Telco market, and many other countries are following the same trend.

The major research question incorporates several subsidiary questions. First, the research has to establish a satisfactory basis for consistently evaluating project managers in all dimensions. The first sub-problem is then:

> ***What is the basis for evaluating project managers?***

In any research project, answers to initial questions can raise new questions. This study adopts an existing concept of 'skills' to explain and explore a real life phenomenon, and attempts to represent these skills in a simpler and more abstract way. Therefore, the second minor question is:

> ***What skills do project managers use, and can they be represented better and more simply?***

Answering such a question requires criteria based on skills that can better describe project managers. However, this study does not aim to amend a standard or to produce a set of new criteria for certifying project managers. It started with the purpose of finding the factors that enable Telco NPD project managers to successfully overcome their projects' challenges. The competency standards have been produced for a similar purpose: the minimum standard required to qualify as a project management professional by an institution; however, these standards do not answer the research question. A further question, then, is:

> ***How well do competency standards practically cover or define the Telco NPD project managers, who are capable of addressing their projects' challenges?***

Telco NPD projects form an inseparable part of the main research question. The difficulties and challenges they provide determine the skills required by their project managers to be successful. It is a natural consequence to target the projects that reveal the most information about the project managers. Therefore, the investigation explores:

What kind of Telco NPD projects should be examined to get a better explanation of their project managers, and what are their indicators?

NPD projects have different emphases throughout their life cycles (Cooper 1994b, 2002a; Engwall 2001), and accordingly they may demand project managers in different dimensions of project management. Determining their variations in different stages of a Telco NPD project is a natural extension of this research scope.

The subsidiary research questions have been presented here as logical extensions of overarching research question. However, in this thesis they are addressed in a specific sequence that develops sound cause and effect relationships. First, a first broad literature review establishes foundations for theoretical propositions about skills, Telco NPD projects are examined, and then their challenges are related to project manager skills. A similarly consistent approach is followed during the analysis and for presenting the results.

4   Objectives

This research study sheds new light on the critical topic of NPD project managers in the Telco industry. The research objectives were determined by, but are not limited to, the questions presented above. The overall objective of gaining a better understanding of the skills, and ultimately a generalisable description of a successful project manager, necessitated a series of smaller research components with their own objectives. In some cases, areas worth investigating became apparent only as the research progressed. Setting a main objective at the beginning of the research, and then developing smaller objectives for each component, acted as a compass that both guided and constrained the research process within suitable bounds.

This research explored relevant but disparate areas in order to describe what project managers need in managing and overcoming challenges of Telco NPD projects successfully. First, an extensive literature review sought a common basis for studying project managers. While skills can constitute such a basis, many relevant studies have presented opinions, rather than proven facts. Long lists of skills can fail to indicate what is more important, and under which conditions. For example, an overwhelming majority of studies emphasise leadership, but have a diverse range of interpretations. The project manager competency standards focus mostly on managerial aspects, because these are more convenient to quantify and measure. Sometimes they present conflicting and distorted views of one dimension. Consequently, the first objective was to develop a theoretical framework with a well defined rationale and clear definitions.

Industry characteristics differ; what is important in one industry may be irrelevant in another. By considering Telco industry characteristics, it was possible to deduce from the literature the skills most likely to be useful for Telco project managers. Outcomes from the literature review helped ascertain a new organising framework and whether theoretical propositions sufficiently explain the skills of Telco NPD project managers.

The literature review provided only hypothetical explanations for real world conditions. A pilot study then examined what is really happening in the field. Its objective was to identify areas worthy of further investigation. If a pilot study produces no significant variations from the deductions, then the research topic needs to be changed, or the research needs to focus on areas of practical importance. Another objective of the pilot study was to test the data and methods, and to identify the subjects that reveal the maximum amount of information.

Following these preparatory steps, the main research then extended to encompass the Australian Telco industry. The objective was to provide a variety of perspectives, and to find out what and how Telco NPD project managers are generally doing in the field. This stage of the research analysed Telco NPD projects and their challenges in more detail, making connections to the project manager skills. The research scope was extended to cover how they influence an NPD project's success in certain project phases. Differences from the generic competency standards were evaluated to ascertain practical implications useful for Telco companies.

This DBA dissertation was produced with the ultimate goal to meet the quality criteria, as part of the degree's assessment: affording evidence of making a distinctive contribution to the improvement of professional practice; satisfactory as regards its literary presentation; and containing material suitable for publication. The last one has been satisfied by sharing the findings from stages of the research with the research community as various objectives were attained: the skill set formation and theoretical deductions for the Telco NPD project managers (Hunt and Kosaroglu 2006); the pilot study findings (Kosaroglu and Hunt 2007a); and contemporary challenges of Telco NPD projects (Kosaroglu and Hunt 2007b). The thesis outline below describes how the first two criteria have been addressed throughout the thesis.

5 Outline of the thesis

This thesis consists of six chapters. Chapter 2 presents a literature review that provides the theoretical foundations to the study, before embarking on the empirical part of the research. It covers different aspects of the project manager's role and establishes a common ground for evaluating project managers. It develops a theoretical organising framework that can represent skills as a logical combination of skill sets. This is a generic representation regardless of the project types and industries. Then, considering Telco industry characteristics, deductions are made about what skill sets are required, and why. The outcomes from these deductions are compared with the empirical findings in Chapter 4.

Chapter 3 describes the case study methodology, chosen as the most suitable method of gaining a deeper understanding of Telco NPD projects and also for producing generalisable results across the Australian Telco industry. This chapter discusses the research assumptions, the reasons for selecting a particular methodology, the one-on-one interviews used for data collection, data analysis with triangulations, and the presentation of results. It also elaborates why particular techniques were employed, and how the results were triangulated and progressively converged throughout the research.

Chapter 4 presents the findings from the empirical analysis. Cases are introduced and contrasted to illustrate organisational differences. The different project management requirements of Telco NPD projects are examined. The discussion explores empirical evidences whether a better classification scheme could reveal useful relationships

between project challenges and project manager skill sets. The major challenges are examined for a better understanding of constraints under which project managers operate. The theoretical skill set framework is tested to determine how these skills contribute to overcome project challenges and consequently to project management success, extending the analysis to investigate the influence of the skill sets on project phases commonly used in the Telco industry. Last, the selected project manager competency standards are mapped to the empirical findings to indicate how adequately they describe the skill sets of successful project managers.

Chapter 5 summarises the results, compares them with the literature review outcomes, and introduces a more appropriate classification of Telco NPD projects. Chapter 6 highlights the implications of the conclusions for practice, and discusses the potential application of these research findings to other industries and other countries.

LITERATURE REVIEW

1   Introduction

Technology is continually advancing and creating a chain reaction in almost all industries. The possibilities are far beyond human thought and users' expectations keep increasing, feeding technology companies with new product ideas. The companies seizing these opportunities endure tough competition. New Product Development (NPD) is not simply an option, but is a must in today's markets (Wheelright and Sasser1989; Moore 2004; Almedia and Miguel 2007).

Developing new products is not a random effort. Projects are the tools, or means, to align resources in a company to achieve timely outcomes. Like any science, project management has passed through several improvements to discover the most effective and efficient methods and techniques. However, human involvement and the uncertainties that a project manager needs to handle make project management not only a science, but also an art. In particular, human aspects have been emphasised in recent years. Commonalities exist among a variety of projects; however, when details are examined, they all have different characteristics with implications for their project managers.

What is required to be a good project manager has already been questioned and investigated. The majority of studies fail to differentiate among project types and their individual cases. This research study aims to fill this gap; it looks for an answer in the Telco industry from its current status. Initially the NPD project literature is reviewed, considering aspects of project managers in general, without differentiating industry or project types. Project managers' skill sets are classified by a rationale and are explained. Leadership has been emphasised frequently, but it may mean different things to different people. What it means in an NPD context is explained with the recent

literature. It and other skill sets are presented, and interactions among different skills are also discussed. The Telco industry project specifics are examined, especially how its new products and projects differ. Then, Telco NPD project managers' required skill sets are evaluated within these perspectives. Finally, they are summarised and presented as outcomes from this literature review, to guide the empirical research, indicating what to look for and detect any contradictory evidence.

2   NPD success

Technological changes are opening new opportunities in many industries (Tushman et al. 1997). Companies are under pressure to gain or maintain a competitive advantage by introducing technological advances into the market and replacing their conventional products. Companies' survival and growth depend on NPD (Wheelright and Clark 1989; Saunders and Jobber 1994; Moore 2004). Two decades ago, by the end of 1986, 40% of all corporate sales were estimated to be from new products less than five years old (Booz et al. 1982) and this ratio has been increasing steadily since then. It drew attention from researchers a long time ago; a broad summary of NPD studies carried out by the early 1990s is presented by Craig and Hart (1992), in a journal issue dedicated to NPD.

Launching new products is the result of disciplined efforts whereby resources are aligned and managed (Wheelwright and Clark 1992; Adler et al. 1996; Goldratt 1997). An organisation should evaluate business opportunities, compare their relative outcomes, constraints and resource requirements, and then select projects accordingly. NPD projects should focus on a company's strategies (Cooper and Kleinschmidt 1995), and make effective use of its resources with the highest return (Elton and Roe 1999). Contemporary companies have broadened this concept, and they now generally employ a project selection and evaluation process, called Project Portfolio Management (PPM) (Cooper et al. 2001; McGrath 2004; Levine 2005; Killen et al. 2005). Every selected project aims to produce a product that meets customer expectations (i.e. quality) (Gyrna 2001) within time and budget. NPD success depends on all activities before and during a project, and new product launch (Henard and Szymanski 2001).

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Companies used to measure their successes in new products only financially (Cooper and Kleinschmidt 1987a; Page 1993). In an examination of NPD success measures, Griffin and Page (1993, 1996) have grouped them under three different categories, only one of which is financial results (see Figure 2.1). By using the suggested success measures provided in Griffin and Page (1993), Huang et al. (2004) found that Australian small and medium enterprises most frequently employed customer acceptance, customer satisfaction, product performance and quality criteria, indicating that these measures may also vary with respect to the business type and location. In their later study, Griffin and Page (1996) concluded that projects do not all have the same purpose; using different measures is a better representation, since "the perfect product development project does not exist. Firms frequently must sacrifice some level of success on one dimension to achieve success on another" (Griffin and Page 1996:479). They presented a matrix, called 'project strategies', comprising the significant NPD success measures versus products' relative newness with respect to company and market, as shown in Figure 2.2.

Customer-based success	Financial success	Technical performance success
• Customer satisfaction • Customer acceptance • Market share goals • Revenue goals • Revenue growth goals • Unit volume goals • Number of customers	• Met profit goals • Met margin goals • Return on investment • Break-even time	• Competitive advantage • Met performance specs • Speed to market • Development cost • Met quality specs • Launch on time • Innovativeness

Figure 2.1. NPD project success measures (adapted from Griffin and Page 1996: 486)

Product New to the Market

	Low		High
High	**New to the Company** *Market share* *Revenue or satisfaction* Met profit goals Competitive advantage		**New to the World** *Customer acceptance* *Customer satisfaction* Met profit goals or ROI Competitive advantage
	Product Improvements *Customer satisfaction* *Market share* Met profit goals Competitive advantage	**Add to Existing Lines** *Market share* *Rev/Rev gr./Satis/Accept* Met profit goals Competitive advantage	
Low	**Cost Reductions** *Customer satisfaction* *Acceptance or revenue* Met margin goals Performance or quality	**Product Repositioning** *Customer acceptance* *Satisfaction or share* Met profit goals Competitive advantage	

Product New to the Company (vertical axis label)

Project Purpose
Customer-based measure #1
Customer-based measure #2
Financial measure
Technical performance measure

Figure 2.2.   Significant NPD success measures for different project strategies (Griffin and Page 1996: 481)

3   Success and speed of NPD project management

What differentiates a successful product from a mediocre one has been investigated in several studies. A product should provide competitive advantage over their competitors by providing cost, functionality or replacement alternatives (Porter 1985). Montoya-Weiss and Calantone (1994) and later Henard and Szymanski (2001) undertook meta-analyses using measures presented in figures 2.1 and 2.2 to illuminate those factors that may lead to NPD success. Both studies supported individual findings in different industries that product-related factors are very significant; a product should meet customer needs and provide either cost or functionality advantages compared with competitors (Cooper and Kleinschmidt 1987b, 1993; Lilien and Yoon 1989; Iansiti 1995; Song et al. 1997a), or differentiation in customer experience (MacMillan and McGrath 1997; Song and Parry 1997a). Product-related factors are especially crucial for start-up businesses (Robinson 1990). Indeed, Cooper and Kleinschmidt (1993) maintain that the only significant non-product factors that can be counted as complementary to a product are customer service and technical support.

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Although it sounds contrary to common logic, Cooper and Kleinschmidt (1987b, 1993), Montoya-Weiss and Calantone (1994) and Song and Parry (1997b) argued that the market characteristics that are external to a company – market potential and competitiveness – are not significant for NPD success. Companies launching new products, especially breakthrough innovations, may find that they must educate customers about the product's uses and applications, and then re-design the product based on customers' feedback (Zirger and Maidique 1990). If internal processes do not allow product updates quickly enough, the competitors with faster processes (Adler et al. 1996; Tabrizi and Walleigh 1997), capabilities, and marketing channels (Robinson et al. 1992) can capture this developing niche and set the standards. Companies with radical innovative products suffer from poor market performance when product demands vary (Acur et al. 2007). Similarly, Cooper (1985) and Gima-Authene (1995) argued that new markets, or attractiveness in existing markets, are quickly recognised by competitors, resulting in lucrative but competitive markets. Other factors lie in company strategy and process characteristics that are internal to a firm (Montoya-Weiss and Calantone 1994; Henard and Szymanski 2001). Companies operating in complex and rapidly changing markets need to be flexible and operationally effective (Acur et al. 2007).

Cooper and Kleinschmidt (1995) and Cooper (1998) benchmarked the performance of new products and reported the main performance drivers that differentiate solid from weak performers: a high quality product process, clear NPD strategy and focus, adequate resources, senior management[1] commitment and accountability, entrepreneurial climate, high quality development and cross-functional teams. Song and Parry (1997b) investigated Japanese firms and found that cross-functional integration and product competitiveness are two important determinants for NPD success. Integration is collaboration to achieve mutual NPD goals, not simply transactional interactions between departments (Kahn 1996). Griffin (1997a) evaluated best NPD practices from several surveys and found that NPD processes, project leadership, support by a champion senior manager and cross-functional teams were keys to success.

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[1] In the literature, several terms have been used to describe management above project level: top, upper or senior management, or simply management. In organisations, co-ordination and execution propagates through hierarchy, and consequently it is assumed that any involvement above project level is of the same origin. 'Senior management' is preferred, to differentiate it from project management.

Lilien and Yoon (1989) have identified senior management's support, interdepartmental integration and market orientation as the major determinants of successful new industrial products. These findings support Cooper and Kleinschmidt's (1987a, 1996) claim that internal controllable variables, rather than external situational or environmental variables, are the dominant determinants for NPD success. Consequently, attention is drawn directly to differences in NPD projects.

Cross-functional teams have now been widely accepted as one of the mandatory conditions for NPD project success (Cooper and Kleinschmidt 1996; Cooper 1998). They bring professionals with multiple views together from different groups. Hence, excellent skills are needed to motivate, facilitate communication among different groups, manage processes, obtain resources and resolve conflicts with support from senior management (Brown and Eisenhardt 1995). The duties in managing NPD projects have shifted considerably, showing an increased emphasis on the human side. Consequently, this role is now mostly referred to as project leadership, rather than management[2] (Goodwin 1993; Henke et al. 1993; Cleland 1995; Norrgren and Schaller 1999; Thieme et al. 2003; Thamhain 2004a, b).

There is a strong correlation between accelerated NPD projects and their success (Bower and Hout 1988; Gupta and Wilemon 1990; Crawford 1992; Cooper and Kleinschmidt 1994; Griffin 1997b). Many projects that have delayed completion with cost overruns while technical personnel experimented until they got it right, have failed (Thomke 2003); early delivery time is now given as one of the key project goals. Findings in successful and timely projects emphasise cross-functional teams, senior management support, NPD processes, and more disciplined project management with detailed planning and tracking (Rosenau 1988).

Time is an important asset that cannot be recovered if not used effectively. By entering a developing market early a company can reap the benefits before its competitors (Gold 1987). However, best practice firms are not necessarily the first market entrants, but they are sufficiently fast to produce successful results and overtake others (Rosenau 1989; Cooper and Kleinschmidt 1993). They can beat competition by proactively setting the pace with regular new product introductions (Eisenhardt and Brown 1998),

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[2] The terms 'project manager' or 'project leader' are used interchangeably here, since they both mean the same profession.

thereby creating chaos to keep competitors out (Iansiti 1995). They make sure that windows of opportunity are not missed by focusing on delivering products with sufficient quality and acceptability, rather than perfect products with all possible features (Lilien and Yoon 1990; Cohen et al. 1996). On the other hand, NPD projects should not be accelerated unless they are really feasible and well-planned. Otherwise rushing new products to the market may cause key activities to be bypassed, leading to poor design and a malfunctioning product (Meyer and Utterback 1995; Gupta and Souder 1998; Cooper and Edgett 2002). There are also hidden costs of accelerated projects with unattainable time targets (Crawford 1992; LTC International 2001). Examples include employing a trivial solution instead of an optimum one, skipping quality assurance steps in processes, avoiding necessary documentation and recording changes, increased costs in later stages that are caused by earlier shortcuts, stealing resources from other projects and human psychological costs (i.e. burn-outs) due to strong pressures for quick delivery.

A brief summary of the studies on determinants for NPD success and speed above present a variety of factors; however, they all have three NPD project management characteristics in common: senior management involvement, NPD processes and a project manager heading a cross-functional team. Figure 2.3 overleaf presents these three features in a conceptual framework.

There is a misconception that project success is generally attached to project management success. Munns and Bjermin (1996) differentiate project success from project management success:

> *"A project can be considered to be achievement of a specific objective, which involves a series of activities and tasks which consume resources. It has to be completed within a set of specifications, having definite start and end dates...project management can be defined as the process of controlling the achievement of the project objectives." (Munns and Bjermin 1996:81)*
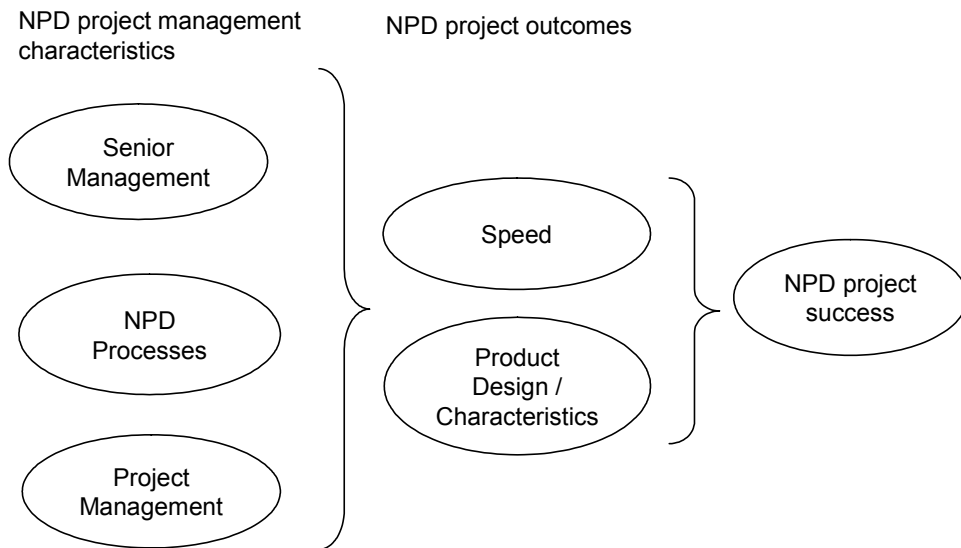
Figure 2.3. Conceptual framework: NPD project management characteristics

Project success is a broader concept. It covers every aspect of a project, and project management success is a sub-component for a new product in the market. Project managers are involved in the process of its realisation, but not necessarily in all that may impact product success. Munns and Bjermin (1996) gave examples where the product is successful but the project management fails, and vice versa, to indicate that they are not conditionally related. Project management basically aims to satisfy three constraints: time, cost, and quality – called by Atkinson (1999) the 'iron triangle' – within a project. Other factors outside the direct control of a project manager may influence customers' acceptance of a product. The project performance may also involve subjective measures, such as perceived values by senior management and client (i.e. sponsor) and team members' satisfaction (Munns and Bjermin 1996; Atkinson 1999). Nogeste and Walker (2005) has presented a process to identify the intangible outputs from a project by engaging stakeholders over a series of workshops. From a project's perspective, it is project manager's responsibility to deliver a project requirement – regardless it is tangible or intangible – to meet the predetermined criteria. If a product or project's success factors are ill-defined from the beginning, its project is already destined to be a failure (Turner 1999). Project managers may not control overall project success; although they can contribute towards its management success, they are, however, unlikely to save it from failure.

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The same argument about distinguishing project management success has also been made by de Wit (1988) and Baccarini (1999). de Wit constrained project management success criteria to cost, time and quality only. Baccarani later added 'quality of project management process' to de Wit's criteria and defined it as efficiency. Atkinson (1999) similarly called Type I the project management failures, and Type II the project failures. This study interprets and considers NPD project management success in the same way as de Wit (1988), Munns and Bjermin (1996), Baccarini (1999) and Atkinson (1999), that is managing the process to deliver a new product within time, cost and quality constraints, and separates it from project success.

The next two sub-sections review senior management involvement and NPD processes to succeed in project management at a high level. These are referred to in later sections, and provide a broader context for understanding the project manager aspects. Then, project managers are examined closer, discussing what makes them competent to perform their professional tasks.

3.1   Senior management involvement

The major duty of senior management is to determine strategies to overcome competition and to enable the company to grow (Cooper 1998). They consequently influence NPD via project selection with the PPM process (Levine 2005), which selects projects to align with overall company strategy, and creates a sense of urgency to reach project objectives. Swink (2000) found that senior management involvement is more beneficial in projects with lower levels of innovation and technology. However, this should be interpreted with caution. Too much intervention, a directive style or excessive bureaucracy limit a project team's actions and add unnecessary layers for approval; they can have a negative impact on a team's motivation, and ultimately on NPD success (Quinn 1985; Bonner et al. 2002). On the other hand, lack of sufficient senior management support to align resources for NPD may open turf wars and political games among departments, and eventually result in cancelling promising projects (Benjamin 1993). Yet another extreme, autonomous teams that are empowered to make and implement all decisions, is not necessarily favourable, since it is difficult to make mid-

course interventions or exercise authority without destroying a team's identity and commitment (Clark and Wheelright 1992).

Project managers integrate technical, marketing and business requirements into a product in alignment with company strategy, while the project team concentrates on project tasks. A subtle senior management control should let an NPD project team and its manager resolve uncertainties effectively free from limitations within given guidelines (Brown and Eisenhardt 1995; Pinto and Kharbanda 1996; Song et al. 1997a). Project teams largely act autonomously, and management control with sufficient checkpoints prevents ambiguity and tension from turning into chaos (Takeuchi and Nonaka 1986). Bounded delegations from senior management, within which people are empowered to work freely (i.e. projects for project managers and project tasks for team members), are the recommended management style (McDonough and Leifer 1986). Senior management's extensive involvement actually slows down NPD (Karagozoglu and Brown 1993).

Senior managers are usually far away from technical challenges that an NPD team may face, and they may not have sufficient detailed technical knowledge. Most of the time, they are not in a position to contribute to product design and determine product characteristics directly. However, in addition to determining strategies (McDonough and Barzcak 1999), they have a significant impact at a higher level by developing organisational competences (Prahalad and Hamel 1990), creating a market-oriented culture to deliver what customers want (Cooper 1994; Li and Calantone 1998; Mullins and Sutherland 1998; Song et al. 1998), promoting teamwork, committing to new products (Song and Parry 1997a; Gupta and Wilemon 1990), and providing guidance via project leadership, which ultimately has an effect on product characteristics (Cooper and Kleinschmidt 1987a; Hershock et al. 1994).

Speed in NPD can also be explained as an indirect outcome of senior management's strategy of encouraging strong market orientation to meet customer demands on time. Market orientation in a company is positively related to product advantages, product performance and launch activities (Langerak et al. 2004). Senior management may also increase speed by making it one of the central objectives to avoid possible revenue losses from late market entry of new products (Cordero 1991; Zirger and Hartley 1996). In fact, senior management may not want to forgo short-term profit opportunities, and

therefore may push to shorten the NPD time. It has been reported that pressure from above is more evident when competitive threats exist (Mabert et al. 1992).

Senior management employs project managers to run projects, address their daily operational issues, and represent them in an NPD project team. Their visible support and a good cooperation with project managers contribute to NPD project success (Probert 2001; Thamhain 2001, 2004c; Cooper and Edgett 2005). Consequently, senior management need to select project managers with the right skills and provide training to enhance these skills (Barczak and Wilemon 2003).

3.2   NPD processes

The NPD process consists of a number of steps, shown on the right of Figure 2.4 (overleaf): detecting business opportunities, evaluating and selecting related products, then developing and commercialising them (Kotler et al. 2001). Page's (1993) outline of this process comprises the same steps, but the Concept Testing precedes the Business Analysis. If a test environment is costly, companies need to have strong business cases before spending. Consequently, a thorough business analysis is required before testing, as shown in Figure 2.4. Cooper and Kleinschmidt (1986) and Cooper (1998) have presented more detailed steps, suggesting that companies tailor them for their needs. His findings showed that companies generally employ seven to ten steps.

Performing steps sequentially does not necessarily meet customer demands in dynamic market conditions. Once a project is decided, it is planned and executed until product delivery, which is sometimes many years ahead. It requires fixing scope and definition early, but they may change during a project. In a volatile business environment, emerging alternatives may make some product designs void, or even make products themselves obsolete before reaching market.

As a remedy, many companies have adapted stage or phase gated NPD processes, to provide flexibility in their project management and to utilise company resources effectively (Cooper and Kleinschmidt 1993; O'Connor 1994; MatrixOne 2003). A stage-gate process consists of phases, which are groupings of closely related NPD steps, and decision points or gates separating them. The originator of the stage-gate NPD

process, Cooper and Kleinschmidt (1991, 2002), has defined the stage-gate process as shown in Figure 2.5. They examined many companies employing it, and found that their NPD projects are much more successful than those of companies using other NPD methods without any project reviews. (Cooper 1998).
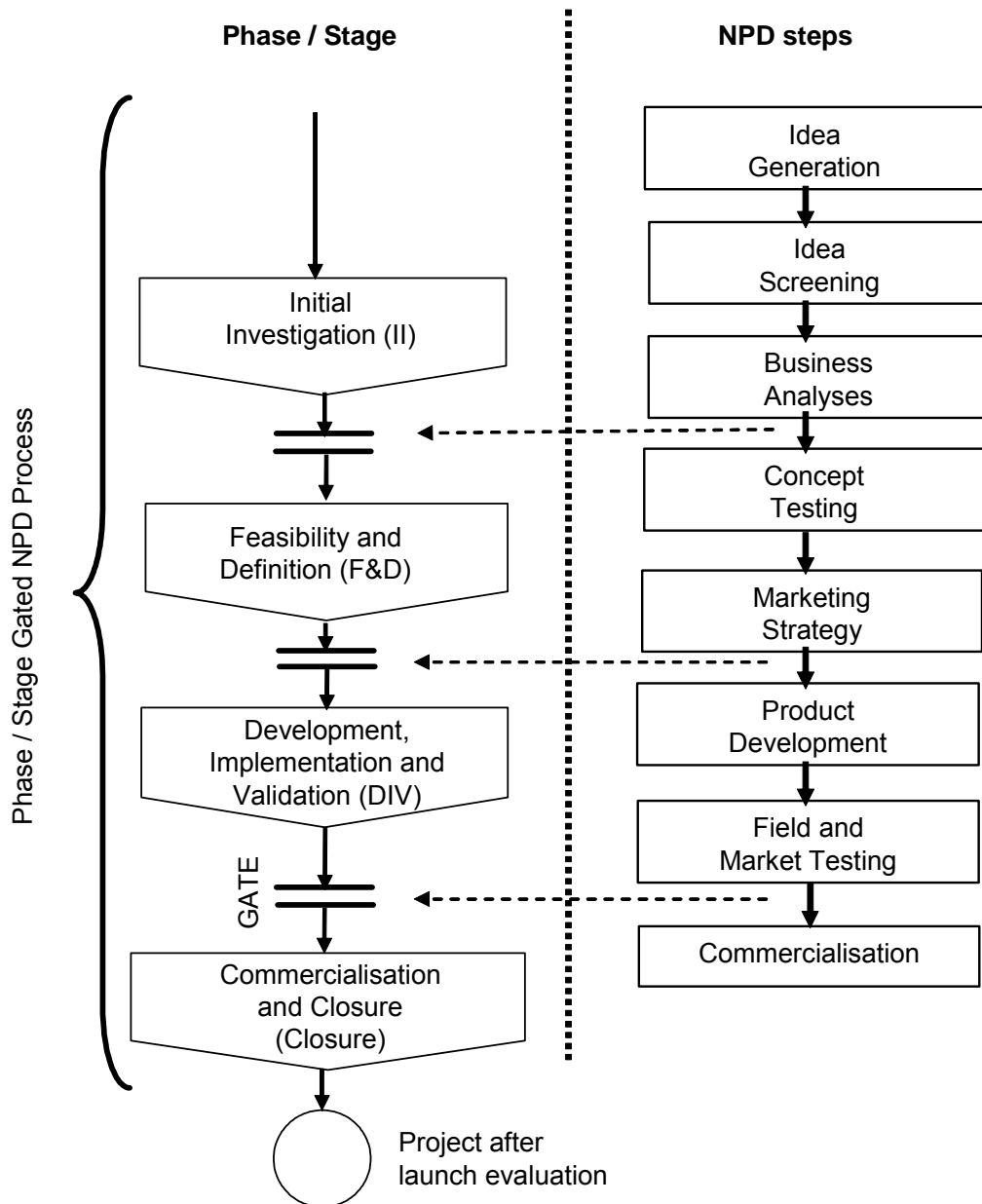
Figure 2.4. NPD steps and stage-gated NPD process (adapted from Kotler et al. 2001:227 and Engwall et al. 2001:5)

At each gate in Figure 2.5, the gate keepers, who are generally senior managers, control an NPD project's progress, approve its movement from one phase to another, and allocate resources. They may also kill or hold a project after evaluating alternatives, new market opportunities and available resources as part of the PPM process (Levine 2005). Depending on circumstances, different industries and companies use a varying number of gates, but the overall idea is the same (Cooper 2005). Additional phases and gates are recommended for research and technology development projects for better direction and focus (Cooper et al. 2002). Telco industry considered in this study generally has four phases (Engwall et al. 2001), shown on the left of Figure 2.4, where the phases are named with the same terminology used by Telco companies.
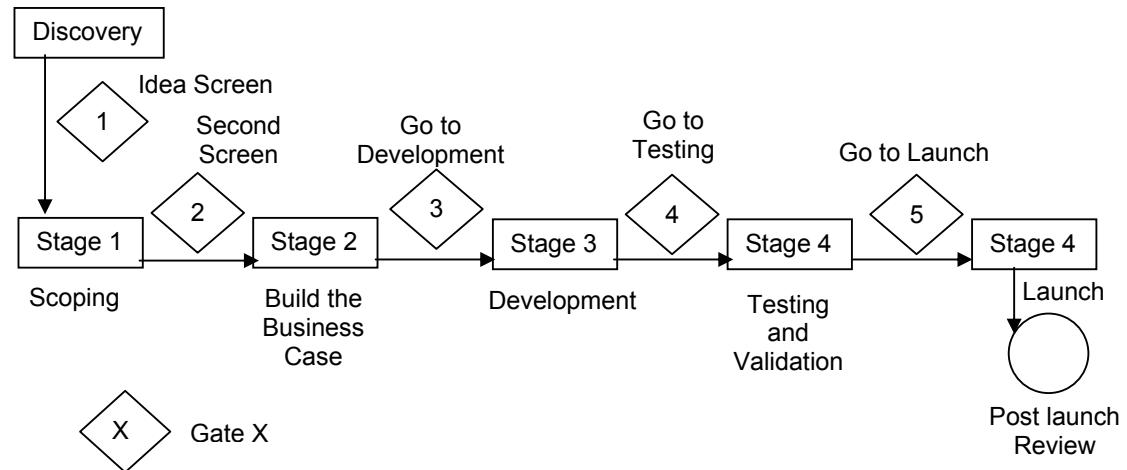
Figure 2.5. Overview of the Stage-Gate Idea-to-Launch Framework (Cooper et al. 2002:22)

Compared with Figure 2.5, Figure 2.4 does not have a gate for idea screening before the Initial Investigation (II) phase. The idea generation, screening and negotiations occur in the marketing, engineering and operations management areas, before proceeding to a formal senior management evaluation, which requires a business case analysis, at a gate. Since the candidate new products are not concrete before the II phase, senior management generally does not look into NPD cases until sufficient information for decision making is available (Light 2001).

The phase gated NPD processes require certain input and output criteria. For this reason some project tasks may be paused until all criteria for entering and exiting a gate are satisfied. To avoid resultant delays and accelerate projects, the phases are often overlapped (Takeuchi and Nonake 1986; Cooper and Kleinschmidt 1991, 1994; Iansiti 1995; Bhattacharya et al. 1998). This improvement in NPD processes is known as concurrent engineering (Mabert et al. 1992; Loch and Terwiesch 1998; Thamhain 2001). Alternatively, the gates can be left open without making a decision on a project's progression to the next phase and the project can be allowed to continue until gate keepers meet. This approach may incur some additional sunk costs if a project is cancelled, but avoids delays in the project time due to inefficiencies from start-stop project execution.

The front-end steps in the NPD process are vital for product success (Cooper and Kleinschmidt 1987a; Cooper 1998), since there may be insufficient detail to describe every feature of a product (Wind and Mahajan 1988). On the other hand, waiting for all requirements to be cleared causes delays, and market opportunities may be lost (Bhattacharya et al. 1998). Krishnan et al. (1997) developed a model which proved that steps and tasks may overlap phase boundaries, thereby shortening project duration, as long as potential negative impacts on downstream tasks are affordable.

Most costs are incurred and resources are used in the Development, Implementation and Validation (DIV) phase. Ideally, therefore, what is to be implemented will be finalised before this phase. The Feasibility and Definition (F&D) phase may accommodate some required changes, but delaying proof of concept trials into the DIV phase may interrupt, or require repeating, tasks that are progressed without fixing specifications. Therefore, making the effort to finalise fundamental requirements in the front-end steps is worthwhile (Cooper and Kleinschmidt 1986).

Overlapping phases to speed up the NPD cycle requires much more disciplined project management to ensure that any task is not overlooked, and gaps do not occur between activities in sequential phases (Bower and Hout 1988). Otherwise, backward corrections may result in duplication of tasks and high additional costs.

4 NPD project manager competency and skills

In businesses that are driven by fast technology changes, building and sustaining high performing NPD project teams under a dynamic and often turbulent environment can be daunting (Thamhain 2003). Matrix organisation structure is more suitable for such projects (Larson and Gobeli 1988; Ford and Randolph 1992; Henke et al. 1993), and most contemporary companies employ it. Project managers borrow team members from functional groups and manage them during NPD projects. They carry only partial authority over the resources, but they are still responsible for the delivery of a new product. Their role is both managerial and administrative, and they must also influence team members to fulfil their responsibilities and bring an NPD project to success. Compared with early literature (Gaddis 1959; Avots 1969), leadership skills of a project manager have been discussed more frequently in recent decades (Thamhain 1990a, 2004a, 2004b; Cleland 1995; Babcock and Morse 2001). In addition, they have to deal with technological, economic, political, social and regulatory changes (Thamhain 2004b), and their performance is critical to product success (Zirger and Maidique 1990).

Effective teamwork in cross-functional teams is also essential to NPD success and speed. Project managers are now expected to address the complexities of advanced technologies, guide a project team through uncertainties, and especially handle human aspects, usually called 'soft skills', effectively (Boyatzis 1982; Jillins 2001; Krahn 2005). Cooper and Kleinschmidt's (1995) investigation of the high-impact technical winners, which have the highest success rate of new products in their grouping of the companies, found the effective team leaders are able to compensate for organisational weaknesses in NPD. Helm and Remington (2005) similarly noted that effective project managers can also mask inadequate executive sponsor support. Pinto and Kharbanda (1996) reiterated that a weak project leader who lacks the necessary skills is an invitation for failure. A strong, empowered project leader with the right skills was found to be one of the conditions for successfully accelerated projects (Cooper 1994). Similarly, Mabert et al. (1992) considered skilful and knowledgeable leaders vital for projects of multi-disciplinary NPD project teams. However, none of these authors presented a description of such leaders. Increasing numbers of organisations have been replacing traditional management with a result-oriented and efficient project management paradigm, called 'management by projects' (Gareis 1989),

'projectification' (Midler 1995) or 'project-based management' (Martinsuo et al. 2006), and applying it to any change initiative (Clarke 1999). Such descriptions are necessary to avoid confusion in the NPD context and separate projects from others not in the same line as NPD.

4.1   Project manager competency standards

With the recent trend towards managing by project concept, companies need competent project managers to reach their objectives. Several project management institutions have developed standards and certification programs to help them select qualified project manager professionals who satisfy a minimum level of expectations dictated by these standards.

Basically, there are two kinds of certification: knowledge and competency based. The first is measured against a test, and the second is an evaluation of how effectively the competence is actually applied in the workplace. They are usually repeated over a number of years to assure that up-to-date state of the project management profession is attained. Knowledge examination measures a candidate's understanding of the body of knowledge and best practices, an acceptable level of proficiency is assumed. The Office of Government Commerce Projects In Controlled Environments' PRINCE2 certification is of this type (Lopez et al. 2005).

Competency based certifications are broader; they encompass knowledge of the project management subject, which may be measured with a knowledge-based test, with an examination of evidence produced by a candidate. The artefacts from his/her projects are assessed against a number of units of competencies. They are likely to give a greater degree of assurance to be able to perform to the given standard. The Australian Institute of Project Management (AIPM), International Project Managers Association (IPMA), Association of Project Management (APM) and Project Management Association of Japan (PMAJ) employ this kind of certification. They certify project managers with a band starting from a practitioner, who has some experience in project management, to a program or project director, who manages a group of projects, usually in three (PMAJ, AIPM) or four (IPMA, APM) levels. Although they claim to be mapped equally with or similarly to each other, their certification criteria are not exactly the same. Recently, the

Global Alliance for Project Performance Standards (GAPPS) has produced a unified competency based standard at two levels, Global Levels 1 and 2, and, most importantly, differentiated the projects to be used for assessment purposes. GAPPS does not claim to replace the previous standards, which had been developed mostly for local requirements. Some others also extend beyond a project's scope. For example, IPMA and Project and Program Management for Enterprise Innovation (P2M) from PMAJ certification extends to all programs and their projects in a company, and connects to the ultimate goal to serve the public.

In November 2007, the Project Management Institute (PMI) released a new version of their certification criteria, the Project Management Competency Development Framework (PMCD 2007). Its previous version (PMCD 2002) required demonstration of practical project management experience, and then passing a knowledge test. Its framework directly mapped to A Guide to the Project Management Body of Knowledge (PMBOK 2004) knowledge areas in nine matching units of knowledge and performance based competencies. It also had six units of personal competencies, which are combinations of skills and personal attributes. The closely related elements under the units were collected under process groups, called clusters. In the new version of PMCD (2007), the competencies are re-arranged under knowledge, performance and personal dimensions in the framework, and the knowledge component has been taken out; but it is still mandated to take the knowledge test against PMBOK, as previously. The performance and personal competencies' criteria ask for proofs, e.g. plans, schedules, feedback from stakeholders, etc. Theoretically, an accredited assessor should examine them to judge if the competency exists. However, in practice as before, the candidates are assumed to have these competencies by providing experiences that they have managed projects for a certain duration, depending on their education levels, and they are subject to a random audit (PMP Credential Handbook, 2007). Consequently, PMP is still a knowledge based certification.

AIPM has adopted PMBOK (2004) as the knowledge-base for their national competency standards, and structured around its nine units of knowledge (integration, scope, time, cost, quality, human resources, communications, risk and procurement management). AIPM is currently in the process of adding another level Executive Project Director for project portfolio and program management (AIPM 2007). Since this study's scope is projects only, the certification programs beyond this level in AIPM and

other standards are not considered here. The AIPM project manager competency standard presents a guide for each unit of knowledge about what kind of evidence to look for. Consequently, it is very similar to the early version of PMCD (2002), which collects assessment criteria under those nine knowledge areas from PMBOK. AIPM has not stated yet if and how they adopt the changes in superseding PMCD (2007).

Certifications that rely on past experience and theoretical tests may guarantee success if tasks are repeatable and known a priori. However, this conflicts with the definition of a project: "a temporary endeavour undertaken to create a unique product, service or result" (PMBOK 2004:5). For this reason, the project manager competency standards consider common project management activities that are known to occur in most projects, and do not take any industry or project type specifics into account (Crawford and Pollack 2007). Thus, although they are necessary, they do not reveal the whole picture. Therefore, the performance criteria are based mostly on managerial aspects in project management that are convenient to quantify and measure. They have already recognised the need to tailor or extend the existing frameworks to fit specific circumstances in different industries and project types:

> *"An entity that adopts the GAPPS framework should use all of the Units, Elements, Performance Criteria in order to help ensure consistency of application and reciprocity. Additions and modifications can be made as appropriate to suit local and regulatory requirements." (GAPPS 2006:10)*

> *"The PMCD Framework is based upon the principles and processes of the PMBOK Guide – Third Edition. It describes the generic competencies needed in most projects, most organisations, and most industries." (PMCD 2007:3)*

The competency standards set a number of criteria that must be satisfied to determine if a candidate has exhibited associated outcomes in the units of competencies. Due to their nature, they do not address what makes project managers competent, or comparatively more competent. This research complements these generic standards for Telco NPD projects from this respect:

> *"The GAPPS standards include the minimum number of Performance Criteria needed to infer competence. As a result, a candidate must satisfy all of the Performance Criteria in the applicable Units in order to be viewed as competent....*

> *The material in this document can also be used to support learning and development when applied by qualified educators and trainers. In order to*

provide such support, the framework would need to be expanded to address questions such as:

- *What skills and knowledge are needed to demonstrate this standard of performance?" (GAPPS 2006:3)*

"The units and elements of the competency in the PMCD Framework are intended to represent the project manager who would generally be accepted as competent. The PMCD Framework has been designed to apply to most projects most of the time...

The assessment model is then implemented by organisational and industry-specific performance requirements. The actual level of achievement of those competencies defines the project manager's competence." (PMCD 2007:3-4)

4.2   Project manager skills

Determining the attributes of the ideal project manager is thought-provoking. Kerzner (1984:162) provides a suggestion, noting the importance of education, training and experience:

> *"This ideal project manager would probably have doctorates in engineering, business and psychology, and experience with 10 different companies in a variety of project office positions, and would be about 25 years old."*

A hierarchical framework proposed by Rifkin et al. (1999) shown in Figure 2.6, illustrates the competency levels for a technical manager. He empirically tested it to be robust and flexible for guiding professionals' development in practice (Rifkin 2000). The higher three levels of the apex are about demonstrating competencies and are job-specific. The same model can be adopted for project managers. Rifkin clearly distinguishes personal traits from skills and knowledge required to perform a job. The personal traits, such as being willing to lead, possessing integrity and honesty, and being prepared to seek challenges and takes risks, can be considered as important foundations that contribute to job success. Job performance can be assessed by accomplishments arising from work activities that utilise certain knowledge and skills.

Personal traits are separated from skills and knowledge in Figure 2.6. The personal characteristics of project managers to meet the demands of complex projects in developed societies are well presented by Jaafari (2003). Although certain personal

traits and characteristics are more conducive to particular behaviour and skills, they do not uniquely correspond to the project manager profession (Dvir et al. 2006; Gehring 2007). In general, any professional is now expected to have these attributes, since mechanisms to control each employee are expensive and slow. For example, all project managers should be trustworthy. However, not all trustworthy people are project managers. Consequently, these traits are not the sole basis differentiating project managers.
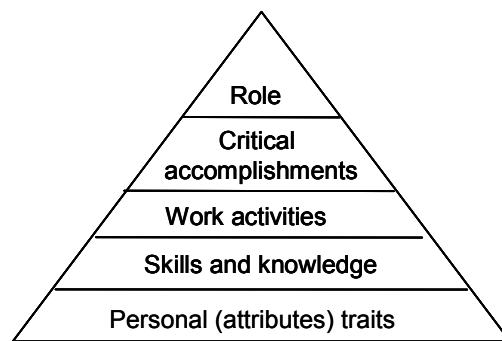
Figure 2.6. A hierarchical framework for a technical manager competency model
(Rifkin et al. 1999:54)

Personal traits cannot be changed easily (Berge et al. 2002); however, skills can be learned, and then individual behaviour can be modified to act in a predetermined way for achieving specific goals (Senge 1990; Goodwin 1993; Wateridge 1997). Therefore, skills form the best basis for selecting and training project managers, because they can be defined, measured and broken down to teachable units (Thornberry 1987; Anderson 1992; Rifkin et al. 1999). Recently, Jugend et al. (2007) examined some Brazilian technological companies, and demonstrated that project managers are critical and they need to be developed with managerial skills, beyond their technical knowledge.

The approach taken in this research to determine the quality of a project manager reflects this common-sense definition: the possession of certain skills makes project managers competent for performing in the profession effectively and efficiently. Other studies have taken another approach, that of analysing common factors and ranking

them without differentiating traits and skills (Jiang et al. 1998; Hauschildt et al. 2000; Dainty et al. 2003). However, that approach does not align with this study and several others (Wateridge 1997; Thamhain 1989; Rifkin et al. 1999), which all consider that traits and skills are not the same; necessary skills can be developed depending on individual needs. Having the necessary skills enables project managers to produce work activities and thus critical job accomplishments at higher levels of the competency framework, ultimately satisfying the project manager role. Those skills may be applicable to several jobs, since different jobs may share the same skill base. Companies also look for transferable skills that suit their particular circumstances. For example, technical engineers with relevant skills are usually promoted as project managers in engineering projects (Thornberry 1987; Jugend et al. 2007). In practice, a candidate project manager may not have experience in some project types; or a competent, suitably experienced manager may be unavailable. In Telco, an agile industry with high staff turnover, opportunities may be missed while seeking the perfect project manager, and so compromises are usually made by considering the skills that suit the various demands from particular projects.

4.3   Project manager competency standards versus skills

Competency standards certify project managers to indicate a professional's credentials about his/her 'theoretical knowledge' on project management activities and/or past performance. Someone, who has enough familiarity of a project management standard framework and generic project management activities, even without having managed a project, may attain a knowledge based certification. Knowledge tests, if used as part of the assessment, in a competency based certification are not much different. Consequently, the competency based certifications tend to examine the top three levels in the apex of the hierarchical competency framework in Figure 2.6 (Rifkin et al. 1999), and consider only demonstrable proofs of project management activities, that is, experience in the job is one dimension. They do not go below and examine what underlies the project management profession.

This research aims to identify the skill sets that successful project managers should have to address the challenges in Telco NPD projects. The competency standards for

assessing and certifying project managers have a different purpose: evaluating evidences to judge competencies. As the ratio of certified project managers to the whole community is low, considering only the certified ones would exclude a big portion of the sampling population, and would not give accurate indicators in the research area. Although the certifications show that project managers have satisfied a minimum threshold, one cannot say that certified project managers are sufficiently competent to run any kind of project successfully. It is stated in several standards (AIPM 2003; GAPPS 2006; PMCD 2007) that the certifications are generic and do not guarantee project success in all industry, project and organisational contexts.

The competency framework in Figure 2.6 implies that, to achieve the competency for a project management role, a candidate should satisfy all levels in the model. However, as already noted, project management certifications fall short of evaluating the foundation two layers of the model. Although the standards somehow mention traits, attitudes, skills and capabilities, they do not differentiate or analyse what these are. To clarify the connection between skills and competency, we first need to explore what they mean.

Several standards define competency in a similar way, but with different wording:

- knowledge, skills, personal characteristics and attitudes, when focusing on delivering a project. (PMCD 2007)

- sufficiently skilled to perform a specified task or fill a position (GAPPS 2006)

- the ability to perform to standards required in employment across a range of circumstances and to meet changing needs (AIPM 2003)

- knowledge, experience and personal attitude and the general impression of the project management personnel (IPMA 2004)

- attitudes, skill and knowledge (ASAPM 2006)

- individual capability, integrative ability that produces effective behaviour patterns. There is an overlap in the unification of knowledge, experience, attitude and talent in specific features of behaviour. P2M is based on proven knowledge and experience (PMAJ 2005).

The dictionary meaning of 'skill' is defined as: *the ability, coming from one's knowledge, practice, experience, aptitude, etc., to do something well,* and (from Oxford dictionary), or *an ability to do something, acquired through practice and learning* (from Macquarie dictionary). 'Competency' is the noun form of adjective 'competent': *being suitable and sufficient for purpose* (from Oxford and Macquarie dictionaries). It is worthwhile to note that skills are developed by a collection of all possible means. In this study, prior project management experience is one of the inputs, as are training and personal attributes. One of the meanings for 'skill' in the Oxford dictionary is given as *knowledge*, indicating that knowledge in an area is embedded in and inseparable part of an associated skill. The knowledge mentioned here is not limited to the theoretical knowledge of generic project management, which is measured in the certification tests; this is much broader and covers all the dimensions to manage projects successfully. Knowledge acquisition and adaptation to unfamiliar conditions occurs by sifting out relevant information, and integrating it with what is already known and with developed skills. Therefore, it varies among individuals (Sternberg 1985). Tacit knowledge, which constitutes most of our capability, is expressed or inferred from actions, and not easily measurable in simple tests, and it is an essential part of mastering a skill (Wagner and Sternberg 1985, Kerr 1995).

The above definitions of competency can be interpreted in short as 'having sufficient skills to be suitable for performing project management activities properly', as skills already cover a variety of other factors to form the ability. A professional with competency, that is, being suitable to perform a job, must have associated skills, and all of them may not be emphasised in the standards. They are not specific to only one job; different jobs may share the same skill base. Consequently, people generally talk about 'transferable skills', not 'transferable competency', as an indication to adapt to varying circumstances.

5   Project manager skill sets

Some studies have investigated the skills of a project manager, and ranked them with empirical evidence without differentiating or examining inter-relations among them (Anderson 1992; Krahn 2005). Although this approach highlights important skills, it

does not give a holistic view. In particular, the emphasis on leadership and the assumption that it incorporates the majority of management aspects presents a blurred picture (Hosking 1988). Grouping skills under separate management and leadership headings could overcome this deficiency (Thamhain 1989; Wateridge 1997). However, those groupings were based on intuition rather than logic. Wateridge (1997) put managerial work (i.e. developing plans, scheduling, resource allocation and tracking projects) and coordination with senior management under administrative skills. Similarly, Hosking (1998) included all managerial work and team motivation under leadership skills. Song et al (1997b) defined project management skills broadly to include technical and marketing skills, management style and authority.

In his research on the construction industry, Anderson (1992) considered a project manager as the CEO of a temporary organisation with four attributes: human relations and leadership skills, and technical and administrative experience. Planning appeared under both administrative experience and leadership skills. All four attributes except technical experience had big overlaps, and the rationale for defining the attributes was not explained. Anderson also claimed that these attributes are not correlated to project performance, but to the use of good project management practices. This is contrary to general reports in the literature that effective project managers make a difference (Gupta and Wilemon 1990; Cooper 1994, 1995; Cleland 1995). Turner and Muller (2003) described a project manager favourably, paying attention to agency costs. They stated a control must be in place to monitor the manager's performance; the practices are important, but how they are applied is more important.

Thamhain (1989) categorised the skills required in a project manager as technical, interpersonal and administrative. More recently, he expanded the classification to "sophisticated skills in leadership, administration, organisational and technical expertise" (Thamhain 2004c:543). He made some recommendations for behaviour and activities to achieve project success and organisational excellence, but did not present any reasoning or explanation for his classification.

In this study, the researcher aimed to use distinctive skill sets that a project manager needs to be successful. It is easier to measure and evaluate with non-overlapping and independent skill dimensions. These dimensions are formed by distinguishing particular skills and collecting closely related ones under a generic skill set, as proposed by Berge

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et al. (2002). Although it is impossible to draw clear-cut boundaries among skill sets, the following observations indicate the logic behind the formation of the skill sets:

- The technical knowledge in an industry is different from the general project management knowledge. For example, a project manager in the construction industry may have a good understanding and practice of project management tools, but it does not make him/her an effective project manager in the Information Technology (IT) or Telco industries.

- A project manager who is used to procedures, processes and culture in only a single company may not be successful in another company with different settings.

- A project manager with excellent planning ability may fail in project execution, since it requires different interpersonal and technical skills to address practical problems.

- Good marketing and communication skills may help gain senior management support, but may not be sufficient for understanding complex technical problems or making decisions.

Based on the literature review above, this research study proposes a new organising framework for NPD project manager skill sets: technical, leadership, managerial and administrative skills form the most distinctive and mutually exclusive skill sets. Its analysis differs from others in that it provides clear definitions and a rationale for the groupings, based on the recent literature on management and leadership. The following sections define and describe these four skill sets in detail, discussing how they are differentiated from each other and in what respect they contribute to the success of an NPD project manager.

5.1 Technical skills

Cross-functional teams gather individuals from different departments and professions, and require the integration of marketing and technical aspects for NPD success (Capon and Glazer 1987; Jaworski and Kohli 1993; Griffin and Page 1996b). Gupta and

Wilemon (1986) and Cooper (1986) reported that engineering and marketing are better integrated when relevant managers are of similar professional and bureaucratic orientation. NPD project execution often includes improvisation (i.e. discussion, composition and execution of actions simultaneously), especially in turbulent environments (Moorman and Miner 1998). Therefore, project managers should be capable of understanding a diverse team in order to integrate efforts. Correct interpretation of professional languages in a cross-functional team requires multi-skilled managers (Thieme et al. 2003). Today's project managers need to translate marketing requirements to engineering, and technical possibilities and limitations into marketing language (Yap and Souder 1994). Such project managers have also been found to be one of the key factors behind successful NPD projects in Japanese companies (Song et al. 1997b, Song and Parry 1997b). In several technology-based industries, including Telco, there is a trend to fill engineering and project management positions with technical staff and enhance them with further managerial training (Thamhain 1990b; Kalu 1993). This is also evident with increased emphasis on business education in technical management (Thamhain 1990a), which clearly indicates the demand for strong technical skills in a project manager.

Managers of accelerated projects do not have the luxury to spend limitless time on tasks, such as developing all alternative designs to find the best one, or conducting endless quality inspection tests. Tasks have to be done right the first time (Bower and Hout 1988). Efficiency of project execution becomes the key. It is a project manager's duty to root out possible quality and time problems and develop contingency plans beforehand. Consequently, it is vital for managers to understand the technical challenges lying ahead in an NPD project.

Rosenau (1999) emphasises the importance of determining product specifications in the early stages of a project to shorten project life cycle. He recommends spending enough time so that requirements can be agreed among stakeholders. However, it may be difficult to allocate technical staff, who are already overloaded due to cost-cutting measures in several industries, for such time-consuming activities. Project managers can contribute to accelerating the initial stages by providing technical input for areas that require broader technical knowledge, communicating with specialists for detailed information, and engaging them only when required. Therefore, they can prevent a

project starting with a poor definition of requirements, which Gupta and Wilemon (1990) counted as the first reason for delays in NPD.

NPD can also be delayed by technological uncertainties, while incorporating the latest technology advances (Gupta and Wilemon 1990). With shorter technology life cycles today, it is becoming more difficult to select the appropriate technologies. It is desirable to have the latest technology to offer better products. However, technological improvements may occur during a project, and so both the present use of a selected technology and its future potential extension must be considered. Such future vision of a product, called a new-product stream map or product roadmap (Wheelright and Clark 1989; Tabrizi and Walleigh 1997), facilitates incremental product innovations that a company can exploit with lower costs. However, there must be a limit to the technology selection process; product specifications must be frozen in a timely manner to avoid serious delays and missed opportunities (Gupta and Wilemon 1990). A project manager can play a critical role in selecting technology by considering how it impacts the overall project with given time, cost and resources constraints. To make such a judgment, project managers need a good knowledge of the technologies on which their projects are based.

One of the major concerns in NPD is the exponentially increased complexity when integrating several technologies in a single product (Mihm et al. 2003). An NPD team consists of technical specialists; however, having them together does not imply that the gaps during their tasks' integration are well covered (Gupta and Wilemon 1990). They usually focus on their individual tasks, and may not have visibility of the big picture. A mismatch from one or more areas, like pieces in a jigsaw puzzle, may have disastrous effects. Many organisations employ insourced or outsourced architects for system solutions for such projects. Once the design is completed, the architect is usually assigned to other projects or no longer kept in the company. During a project, unavoidable changes may happen and there may not be any quality control authority if there is no architect providing a holistic view. A project manager, who already has contacts with all team members from related areas, can evaluate further changes to fit together coherently, if he or she has the right technical skills. However, it should not be interpreted that a project manager must be an expert; simply asking the right questions can prevent errors. The emerging consensus among researchers is that while project

managers need not necessarily be technical specialists, they should have a degree of technical skills encompassing the discipline of the project (Ogunlana et al. 2002).

Although cross-functional teams have been strongly advocated to speed-up projects, Song et al. (1998) found that effectiveness decreases if such teams are promoted blindly. Additionally, the interactions among marketing, engineering and operations change through a project's life cycle (Olson et al. 2001). They shift from marketing to engineering, and to operations, and then back to marketing (Song et al. 1998). These findings suggest that NPD is more likely to succeed when appropriate functional groups are employed for the project task; involving every group is a waste. Selecting groups for their contributions through a project schedule requires sound judgment based on technical knowledge.

In technologically challenging jobs, like IT and Research and Development (R&D), the professionals' personality and occupational characteristics are notable: autonomy, achievement-orientation and loyalty to the profession (Thite 2000). Such team members can connect and communicate comfortably with those who understand their common professional language and show empathy. A project manager with technical skills can therefore gain their trust and respect, and ultimately credibility, and then attain the leadership position in the team without formal authority.

5.2 Leadership skills

Leadership is a popular research topic in the social sciences, and NPD project management is also investigated. There are tendencies to put leadership in NPD in a wider generalised context, or force it to fit into one of the well-known generic definitions. The following sections provide a clear description for NPD. Cases, examples, findings, analyses and conclusions from the recent literature on project management and NPD have been examined in detail and commonalities have been combined to define leadership in NPD project management context. In addition, the associated skills required of an NPD project manager are discussed.

5.2.1 Defining leadership in NPD projects

One method of investigating leadership is to observe the behaviour of people acknowledged as leaders. Leadership can be described on a scale between transformational and transactional leadership (Lowe et al. 1996), with combinations such as participative and situational leadership between the two extremes (Kelly and Loong 2002; Loo 2002; Turner and Muller 2005; Neuhauser 2007). Transformational leaders convince people of the need to change, create a new vision, mobilise resources and transform individuals and, ultimately, organisations. From this point of view, NPD has similarities to transformational leadership; it involves human and capital resources with a vision to reach an NPD project's goals. Some researchers have taken this analogy to examine project leadership and reported transformational, participative, situational, delegative and people-oriented styles as contributors for NPD project success (Randolph and Posner 1988; Norrgren and Schaller 1999; Loo 2002). Others have analysed it from different perspectives using trait, behavioural, contingency and visionary approaches (Turner 2003). However, they have all considered project leadership in terms of general leadership theories, which need to be re-considered for NPD projects, with limited duration and a temporary setting. In a recent study, Carroll et al. (2007:12) have similarly argued that "both a broadening and redefinition of who is engaged in leadership work is well overdue and promises the potential for research to be more focused and specific around how leadership is constituted in different sites and from different organisational positions (or non-positions.)"

The roles of functional and project managers differ. Functional managers are technical specialists and supervisors who know how to analyse and address an issue within their areas. On the other hand, project managers are facilitators and generalists, who are able to put pieces together into a coherent whole (Meredith and Samuel 1985). Dunn (2001) found that functional managers heavily control hygiene factors (Herzberg et al. 1959) in team members' job satisfaction (salary, promotion, status, job security, etc.). However, project managers may only influence the motivator factors. Later, Keegan and Hartog (2004) compared the relationship of team members with project and functional managers, as the rows and columns in a matrix organisation. They concluded that leader–follower relations differ between the two. The leadership role is more relevant to supporting individuals in reaching their potential and excelling in their field with

coaching and constructive feedback. Project leaders are unlikely to satisfy these roles, since their main focus is to get the job done, not to develop people.

Team members who are challenged and encouraged to extend their knowledge in projects are more committed (Barczak and Wilemon 2003). However, with pressure to meet milestones during project execution, a project manager may not have the time to consider learning opportunities for each individual in the team. When projects finish and team members are assigned to other projects, the temporary connection between a member and a project leader is broken. Project and functional managers' activities differ during project execution (Globerson and Zwikael 2002); while project managers focus on meeting project goals and maintaining the team, functional managers support their members in the NPD team to contribute tasks and to resolve issues in their area of expertise.

Matrix organisations have inherent conflicts due to having a two-boss structure (Kalu 1993). Line managers may resist heavy project manager involvement in their business, since they may have different sub-cultures or performance appraisal systems. Consequently, the relationship between a project leader and a team member is not the same as with a functional manager (Keegan and Hartog 2004). Conventional leadership definitions do not hold for project managers, but fit better for functional managers.

What brings people together to form a team is a common commitment from its leader and members to achieve a goal or vision (Katzenbach and Smith 1993). The leader engages people and maintains their engagement on a difficult path to reach that vision. Mintzberg (2004) complained about the fuss around leaders and leadership; they are not the cure for every problem in companies. He thinks many of them have had too much leadership. They need less or 'enough' leadership. He described this balance as "a leader has to be a manager, and a manager has to be a leader" (Mintzberg 2005:22). Recently, he re-evaluated leadership in the context of leadership in developing countries and chose to name it as 'Engaging Management' (Mintzberg 2006). His comparison is useful to express what this study interprets as leadership in NPD projects:

Heroic Leadership

To manage is to make decisions and allocate resources – including human resources. Managing thus means analysing, often calculating, based on facts, from reports.

Engaging Management

To manage is to bring out the energy that exists naturally within human beings. Managing thus means engaging, based on judgment rooted in context.

Leadership is sometimes defined as a combination of all forces and behaviour to have people act in a desired way (Lowe et al. 1996; Thite 2000). This study adopts the definition proposed by Mintzberg (2006) and other schools of thought: leadership is influencing stakeholders to *choose* to engage, commit and participate *by will* to reach a vision (Thamhain 1990a, 2004a, b; Goodwin 1993; Cleland 1995; Babcock and Morse 2001). In the NPD context, leadership skills are defined here as 'a collection of closely related skills that underlie the actions to affect positively in favour of an NPD project management's vision, basically to deliver a quality product within time and budget'.

It is suggested that a manager can modify behaviour by exerting one or a combination of legitimate, rewarding, coercive, expert and referent, i.e. charisma, powers (French and Raven 1959; McShane and von Glinow 2000). The first three powers force people to act by obedience to external factors, such as a promotion, salary increase, punishment or penalties, which are not internal to an employee. Command and control by emphasising these powers are sometimes called transactional (Thite 2000) or production-centred leadership (Norrgren and Schaller 1999). It is an extreme point in the manager–leader (in classical sense) continuum. Based on the above definition of leadership, that is influencing and engaging people with their will, using authority to force against their will in the project manager position is not considered under leadership skills here. Expert power may come from technical skills, which are discussed above in detail, or a specialty needed in an NPD project. Referent power is valuable for leadership, but it develops slowly in time, as a form of interpersonal attraction with respectful and trusting relations (Kudisch and Poteet 1995).

In this study, the researcher is not concerned with defining or fitting NPD project leadership into a particular leadership style. Studies in the literature often mention the importance of project leadership in NPD but don't give an explicit description (Cooper 1998; Zimmerer and Yassin 1998; Krahn 2005); maybe this is intentional for similar reasons. The leadership role and leadership among team members are also not

considered. The aim here is to point out the associated leadership skills of an NPD project leader to be effective in his/her profession.

No single skill can be defined as the leadership skill. An examination of related studies reveals that several closely related skills describe people as managers in the NPD context. The following sections present short descriptions of the associated skills that have been encountered in the literature.

5.2.2 Interpersonal skills and team building

Companies allocate resources for NPD projects to fulfil their visions, and assign project managers to lead them. One of a project manager's goals is then to gain commitment from stakeholders to support a project and align people and other resources to achieve project management's vision. Stakeholders range from team members, senior and functional managers to customers and public, which are external to a company. Having a vision of producing a successful product does not suffice; project managers have to empathise, influence and inspire stakeholders (Goleman 1995, 1998; Dulewicz and Higgs 2000), and first of all, be committed to that vision themselves (McDonough and Leifer 1986; Hershock et al. 1994; Cleland 1995, Walker and Shen 2004, Helm and Remington 2005). Technology projects have inherent uncertainties and risks. It is not unusual that plans derail, budgets do not suffice or hidden requirements appear almost at the end of a project. A good project manager can always find a way to motivate and recover the team from devastating failure, re-evaluate the situation and look forward with a new plan to achieve the vision (Morris 1998). Henke et al. (1993) called the skills to create a motivating environment for team members as 'team building and maintenance'. Manipulating forces, such as fear, are not favourable methods and they have undesirable consequences on an individual's commitment (Sotiriou and Wittner 2001).

Project leaders must build teamwork between people across an organisation and interact in highly complex and intricate relationships (Thamhain 2004b). Although technical skills are advantageous, having good relationships among people can compensate to a degree for technical shortcomings (Henke et al. 1993). It also helps a team to work smoothly, and in turn facilitates its members to focus on their project activities (Cleland

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1995). A project leader's interaction is not limited to the team. It is also crucial to negotiate resources with senior and functional managers in a matrix organisational structure. Project leaders must have good interpersonal skills for effectiveness in their interactions.

5.2.3 Communication skills

Communication is one of the most cited skills of successful project leaders (Thamhain 2001, Helm and Remington 2005), sometimes ranked the highest (Pettersen 1991; Krahn 2005). As a bridge between project stakeholders and the NPD project team, the project leader needs to communicate frequently with both. Considering leadership is about engaging people to reach a vision, unless the vision is communicated and stakeholders' buy-in and commitment are obtained, it does not have much meaning (Cooper and Kleinschmidt 1995). A project leader should have good verbal communication skills and reinforce a project vision informally within the team, and externally to senior managers, functional managers and customers (Thamhain 1990a). Although technology is providing means for faster and easier communication, like e-mails and phone calls, nothing replaces face-to-face communication, the most effective way known (Culp and Smith 1992; Barczak and McDonough 2003). Naturally, it is one of the most essential components of leadership skills.

5.2.4 Listening skills

Communication in successful NPD projects is not a one-way top-down informational process; it needs to be two-way. Teams with better internal communication have superior performance, but it is the effectiveness of the communication, not the quantity, that is important (Iansiti 1995). These teams improvise more to fill gaps as they move forward, instead of following a linear predictable pattern, therefore they can be flexible and quick to try many ideas and iterations to launch a product in a shorter time (Crawford 1992; Lynn and Reilly 2002). Their project leaders also act as gatekeepers to represent the team and convey external and internal messages within the team and with external customers (Brown and Eisenhardt 1995), and promote ideas for an innovative

product design that meets customers' expectations (Leonard-Barton 1995). Listening to understand and sending correct messages are strongly related to being an effective communicator (Thamhain 2001; Krahn 2005; Bucero 2007). As Randolp and Posner (1988:71) said, "no good idea ever entered the mind through an open mouth".

5.2.5 Writing skills

Project managers need to produce many documents and presentations throughout a project's life cycle. They may be for internal or external consumption. Some of them may be for customers. They represent both author's and company's artefact. Mistakes may create confusion that eventually results in conflict and giving the company a bad name.

With recent technological advances, emails have become a norm of corporate life, but it is easy to write and send an email without thought. Kahn and McDonough (1997) consider emails as a category similar to phone calls, since they are instantaneous and may represent a real-time dialogue. However there are differences: one is verbal, the other is written. Punctuation or misspellings that pass unnoticed in conversation may imply different meanings in written form and create confusion. Especially for team members who are less fluent in English, emails are important for understanding issues correctly (Barczak and McDonough 2003). Consequently, writing skills are becoming at least equally important as other forms of communication, and they need to be to the point, precise and concise.

5.2.6 Cultural awareness

A recent study (Makilouko 2004) found that project leaders do not handle working with different cultures well. They usually base their management on negotiations, instead of building personal relationships. Managing geographically separated teams is challenging; a well-accepted gesture or joke in one country may be taken as an offence in another. Successful leadership styles vary among nationalities (Fretty 2006), and local managers with cultural sensitivity in their relations may be more effective than unifying operations under central project managers from the country in which the

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company is based (Kruglianskas and Thamhain 2000). Similarly, a manager working overseas needs to consider how to adapt the cultural values that are foreign to him/her (Mikkelsen and Folmann 1983). Project leaders with cultural empathy are more effective than those who are blind to differences, and have been reported as experiencing the fewest project problems (Makiouko 2004).

5.2.7 Conflict resolution

An effective project leader anticipates potential conflicts, understands their causes and addresses them beforehand. The conflicts may happen due to project priorities, administrative procedures, alternative solutions, cost, resources, and schedule or personality differences. Leaders should also be aware of the mindsets in different cultures (Barczak and McDonough 2003) that may also be a source of interpersonal and inter-group conflicts (Manning 2003). They need to adopt a suitable conflict handling method: withdrawal, smoothing, compromising, forcing or confronting, depending on the circumstances (Thamhain and Wilemon 1975, 1977). Project managers are seen as more effective if they cooperate and compromise for a solution (Barker et al. 1988). They may let people agree on an issue without initial intervention, since resolution of a dispute by working it out by themselves enhances their relationships (Ruekert and Orville 1987). If this does not happen, project managers can bring together parties with opposing views to reach a compromise. When a conflict starts disturbing project coherency and blocking its goals, they listen to stakeholders' views, choose an optimum resolution and communicate it assertively to the team. Therefore, project leaders need to be effective in all conflict resolution methods, communication and listening skills, and show cultural awareness.

5.2.8 Marketing skills

Marketing proficiency has been found to lead to successful products in Japanese firms (Song and Parry 1997b). Its effectiveness depends on top management support and selection of a project leader who fits project functional areas: technical and, more importantly, marketing skills. Compared with marketing people, engineers are more

pessimistic towards new ideas and sceptical of marketing data and methods (Ettlie 2002). A good potential new product, even backed with marketing research, could be rejected due to the 'not invented here' syndrome from engineers. Selling ideas to technically oriented people is another challenge for project leaders. Their marketing skill is needed not only to convince external customers why and how a new product satisfies their needs, but also to convey to internal engineers, team members and functional managers the marketing requests in a suitable manner, i.e. indirectly in the customer's voice.

5.2.9 Negotiation skills

Lack of resources is one of the main reasons to delay NPD projects (Gupta and Wilemon 1990). Part of this may be attributed to lack of senior management involvement. With proper PPM execution only the projects that a company can afford and benefit from the most should go ahead (McGrath 2004; Levine 2005). Cost cutting measures can still cause resource conflicts, or management cannot let go high sunk cost projects, while accepting new ones. A project manager should be able to negotiate with senior and functional managers to prioritise a project, to keep its resources during its life cycle and even to add new ones when needed (Culp and Smith 1992).

5.2.10 Politics and networking

Without skills to handle politics, project managers have little or no control over the external and internal events in a project (Sense 2003). Forming political alliances with powerful members of stakeholder groups helps project managers to elevate their projects' visibility and obtain company resources. The inability to understand, and to handle political and power dimensions within and around a project team, can bring about a project's downfall (Lovell 1993; Hatfield 2006). Project managers must acknowledge the political systems and tactically use them for their projects' advantage (Keys and Case 1990, Helm and Remington 2005, Shelley 2007). Pinto (2000) classified characteristics of political behaviour in a continuum, as shown in Figure 2.7. Aggressively exploiting every opportunity for selfish reasons can be as bad as being

naïve in not recognising the existence of politics (Pinto and Kharbanda 1995). It may help in the short term, but a team does not follow such a leader once they realise they are serving an individual's ambitions, not the team's or the company's.

Project leaders should work effectively with senior management to ensure visibility and resource availability, and to eliminate blocks on project progress (Thamhain 1990a, 1994b). They are like a bridge between senior management and the team, establishing a project's presence at higher levels in the management hierarchy. Their effectiveness increases via networking among senior and functional managers (Keys and Case 1990; Hastings 1995). Building a network is not a one-off effort; the network needs constant maintenance (Blackburn 2002). Projects leaders should consider that they may need the same network in future projects.

Not political   Very political

Characteristics	Naïve	Sensible	Sharks
Attitude	Unpleasant	Necessary	Opportunity to exploit
Intent	Avoid	Achieve project goals	Self-serve, predatory
Techniques	Tell as it is	Networking, expand connections, reciprocity	Manipulation, fraud and deceit
Favorite tactics	None	Negotiation	Bullying, misuse or hiding information, using alliances to own benefit

Figure 2.7. Characteristics of political behaviour (Pinto 2000:87)

5.2.11   Representation and protection of NPD project team

Gupta and Wilemon (1990) raised another concern for project managers: in addition to representing an NPD team, they should prevent team members from exposure to non-project related issues or additional work, which may divert their attention or overload them. A project team expects its leader to support an autonomous team to minimise interference from marketing, operational and functional groups. The better a team leader supports and protects his/her team, the more commitment he or she gets from the team

to achieve project goals (Ancona and Caldwell 1992; Lovell 1993). Effective external relations also establish a project manager in a well respected leader position, and increases his/her influence on the team (Gerwin and Moffat 1997). Indeed, a combination of superior marketing, communication, listening and negotiation skills produces a positive feedback in a project leader's effectiveness.

5.2.12   Encouraging business sensitivity

One of the challenges in growing and large organisations is to keep organisational energy high to respond in a timely manner to external threats. This is difficult to achieve with bureaucracy and static organisational structures. Senior management keeps a controlled and built-in instability to respond to such threats proactively (Quinn 1985). As part of the hierarchical management chain, a project leader is asked to lead an NPD team accordingly (Gupta and Wilemon 1990), not to focus on development work only with a tunnel vision. They are expected to act like entrepreneurs, encouraging an NPD team to keep an eye on alternative products from the same or other industries and to report possible business opportunities for new functions or products (Cooper 2005).

5.2.13   Summary of leadership in NPD projects

In contemporary organisations, the middle level in hierarchy has been flattened, reducing bureaucracy, moving decision-making down to the project level, and giving more responsibility and accountability to the team and eventually to the project leader (Larson and Gobeli 1988; Donnellon 1993; Olson et al. 1995; Pinto and Kharbanda 1996). Although the position gives legitimate power, the project leaders of successful NPD projects are found to have a variety of styles: supportive (Keller 1986), participative (McDonough and Barzcak 1991; Donnellon 1993; Thieme et al. 2003), collaborative (Olson et al. 1995), employee-centred (Norrgren and Schaller 1999) and transformational (Lowe et al. 1996; Thite 2000). Although different descriptions are used, they all mean freedom of expression, openness to debates and challenges, supporting ideas and creating trust in teams. A project leader should be empathic,

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politically savvy, avoiding dysfunctional conflict, helping team members to reach their maximum contributions, and removing barriers to realise NPD project goals.

5.3   Managerial skills

Having a vision and practising good people skills do not replace basic project management duties. Cleland (1995:86) argued that "a leader does the right things (effectiveness); a manager does the things right (efficiency)". The title 'leader' that had put an emphasis on leadership skills in recent years may have been causing a misconception. Ultimately, estimating resources, cost and schedules, developing plans, executing them, and completing a project within time and budget while satisfying its technical performance requirements, are unchangeable fundamentals of the project manager profession.

A clear definition that describes a good leader and manager is not easy to find, and overlaps are possible. In the project context, Pettersen (1991) examined the profile of effective project managers by an analysis of many publications and made a clear distinction between leadership and managerial skills, which were used in the same way in this study. He defined leadership (or influencing) skills as the ability to influence individuals without formal authority, and managerial skills as planning, execution, decision making and supervision. The following sections briefly present the latter skills.

5.3.1 Planning

Project managers should develop contingency plans, proactively considering uncertainties and risks with well-understood assumptions (Cooper 2005); for example, if a chosen technical design is tested to be very expensive, or a key engineer leaves the company. When the risks turn out to validate one of the possible assumptions, managers should immediately put a relevant contingency plan in execution, saving a great deal of time. Even if a previously unconsidered case arises, already existing processes and an adjusted mind set can help to produce a new plan quickly (Maylor 2001). As Eisenhower, an army general and later president of the USA, stated, "plans are nothing,

planning is everything". Especially in technologically sensitive industries, such as semiconductors, computers, and Telco, slowing down the NPD cycle is not affordable (Gupta and Wilemon 1990). Ambiguities and complexities increase uncertainties and risks in a project. Continuous consideration of constraints and risks, and being flexible to update project plans, are indicators of efficient project managers (Pinto and Kharbanda 1996; Pick et al. 2002). They may need to pursue multiple potential plans simultaneously until an optimum one can be determined.

For the sake of completeness or excellence, some project managers may prefer to develop finely detailed project plans. However, any NPD involving new technologies always has uncertainties and risks. Under such circumstances a detailed plan is not very useful, as it is likely to change. Extensive planning is simply a waste of time, and causes unnecessary delays (Eisenhardt and Tabrizi 1995). A good plan is the one with sufficient detail to act upon and move forward.

A project manager should be capable of breaking a project into phases and subsystems in a project plan to resolve complexities. This breakdown helps cross-functional communication, and provides a framework to integrate efforts. It also facilitates tracking and reporting project progress in quantitative terms for stage-gate processes, such as scoping, design, proof of concept, prototype, trial run, etc. (Thamhain 2001).

5.3.2 Executing project plan and using positional power

Several studies emphasising leadership (Randolph and Posner 1988; Cleland 1995; Babcock and Morse 2001) for project execution sometimes may mislead one to thinking that project managers are accountable for NPD project results, but they lack power due to their position in a matrix organisation. Especially in big, long-term projects, all or some team members may have direct links to project managers, similar to a functional structure. In other projects, the groups on rows and columns in a matrix structure are connected to a single senior executive position at a higher level in the organisational hierarchy. The presumed authority gap that project managers have to deal with can be eliminated through formal reporting structures and processes (Hodgetts 1968). The organisation can be designed so that a project manager does indeed control the members in the team via formal connections to functional groups' managers, and by reporting to

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senior managers. A project manager as part of the NPD team is empowered and given complete authority over the project, and in return is accountable for the results (Cooper 2005). Whenever matters arise where project managers can no longer resolve issues within the team or among functional groups, they can escalate issues to functional and senior managers in the management hierarchy and recommend actions. Otherwise, they are a 'scapegoat' for failures (Pinto and Kharbanda 1996; Graham and Englund 2004). However, escalations are best exercised rarely, due to their possible impacts on a team (Sotiriou and Wittner 2001).

As leadership is associated with influencing people, management is associated with responsibility, accountability and authority to deliver results. Project managers' main role is to get the job done, within budget and according to the specifications (Jiang et al. 1998). Sometimes leadership skills are insufficient for overcoming difficulties and conflicts encountered in a project. At the extreme, a project manager may run out of ways for handling conflicts, and still be without opposing sides' agreement or acceptance. Organisational and personal conflicts may become time consuming and ultimately unbearable by waiting to reach an agreement. The legitimate reward and coercive powers, which are separate from leadership skills, are also needed (Thamhain and Gemmill 1974). They enable project managers to modify behaviour of team members, perhaps unwillingly, to achieve NPD project goals.

Senior managers prefer a task-oriented or transactional style to bring back under control projects that have fallen behind schedule and above budget (Thite 2000). Team members also respect competent leaders who can exercise authority with professional integrity to achieve challenging goals (Sotiriou and Wittner 2001). The skills to produce plans, oversee their execution and use authoritative forces wisely are called managerial skills here, since their roots originate from classical scientific management (Burnes 2000).

Accelerated projects require several tasks to be implemented simultaneously. The rush to deliver new products may cause key activities to be ignored, which consequently results in poor design, malfunctioning, customer dissatisfaction and ultimately lost market share and profits (Gupta and Wilemon 1990). Although business conditions push for speed nowadays, project managers should use their position to resist pressure

and stick to the plan, unless it is really feasible to speed up (Pinto and Kharbanda 1995, 1996).

5.3.3 Aligning with company strategies

One of the key functions of management is to develop strategies and ensure that activities in a company align with them. Strategic focus is one of the contributors to NPD success (Zirger and Maidique 1990). Reinertsen and Smith (1991) demonstrated how a strategist can play a critical role in NPD projects and proposed some activities to benefit from business opportunities. However, companies are already under cost pressure and they do not have the luxury to employ dedicated strategists in projects to perform those activities. Project managers are now also expected to act as strategists (Gupta and Wilemon 1990). During an NPD project, a product may go through many modifications (e.g. reduction in functionality, adding new features), and the end product may not sufficiently serve the purpose as originally planned. Alternatively, business conditions may change with implications on the product. Project managers need to ensure that the final product is in line with the company strategy. Although some NPD projects may be successful, diversion from strategic direction cannot save a company from collapsing in the long term (Bobrow 1998). Acur et al. (2007) and Christenson and Walker (2006) have emphasised that alignment of NPD strategy with other business strategies has much more influence on an NPD performance.

5.3.4 Process improvement

The competitive business environment forces companies to produce the same outcome with less cost and to be more efficient to respond to market changes quickly. This can be achieved by doing it right the first time. Fire-fighting may help to resolve immediate problems on a temporary basis. After a point, available resources cannot fire-fight anymore and an irreversible reinforcing downward spiral may destroy the balance between fixing products in the market and NPD, consequently shutting down all NPD efforts (Repenning 2001). Doing it right the first time requires accumulating knowledge and rectifying processes over a long time in order to excel (Filippini et al. 2004), and

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retaining the knowledge from the projects in the company (Nogeste and Walker 2006). Contributing to process improvement activities to achieve Total Quality Management (TQM) targets like Six Sigma, or higher levels in Capability Maturity Models (CMM) in project planning and execution, are now among project managers' duties (Gyrna 2001; Thamhain 2004a). They need to simplify and eliminate unnecessary delays and steps to speed up NPD (Millson et al. 1992) and make the processes lean (Cooper 2005). However, random un-coordinated efforts do not produce financial benefits (Nijssen et al. 1995); processes must be modelled, and their changes have to be recorded and evaluated. A planned systematic approach with feedback controls, which again emphasises the need for managerial skills, must be applied.

5.4 Administrative skills

In a small organisation, people know each other and processes are simple and straightforward. As organisations get bigger with various groups with specialised functions, bureaucracy unavoidably increases, and mandatory policies and procedures need to be applied. As the complexity increases, there is a greater need to use methods and tools to simplify company-wide planning and integrate many functional and managerial groups (Swink 2002). In small companies, project managers with dominant managerial and technical skills are desirable (Yap and Souder 1994). When they join a large organisation, these skills may be transferable. However, administrative skills to understand and adapt a more complex environment, its methods and associated tools then need to be learned (Senge 1990). These skills are summarised in the following sections.

5.4.1 Performing administrative tasks

Compared with a small company, big companies have more administrative tasks: planning project purchases for cash flow management; conducting regular team meetings, and recording minutes and decisions; producing feasibility, financial, operational and support procedure documents; reporting project status regularly to provide visibility to senior and functional managers; tracking staff leave and its impacts

on projects; providing certain documents in a central repository to retain knowledge, among others. When looking at the activities in a project in general, an NPD project team is loosely decoupled from the rest of the organisation in much the same way as decentralisation. These administrative tasks, which generally involve company-wide methods and tools, integrate a project into the organisation by propagating information through the administration system (Lindkvist et al. 1998).

Project team members must comply with the administrative rules, policies and regulations in a company. Related activities may take a great deal of their time, which should otherwise be spent on project works, thereby negatively impacting on project progress. Project managers need to protect team members from being overwhelmed with administrative duties, seek support from other groups, like human resources and accounting, and facilitate them to focus on project tasks (Babcock and Morse 2001; Thamhain 2004b).

5.4.2 Understanding organisational structure and culture

Project managers should understand policies on how different groups work, and have administrative skills to be efficient in organisational matters in a company (Keller 1986; Rosenau 1988), which Ogunlana et al. (2002) called 'conceptual skills'. Especially during project execution, there may be cases that require determining who is responsible for what, and finding authorities to address specific problems. A good understanding of company culture (practically defined as "that is the way we work here"; McDonough and Leifer 1986) and an organisation's formal and informal structure can significantly help a project manager address them (Brown and Eisenhardt 1995). Even in the same industry, cultural variation among companies could be substantial. Cooperation with senior management, in line with the company values and culture, definitely increases the chances of a project reaching its goals (Clark and Wheelright 1992; Song et al. 1997a; Thamhain 2004a).

Engwall (2003), investigating two cases from a construction company, demonstrated the benefits of good administrative skills. In one case, a well educated project manager employed state-of-the-art project management methods, changed the company's normal organisational structure with direct reports to him and broke established processes and

procedures. Another project manager was a well respected engineer. He did not have any intention to challenge traditions and did not claim any formal recognition to be titled as a project manager. In his project, groups were autonomous and communication was mostly informal, while he was performing supporting activities behind the scenes. In the first case, the project manager had to divert his attention regularly to defend his decisions against the functional groups and to get their acceptance. His style was dysfunctional compared with the second manager. Both managers created plans, executed them and tracked progress. But the second manager, instead of resisting the existing organisational structure and methods, acknowledged and utilised them for his project's benefits. This example clearly indicates that pursuing practices and methods directly from project management textbooks is not necessarily good practice. Project managers should balance what can be considered acceptable within the norms and values of their environment.

5.4.3 Organisational project management and support systems and tools

In parallel with the widespread use of projects, several project management tools have been introduced to help project managers to produce budget, resource and timeline estimates, and to monitor and track progress versus schedule (Gupta and Wilemon 1990; Mabert et al. 1992; Rosenau 1998; Sotiriou and Wittner 2001). As NPD projects get more complex with increasing uncertainties and risks, it is vital to analyse impacts from risks and unexpected changes. Integrating the tools with stage-gate NPD processes can be more influential than using them independently (Brethauer 2002). The latest trend in organisations using PPM recommends additional tools for selecting the right projects (Levine 2005). All these tools improve communication with team members and senior managers, and measure the overall performance at a higher aggregated level (Gerwin and Barrowman 2002). Consequently, project managers should have sufficient knowledge to use them with minimal interference to the NPD team and company operations (Thamhain 2004b).

Ineffective use of project management tools and processes can cause delays in NPD projects (Gupta and Wilemon 1990), for example, an insufficient number of milestones to check if the project achieves its goals, not monitoring a project's progress and its

accumulating costs, and undefined or conflicting requirements. The tools, like task network and Gantt charts, are only useful if project managers utilise them practically (Culp and Smith 1992). They can also provide evidence to determine root causes of problems (Shah 1971). Therefore, crises can be prevented proactively at their early stages. Showing colourful graphics to senior management at project presentations, while in reality the project is following an un-recorded track, is counterproductive. Additionally, a team resists and questions the value of NPD project management (Gupta and Wilemon 1990). There is a duty for project managers to prove to team members that the tools are used to enhance project management practices, to integrate with company PPM, to increase the project's visibility at higher levels and to demonstrate how a project impacts on the big picture.

On one hand, proper use of project management tools is considered one of the most important factors for project success (Munns and Bjermin 1996; Bell and Kastelic 2001). On the other hand, pursuing perfection in the use of project management tools may result in paralysis due to an obsession with using technology in planning, as if the tools prevent all future problems and move the focus from action (Wind and Mahajan 1988). Unfortunately, project management education focuses mainly on such tools (Fabi and Pettersen 1992), which are only the mechanics of a project. A project manager who produces only attractive network diagrams, project schedules or resource allocation graphs, is little more than a handy administrative assistant. Getting time, cost and resource estimates and project constraints together, and then examining them for their impacts, are the desired skills.

5.5   Skills and the project manager role

Table 2.1 summarises the literature review findings on project manager skill sets proposed and discussed above, and the associated skills. It constitutes a starting point for the research topic: project managers' skill sets in Telco. This section first presents how these skill sets can interact and increase project managers' effectiveness. Then, closely related studies, which look at project managers from senior managers' perspectives and their qualifications with respect to the project characteristics, are

summarised briefly. Next, the impact of project phases on project skill sets is reviewed. Last, implications from recent trends in NPD project management are drawn.

Skill set	Skills	Section
Technical	Knowledge of technology on which project work is based	5.1
Leadership	Interpersonal skills and team building	5.2.2
	Communication skills	5.2.3
	Listening skills	5.2.4
	Writing skills	5.2.5
	Cultural awareness	5.2.6
	Conflict resolution	5.2.7
	Marketing skills	5.2.8
	Negotiation skills	5.2.9
	Politics and networking	5.2.10
	Representation and protection of NPD team	5.2.11
	Encouraging business sensitivity	5.2.12
Managerial	Planning	5.3.1
	Executing project plan and using positional power	5.3.2
	Aligning with company strategies	5.3.3
	Process improvement	5.3.4
Administrative	Performing administrative tasks	5.4.1
	Understanding organisational structure and culture	5.4.2
	Using organisational project management and support systems and tools	5.2.3

Table 2.1. Skill sets of a successful project manager

5.5.1 Interaction of skill sets

A holistic framework (Thamhain 2002) in which technology projects operate is presented in Figure 2.8. Project managers are not likely to handle the intricate relations with only one or a few dominant skills. There are different opinions about the priority of the skills that project leaders should have. In addition to project managers' basic goal to satisfy three well known constraints – quality, cost and time – they are now asked not only to focus on customers' immediate needs, but also to be market-oriented for their companies' long term success (Capon and Glazer 1987; Jaworski and Kohli 1993; Slater and Narver 1995, 1998; Kahn 2001). In contemporary companies, internal marketing groups are the project managers' prime customers. They lead the product roadmap and require engineering resources to develop products to achieve the

company's strategic goals. In her analysis among Telco equipment manufacturing companies, Barczak (1995) argued that those who are technically dominant, not marketing biased, should head NPD. In contrast, McDonough and Leifer (1986) stated that a technically biased attitude causes poor coordination among groups.
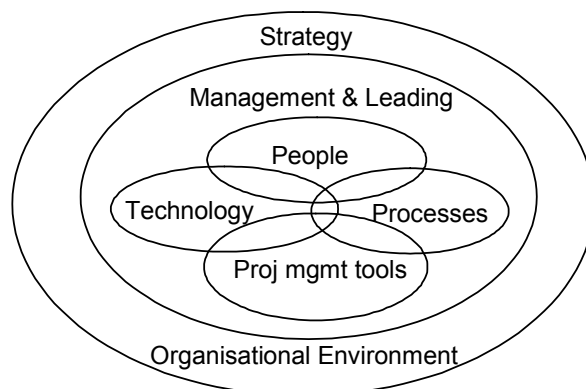
Figure 2.8. Framework in which a technology project operates. The researcher modified Thamhain's (2002) framework to show project management tools use different technologies from those involved in a new product.

Some researchers have found that technical skills are the lowest ranking and least essential (El-Sabaa 2001) or have no significant relationship to project management success (Belassi and Tukel 1996). Zimmerer and Yasin (1998) reported that, although technical expertise is one of the lowest ranking characteristics, technical competency is, interestingly, one of the highest. In a dynamic business world, taking calculated risks and speed in decision-making are critical to success (Calantone et al. 2003). Although a project manager is not expected to be a specialised expert, understanding and evaluating alternatives for a technical problem requires technical skills. However, making an informed decision requires weighing and comparing benefit, cost and risk factors, putting the engineering mind set aside. Managerial skills, therefore, complement making sound and bias-free decisions.

An opposite case is promoting a successful talented engineer to project management positions, without checking his/her interpersonal skills or business orientation. Thite (1997, 1999 and 2000) reported that they should also have some transformational

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leadership qualities and called this 'technical leadership'. However, projects have different challenges involving process changes, organisational, business or personal conflicts, which they may not handle properly (Thornberry 1987). In engineering projects, project managers selected from business-minded engineers are found to respond to NPD quicker (McDonough and Spital 1984). When closely examined, they are found to use leadership and managerial skills more frequently than technical skills (Gemmill and Wilemon 1994; Cowie 2003).

Project plans produced by a project manager who lacks managerial and technical skills are likely to have gaps. For example, tasks are not related properly, and the schedule does not follow a predictable pattern. Lack of planning skills can also hinder technical skills (Doughty and Kliem 1987). Team members working with such plans may get frustrated with the gaps and take much time fixing them. It may require repetitive updates of project plans, which cause confusion, frustration and ultimately demotivation among team members (Matta 2003). Melcher and Kayser (1970) presented a case where a sales person with good marketing skills seized an opportunity and achieved senior management support for an NPD project. He overlooked or did not understand technical challenges. As a result, he miscalculated risks and could not make timely decisions; delays were unavoidable. When the project finished, their competitors had already launched similar products, senior management had lost interest, and the company did not have sufficient revenue to meet the project costs. This example shows that even if project managers have good interpersonal skills, after a few iterations to get a project back on track, they lose credibility among the team and senior management (Thite 2000), and cannot prevent the demise of such a project. A well developed plan is based on technical facts and uses supporting project management tools to reinforce its effectiveness (Webb 1995).

Barzcak and Wilemon (1989) summarised the roles of a project manager as communicator, climate-setter, planner and interfacer. The differences in choosing the roles are relative to the type of NPD team: innovation versus operation, according to the degree of change in a new product. The innovation teams pursue new products, and operation teams work on current products. Both teams considered planner and interfacer roles of project managers crucial for NPD success. Innovation teams show a strong emphasis on climate-setter and communicator roles. It is concluded that the managers of innovative teams should have a wider range of skills. Pinto and Covin (1989) made a

similar comparison between construction and R&D projects. Many factors are common, but especially in R&D, teams are found to be critical. The degree of uncertainty was claimed to be the reason. When the product is better-known and the project activities tend to be more standard, as in the construction industry, it is easier to plan, schedule, and monitor (Belassi 1996). As unknowns increase, leadership skills to handle a team of specialists become essential, thereby supporting Barczak and Wilemon's conclusion. Pinto also commented that industry characteristics may make a difference in project characteristics and their management.

In a study to research project success in the chemical industry, the top three activities that are strongly related to project outcomes are initial screening, preliminary technical assessment and product development (Cooper and Kleinschmidt 1986). Projects tend to be more successful if they are implemented proficiently. A project manager is expected to understand technical issues, at least at a higher level, to perform impact analysis for preliminary technical assessment and later for development. Godsave (1989) similarly examined the IT industry and stated that a project manager needs to be predominantly a business person who understands several technologies and applications, and how they are integrated. Technical skills are also important to gain credibility from team members and to be accepted as leader of the team (Pettersen 1991; Wateridge 1997).

Clark and Wheelright (1992) defined a 'heavyweight' project leader in the electronics industry as having a hands-on role at every stage of an NPD project: gathering product requirements directly from users, translating them into different professional languages for stakeholders, and then managing, directing, co-coordinating various engineering sub-functions, and resolving conflicts among them until product launch. Today's project leaders, contrary to the heavyweight definition, are not meant to dominate in projects and execute projects with close to a transactional management style (Thamhain 2001). First of all, they need to be social architects in unifying around project goals, and encouraging innovation and cooperation to get the maximum outcome from a multifunctional team. They should delegate and foster a professionally challenging and motivating work environment.

Tampoe (1989, 1993) emphasised freedom of project team members with a supportive project manager with an empowering style in IT projects. He considered leadership of the team members important, with the project leader role as an administrator, letting

team members focus on project work. He mentioned several functions, like planning and tracking, but preferred to exclude them in evaluating the success of a project manager. On the other hand, Godsave (1989) accepted the project leader as a distinguished role in IT projects.

In investigating success factors through the stages of the project life cycle with a regression analysis, Pinto and Prescott (1988) found that personnel was not a dominant variable in any one of the stages. Such a conclusion tends to void the requirement for a leader role in projects. Later, Belout (1998) strongly rejected this outcome, backing this up with extensive literature support stressing the importance of the human factor.

Another remarkable argument in the literature, instead of prioritising project manager skills, is to consider managerial skills as threshold or hygiene competencies to perform the project manager role (Thamhain 2004c). Considering the overwhelming leadership emphasis in the literature, it may have been assumed that the fundamentals of project management are already in place and leadership acts as a catalyst to boost project management performance. However, such an assumption presents a biased view towards leadership skills that is not quite objective. They may fall into the leadership trap that Mintzberg (2004) has pointed out.

5.5.2 Senior management's perception of project manager role

To provide flexibility to respond to dynamic business conditions, senior management may deliberately encourage conflicts of ideas, called 'creative tension' (McDonough and Leifer 1986), or 'creative abrasion' (Leonard-Barton 1995). In the NPD context, this conflict is found to have a positive influence on performance (Madhavan and Grover 1998). Its creativity or destructivity depends on individual team members' capability to manage a meaningful conversation with each other. The negative effects against competitive arguments in a team of good technical members can be counterbalanced by a leader who can motivate and keep the team intact. It is a challenge for project leaders to use conflict as a tool to unleash imagination and creativity and to transfer knowledge among team members (Randolph and Posner 1988). Consequently, they should have both technical and leadership skills for creation and dissemination of knowledge in a company (Madhavan and Grover 1998).

Senior managers' perception of how project managers perform presents an interesting picture (Crawford 2005): they prefer project managers to limit themselves to traditional project responsibilities of time, cost and resources management, and not to cross boundaries into strategy, project selection and higher level communications. This is contrary to the view that a project manager as a strategist contributes to NPD success (Gupta and Wilemon 1990; Reinertsen and Smith 1991). It proves that a project manager should be politically sensitive and frame issues so as not to be seen as threatening and disturbing power balances when communicating to senior management. Communication and negotiation skills and networking are essential to overcome barriers that affect the NPD strategy.

In companies with high quality NPD processes (e.g. CMM, Six Sigma – Gyrna 2001), the planning and execution are not simply left to individuals. There are several measures for making timely informed decisions based on facts, and not rushing in order to avoid producing a wrong product in the first place. A project manager has to apply certain unchangeable rules in the processes. Indeed, these precautions help them evaluate progress frequently and resolve problems before they arise. If a company is mature in project management, it is unlikely that a project manager is accepted as a high performer (Crawford 2005). Senior management's perception of the project manager role in such a company is attached to well proven processes, not individual differences. Compared with a company with poor NPD processes, where fire-fighting is the norm, any employee putting out fires is accepted as a hero (Repenning 2001).

5.5.3 Experience and education

Another factor that may impact on a manager's performance is experience. It is generally assumed that an intelligent person working in a specific area for a considerable duration can be a good manager. However, it also increases the tendency to rely on past experience. Fiedler (2001) found that the experienced managers with high intelligence do not perform better on routine works than those with lower intelligence. However, intelligent managers are much better at handling emergencies and stress. Some skills take longer to develop; technical skills can be learned faster, but mastering leadership skills requires experience. Managers with longer tenure in a

company are found to communicate more frequently and to have a wider network, since they have had a longer time to gain more exposure and understand company culture (Ancona and Caldwell 1990). Similarly, Gerwin and Barrowman (1997) stated that a team's power is proportional to their leaders' experience and expertise.

In addition to experience, qualification is another factor questioned for project managers' success. McDonough (1990) reported that it varies with respect to the project purpose. For new technology R&D projects, managers with high qualifications, like Masters or PhD, were the most effective (Keller 1986). For projects that use developed technologies to produce practical applications, the ones with fewer years in a company performed better. In incremental technology intensive product modifications, performance was proportional to experience. McDonough (1993) later investigated the relation to speed in projects, and obtained similar results for routine projects. But for radical projects, he reported a conflicting result with his previous work (McDonough 1990): inexperienced and less educated project managers delivered projects faster, because they did not let teams wander to evaluate alternatives and locked them into a solution, which might be suboptimal. This is contrary to the common belief that radical projects develop new technologies and their teams are to be given freedom to search all possible solutions (Thomke 2003). More recently, Kessler and Chakrabarti (1999) validated Keller (1986) McDonough's (1990) earlier findings: as technological uncertainties increase, experienced and qualified project managers should be preferred.

This study considers experience, education and training as some of the contributing factors shaping project managers' skills. The latest version of PMCD (2007) was amended with a development model that resembles the closed loop learning cycle (Senge 1990) for continuous skill improvement. Their influence and how they form skills are another research area by themselves: intellectual capacity research in cognitive sciences, and are beyond the scope of this study.

5.5.4 Project life cycle and phases

Activities in different phases of projects may vary and require more emphasis on some skills. Weinkauf and Hoegl (2002) analysed the activities of a project manager during a project's phases in the automobile manufacturing industry. They assumed that projects

have two phases: Creation and Implementation. They used three major activities as shown in Table 2.2, based on a model from MacKenzie (1969), and compared their frequency between the two phases. They examined a case where a project manager is responsible for many projects and teams directly report to him/her. Consequently, some activities, like 'coach and develop' and 'reward', which are expected to belong to functional managers in a matrix organisation, appear in the table. Although they do not fit the definition of phases in this study or today's project manager position in a matrix structure, some conclusions may still be drawn by examining the activities.

Conceive Formulate ideas	Organise Arrange organisation requirements	Accomplish Direct towards desired goals
Set project goals Determine approaches Plan resources	Establish boundaries Delineate relations Design the team task Determine values and norms Secure resources	Control Secure information flow Resolve conflict Coach and develop Give feedback Reward Grant autonomy

Table 2.2. A conceptualisation of leadership activities in project teams (Weinkauf and Hoegl 2002:173)

Weinkauf and Hoegl's (2002) results did not indicate any significant differences in leadership activities between the Creation and Implementation phases. Looking at the individual activities, 'plan resources', 'determine approaches', and 'set project goals' were somewhat higher in the Creation phase, as expected. 'Control' was also surprisingly higher, whereas it would be expected to be higher in the Implementation phase. 'Design the team tasks', 'secure information flow', and 'resolve conflict' were the same for both phases. They clearly show that planning and execution are vital, indicating the need for managerial skills in both phases. 'Resolve conflict' and 'determine values and norms' are associated with leadership skills with the definition in NPD context here. Only 'design the team task' implies technical skills, since effective plans require understanding relations among tasks. The majority of the activities under the Conceive and Organise groupings are relevant to managerial skills. Weinkauf and Hoegl did not present much evidence to draw conclusions about administrative skills.

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Pinto and Prescott (1988) examined the success factors in project phases, but defined the phases as major steps. Although project phase names resemble stage-gated NPD process (Cooper et al. 2002), they are not the same: Conceptualisation, Planning, Execution and Termination. They presented critical success factors for each phase, as shown in Table 2.3, but did not detail how project managers can make a difference to perform them. They used the term 'client' to indicate users and internal customers.

	Conceptualisation	Planning	Execution	Termination
Critical Success Factors	Project mission Client consultation	Project mission Manag. support Client consultation Client acceptance	Schedule / plans Personnel Technical tasks Trouble shooting Client consultation Monitoring and feedback Communication	Client acceptance Client consultation

Table 2.3. Critical success factors for project phases (Pinto and Prescott 1988:8)

Other studies mention specific observations, but they do not specifically associate with an NPD stage or phase as in Section 3.2. Anderson (1992) states that leadership skills (communications, negotiations, etc.) are more important, especially in the early planning and design stages. Technical skills are needed mostly during project execution, and are also useful early in the project to clarify the project mission. Managerial and administrative skills are required mostly during planning and its implementation (Anderson 2002). Project execution, in particular, is the crunch time in a project; costs and progress need to be tracked and tightly controlled. A similar pattern is also seen in areas where conflicts arise during a project's life cycle (Thamhain and Wilemon 1975).

Some skills may be more important than others, depending on the phase of a project. This result should not be interpreted such that project managers with stronger skills that fit a phase should be employed just for that phase and changed with others as projects progress from one phase to another. It has been found that changing team members, especially project managers, can slow down NPD (Kessler 1996; Cooper 1998). Rather, this result implies that a project manager needs to have all skills to be effective in all

phases of a project, as he is likely to be involved from beginning to end. In some circumstances senior management may need to assign a project manager temporarily to a project. A dedicated empirical investigation for the skill sets has not yet been undertaken with respect to the stage-gate project phases. This research study also extends its scope to investigate this area for Telco NPD projects.

5.5.5 Recent trends in NPD project management

In the last few years, project management has shown a noteworthy shift towards managing risk and project schedule under technological uncertainties, and integrating and evaluating a project in a company-wide bigger picture (Davies 2002; Pinto 2002; Cooper 2005), which require mostly managerial and administrative skills. Managerial skills are now ranked notably higher than communication skills (Barczak and Wilemon 2003). Pinto's studies on project management success factors (Pinto and Kharbanda 1995; Pinto 2002) did not mention the above points less than a decade ago. Among emerging factors in team management are addressing individual needs and creating a supportive environment for collaboration (Thamhain 2004c). These are replacing the project leader's usual highly visible role: a cheerleader, setting an example, leading in the front, representing and taking care of the team like a family. An overemphasis or disproportionate attention to team leaders is known to lessen team members' commitment (Donnelon 1993).

Interestingly, Davis and Stephenson (2006) claimed that management will go from an art to a science. They stated that there is not going to be any place for decisions made with gut instinct any more. The business world is so complicated and competitive that nothing can be left to chance. Detailed statistical control and sophisticated decision making software tools are gaining more supporters. Scientific management that dominantly requires administrative and managerial skills is becoming a competitive advantage.

In today's flattened organisations, employees are now expected to be entrepreneurs and leaders to drive business within their boundaries (Mintzberg 2004) and to be proactive in managing their own careers, as opposed to relying on others. The heavyweight project manager that Clark and Wheelright (1992) described as a one-person show more

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than a decade ago may not hold in today's conditions. The project manager's duties to assure a project reaches its goals and to integrate them with the rest of the organisation are more apparent than before (Thamhain 2004b). In other words, managerial and administrative skills are becoming more important. However, it should not be interpreted that leadership skills are losing importance; rather, it indicates the increasing demand on project managers to excel in every area.

The world has turned into a global village through technological advances. Virtual and multi-cultural teams for NPD are common. A project manager who once used to work with locals now needs to work with people from different backgrounds. Indeed, cultural differences influence project manager style (Manning 2003; Fretty 2006). For example, when comparing NPD projects in Korean and Japanese companies, Thieme et al. (2003) noted that an effective Korean style to implement a project plan is participative, whereas the Japanese style is a more authoritative, or transactional. A project manager must be sensitive to individual differences in a multicultural team, which requires varying leadership and managerial approaches, and adjusting behaviour accordingly (Fretty 2006).

6   NPD in the Telco industry

The review presented above on a project manager's skills is generic, and it does not refer to any specific industry. Before investigating the area of research interest, the skills of an NPD project manager in Telco, this section presents an overview of the Telco industry today. It helps set the scene of Telco's origins, and why NPD is so important in this industry. Then, NPD projects in Telco are examined to determine their general characteristics, so that finally the project manager aspects can be investigated to gain more insight about what skills a project manager in this industry should possess.

6.1   Telco industry and its current status

To understand the real nature of Telco industry, it is useful to look at the products that reach consumers or users. They are phone calls, Internet services, faxes, emails, etc.,

that meet communications needs over long distances. Historically, they were letters sent to carry information via post offices, and carried physically between locations, this is now mainly considered as a transportation and logistics industry. After the invention of electricity, the telegram was popular until Alexander Graham Bell invented the telephone.

Telco has taken a giant leap since Claude Shannon laid the foundation for information theory on which digital telecommunications is based. In the last two decades, with advances in technologies and open standards accepted by many countries, wireless telecommunication has become one of the commodities today that was once used only for military purposes. Internet technology, which was developed for similar purposes, has become the low-cost platform on which voice and data communications solutions converge. Today, the main product that a Telco company offers is the capacity to send information or digitally coded bits (0s and 1s) from one location to another electronically over different media: air, fibre cables, copper wires, etc. The devices, like terminals (e.g. phones, personal digital assistants) or equipment (e.g. routers, switches) in a Telco system, are the means or resources that convert or direct signals, and create this capacity (Polak and Kleiner 2000).

The main product, a capacity to send and receive information, clearly separates Telco from other industries. Telco products have similar characteristics to a service industry (Kotler et al. 2001): intangibility (information signals in a cable or air cannot be seen or touched), personal involvement to receive benefits of a product (people are affected at sender and receiver ends as a result of the information), synchronous conversion (for real time applications, like audio and video calls), variability of service encounters (fax, email, Internet, phone, etc.) and perishability. The capacity cannot be stored for future use; unused capacity is a loss of revenue.

Telco also resembles the manufacturing industry to a degree, since it requires big investments not only for building infrastructure, but also for its renewal with advanced technologies. Creating, maintaining and renewing this infrastructure all require engineering knowledge (Robertson and Jones 1999). Looking at commonalities and differences, the Telco industry does not fit an exact industry definition. However, considering product features and systems employed, it can be defined as 'a service

industry that employs capital intensive high technology systems'. This definition allows us to differentiate the Telco industry from others and points to its NPD project specifics.

Technology advances are creating new opportunities in Telco. Internet technology has had a profound impact (ITU 1999). It has created fast and tremendous Telco networks. The boundaries between voice and data have disappeared, and uniformity of the transmission medium has caused costs to be driven to even lower levels (Lainee et al. 2001). Latest broadband technologies (e.g. Digital Subscriber Loop – DSL, cable and 3G) are removing barriers to high bandwidth (i.e. information transmission rate) access. The interactions with other technologies and advances in computer technology are promoting new services and propagating significant changes in other industries (ITU 2005). For example, with Internet banking, bank branches are becoming history; with automated procurement and ordering, retail businesses have left the logistics area and are now focused only on their core business. Although Information Technology and Telco (IT&T) were linked historically, they are now different (Wateridge 1997). IT delivers practical applications or systems to consumers, and Telco, as a service industry, connects them through data networks. As computer hardware capability is more advanced than before, IT today is more associated with application software development.

Changes in technology have elevated consumers' expectations and demands to higher levels, unforeseen a few decades ago. Telco companies are under intense pressure to bring technological advances into the market and replace conventional data and voice products. In addition, deregulations in several countries, including Australia, have created deep changes in the industry and increased competition (Polak and Kleiner 2000; Beardsley et al. 2004). It is no longer valid that sales from a competitor can be won just because services are cheaper. There have to be quality products attracting customers (Moore 1999). Consequently, NPD is significantly important in Telco.

6.2   NPD project characteristics in the Telco industry

The term 'Telco' may mean different things to different people. For example Barczak (1994, 1995) and Barzcak and Sultan (2001) studied NPD projects in this industry. When examined closely, the companies that provided the data for that research were

Telco equipment manufacturers. Some other studies state that they surveyed Telco companies (O'Connor 1994; Zirger and Hartler 1996), but it is not clear whether they are companies working on supporting IT systems (e.g. billing) or service providers, the core business in Telco. Although several industries' products may be used in Telco, they do not necessarily exhibit its characteristics.

When NPD best practices are compared between manufacturing and services industries, Griffin (1997b) reported that service industry processes are simpler, consist of fewer steps, and consequently have shorter project lifecycles. She also suggested that insufficient research on service companies had been conducted. Although the Telco industry provides communication services, it is not a pure service industry, due to high technology and engineering involvement (Robertson and Jones 1999). Therefore, Griffin's assumptions do not hold exactly for Telco.

Researchers have examined several industries and noted that, although many commonalities exist, project management approaches tend to differ as they have varying tasks depending on the industry. The competencies required to run a project in the construction industry are different from manufacturing (Lampel 2001). The nature of tasks accounts for the differences (Weinkauf and Hoegl 2002). Accordingly, the project manager's job can be heavily influenced by the uniqueness of activities to perform these tasks. The more predictable and standard the tasks are, the easier it is to plan, schedule and track progress. Different project characteristics may exhibit different success factors, suggesting a need for contingent project management (Dvir et al. 1998; Krahn 2005). Industry specifics can shape such project characteristics, and consequently the skills of a project manager (Belassi and Tukel 1996).

The users of Telco services are heavily dependent on the readiness of capacity to send and receive information. They want high availability and reliability (Gyrna 2001) in the products. Especially for business users benefiting from high Telco technologies, their employees and information systems are operative only with data and voice communications. Therefore Telco service providers cannot employ systems and technologies on an ad-hoc basis; they must work 24 hours a day without a glitch. Only heavily tested and well proven technologies can be deployed. However, a Telco company cannot use only reliable but old technologies, otherwise they lag behind their competitors. One type of NPD project in Telco involves deploying a new technology in

practice with associated processes and support systems, and ensuring that it does not fail (Benghozi 1990).

NPD projects in the Telco industry can generally be described as system integration: combining electronics and computer technologies for value-added and cost effective communication solutions. In that sense, although the products are not unpredictable breakthrough innovations, they require significant innovativeness in terms of incorporating different systems and processes. Telco products basically have two components: physical network parts – network links (e.g. fibre optic and coaxial cables) and equipment (e.g. switches and routers) – and support systems and processes. The first creates the information transmission capacity, and the second captures Telco service requirements, to activate them and to address operational matters, such as faults. An automated system that can carry out these processes is highly desirable for efficiency (Robertson and Jones 1999).

7   Telco NPD projects and project manager skill sets

The literature contains little direct examination of project manager skills in the Telco industry, and therefore this discussion evaluates these skills indirectly. First, what are generally involved in Telco NPD projects have been discussed above in section 6.2. Next, the literature that categorises projects with respect to different characteristics is identified. Then, the characteristics are matched against NPD projects in Telco. Finally, project management aspects are investigated in similar industries and associated skills are determined.

For evaluating the skills required by a Telco project manager, this study examines a number of project characteristics and triangulates for more generalisable results. The following sections describe four types of classifications. Each may not provide a sufficient case, but their overall results can give a better understanding.

7.1 Project strategies and success factors

The shortened technology cycles may not allow Telco companies to work on existing products long enough to offer their every feature. Another technology cycle with new attractive functions draws customers' attention, and Telco companies are forced to provide them. A current remarkable example is emerging Voice over IP (VoIP) technology. Customers want to converge their data and voice traffic onto IP networks and reap the benefits of low cost communications. It requires a change of network devices compliant with VoIP and Quality of Service standards in chain throughout a Telco network, therefore demanding new NPD projects. As bandwidth limitations are being removed in networks, the manufacturers already have new functionalities on their agenda, pushing another technology cycle. Therefore a Low–Low combination in project strategy matrix in Figure 2.2 is rare.

NPD in the Telco industry develops new products based on new technologies and systems, or extends product lines with new features, therefore placing most of the new products in the right top corner of the project strategy matrix in Figure 2.2, re-drawn in Figure 2.9 below for convenience. The financial and competitive aspects are always a concern for all NPD project strategies. The most significant customer based success measures for products that are new both to the company and the world compared with product line extension, shifts from market share and revenue to customer acceptance and satisfaction.

NPD projects in Telco may vary widely, ranging from updating a small product to deploying a whole network, and clear boundaries are unlikely to be defined. All feasible features in a product may not be profitable, or there may be insufficient time to produce designs and test them due to the demand for accelerated projects to beat competition. It is usually preferable to launch basic functionality, i.e. base product, first, then add new features with justifiable business cases through the PPM process. Therefore, the second type of project most frequently encountered in Telco are product updates, as opportunities are seized in the market (Robertson and Jones 1999).

Product New to the Market

	Low		High
High	**New to the Company** *Market share* *Revenue or satisfaction* Met profit goals Competitive advantage		**New to the World** *Customer acceptance* *Customer satisfaction* Met profit goals or ROI Competitive advantage
	Product Improvements *Customer satisfaction* *Market share* Met profit goals Competitive advantage	**Add to Existing Lines** *Market share* *Rev/Rev gr./Satis/Accept* Met profit goals Competitive advantage	
Low	**Cost Reductions** *Customer satisfaction* *Acceptance or revenue* Met margin goals Performance or quality	**Product Repositioning** *Customer acceptance* *Satisfaction or share* Met profit goals Competitive advantage	

Product New to the Company (vertical axis label)

Telecom Industry

Figure 2.9. Telco NPD project success measures versus project strategies

There is no direct connection in the literature between NPD success measures and their associated project management aspects, and therefore project manager skill sets; for example, customer acceptance and satisfaction alone are not very indicative of NPD success. The researcher followed the indirect method represented pictorially in Figure 2.10: starting from the project strategies of Telco NPD shown in Figure 2.9 ('new to the world' and 'add to the existing product lines'), he uncovered the determinants for NPD success, and then examined more closely those project management characteristics that have implications for project manager skill sets. Deductions were also made from NPD projects from other industries.

If a company has complete knowledge and experience in a product, indicated by the left bottom corner of the matrix in Figure 2.9, it is a 'routine' project for them (McDonough 1993). For such a project, the requirements – time, cost and resources – are already known a priori to a high degree. Once they are allocated, the project manager's responsibility is to ensure that the project schedule and cost are strictly controlled. It is mostly an administrative task, and they do not need to understand much product technology.
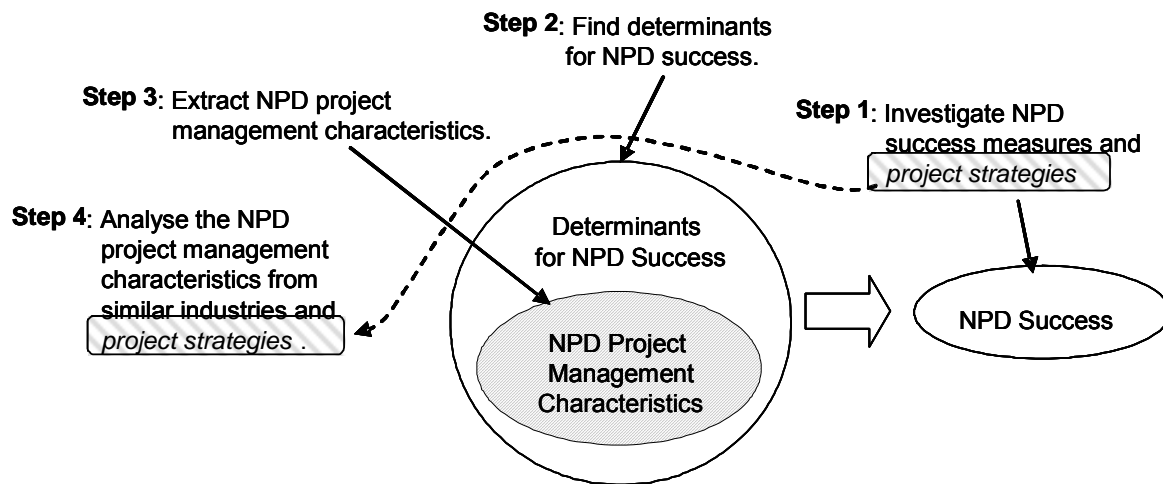
Figure 2.10. Analysing project management characteristics with respect to project characteristics

On the other extreme are new-to-the-world products, those the company has not commercialised before in the market. If customers do not accept them, they have no value. Related projects are generally highly innovative, and they require technically oriented project managers and team members, if technology is also new. R&D projects are well known examples, which several researchers have already studied (McDonough 1990; Jassawalla and Sashittal 2000). These researchers concluded that managing R&D teams requires strong technical and leadership skills; the managerial and administrative skills are not as essential.

Line extensions in Telco industry are incremental product modifications that add new features to an existing base product. Compared with the new-to-the-world products, they have fewer risks and uncertainties. These NPD projects generally increase revenue from the base products, which hold the biggest portion of the investment. Since the required work is usually less and not new, these projects also have shorter life cycles (Griffin and Page 1996; Kessler and Chakrabarti 1996), and they require a project management style closer to routine projects.

High technology telecommunications equipment and systems are developed in R&D projects, generally by third parties, and then deployed and integrated with support

systems by Telco companies. The fundamental difference between R&D and Telco NPD projects is that R&D is to make it work, while NPD is to ensure it does not break. Among Andrew and Sirkin's (2003) definitions for innovative companies in manufacturing, the Telco industry fits the integrator model better. They take an existing market, well understood customers and proven technologies, then follow well defined NPD processes, and produce high Return on Investment (ROI). Therefore the Telco project strategies differ from R&D projects, technical and leadership skills alone are not sufficient.

New Telco products are more complicated than line extensions and require more expertise. Their projects are only a part of overall NPD efforts and the project managers do not influence its several success factors and key tasks. For example, market search and product launch activities (Cooper and Kleinschmidt 1986, 1994) are two tasks that are usually implemented out of managers' control by marketing departments. Although project managers cannot totally influence the success of a product, they can contribute partially to their success (Munns and Bjermin 1996). Looking at the success factors, their contributions occur in three main ways. First, they deliver products that satisfy marketing requirements for customers' acceptance and satisfaction. Second, they contribute by finishing projects without delays, or if possible faster; the earlier a product is launched, the longer a product stays in the market and the more revenue it generates. Finally, effective cost control or savings can directly impact on the ROI bottom line. They all require effective planning and tight control of schedule and costs. Project managers should have technical skills to understand how tasks are inter-related to produce effective plans. Project management tools can produce progress and financial information quickly and facilitate the project managers' job. Consequently, project managers should have good technical, managerial, and administrative skills.

There is little evidence for evaluating leadership skills by looking only into the project success factors, which are based on quantitative measurements in Figure 2.9. People, not machines, do projects. Good communication, listening and negotiation skills definitely help projects run smoothly, and resolve issues by getting stakeholders' buy-in. As Telco NPD projects involve newer technologies, their characteristics get closer to R&D projects, and require similar project manager skills with more emphasis on leadership.

7.2 Innovation

New product is usually associated with innovation and sometimes the terms are used interchangeably. However, this attachment is not entirely correct. An innovation may not necessarily end up with a commercially successful product (Gottfredson and Aspinall 2005). Alternatively, an NPD may not necessarily require an innovation. Innovation used to be a connotation for a technical invention, and therefore more relevant to R&D projects. However, NPD and R&D differ with respect to their goals; NPD projects produce new products for use by the customers outside a company, whereas R&D projects develop new technologies (McDonough 1990) and new knowledge (Shenhar et al. 1995), which may be used internally in a company for NPD. In recent years, in addition to traditional product-related innovations, the scope has been widened to include several other areas: application, process, experiential, marketing, business model and structural innovations (Moore 2004), and management innovation over a much wider company strategy perspective (Hamel 2006). Innovation therefore can be defined as any improvement that a company can exploit for their competitive advantage (Gottfredson and Aspinall 2005). Product innovation involves technology, but this is not necessarily the case with all innovations. An NPD may rely on one or more types of innovation.

Historically, product innovation used to be defined broadly as radical or disruptive (Christiensen 1997; Moore 2004) or incremental (Ettlie et al. 1984). As technology advanced, individual products interacted and resulted in more complex ones, although the individual product subcomponents might have remained untouched. Alternatively, the usage of a product did not change, but the underlying technology did. Consequently, the two broad innovation definitions were not sufficient to describe them. Henderson and Clark (1990) introduced 'architectural' and 'modular' innovations to define such products and the 'product' innovation framework (Figure 2.11). The 'product' prefix is added to her original work to differentiate what she meant among other recent innovation types, stated above by Moore (2004).

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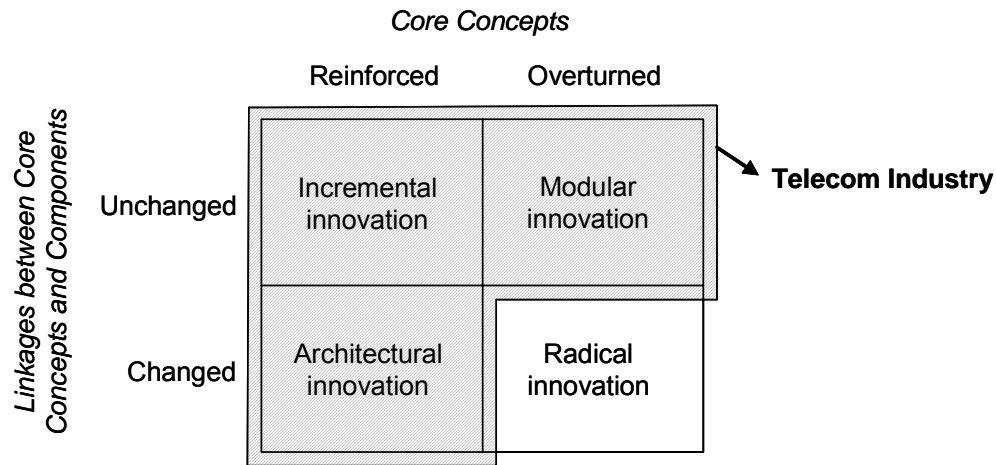
Figure 2.11. A framework for product innovation (Henderson and Clark 1990:12)

Modular innovations are technology changes, where the core concept (i.e. usage from the user's perspective) remains the same, e.g. replacing analog phones with digital ones. Architectural innovations leave the product concepts the same and reconfigure them in a new way that serves a different purpose from the original. It is not necessarily achieved only through products, as process or business model innovation may achieve similar impacts (Moore 2004). VoIP is an interesting example, using IP networks, which had been for data communication, for voice communication as well. From a user's perspective, it is both an architectural and a modular innovation, since the use of the phone basically did not change. However, examining its symptoms and impacts, as described by Christiensen (1997), Graeml and Neto (2007), indicated that it is a disruptive or radical innovation in the Telco equipment manufacturing industry.

Wheelright and Clark (1992) classified project types according to their products in manufacturing industries with similar definitions to Henderson and Clark (1990), but with a different framework, as shown in Figure 2.12. Derivative projects are small incremental modifications or enhancements on existing products. Breakthrough projects bring fundamental differences, the same as radical innovations. Platform projects are in the middle; they do not introduce new technologies, but combine existing ones in a way that result in significant improvements. They require not only engineering, but also marketing and manufacturing groups' involvement. This suggests Henderson's modular innovation, although not in exactly the same way, since Wheelright's scope included

only the manufacturing industries. R&D projects are considered to generate know-how or knowledge, not necessarily a product, and are separate from NPD.
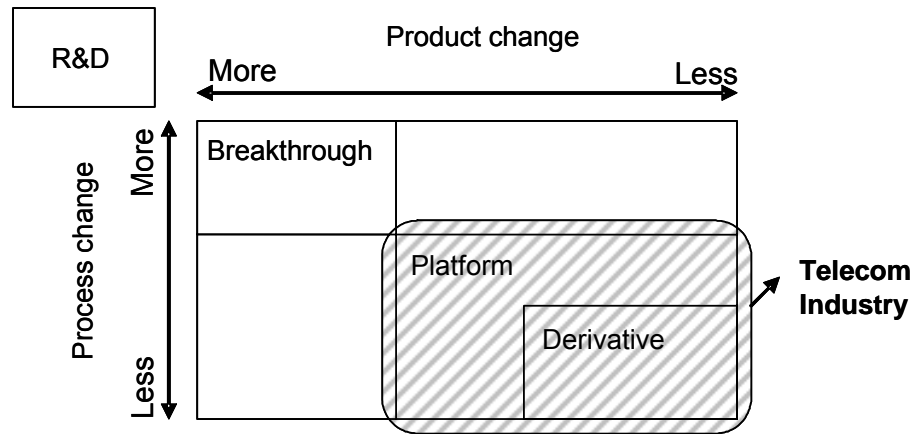
Figure 2.12. Development project types (Wheelright and Clark 1992:74)

Considering product and project characteristics, Telco projects resemble the characteristics of incremental innovation and derivative projects for product line extensions, and the architectural innovation and platform projects for developing new base products and deploying new systems. For an incremental product modification, the base product is already well known and staff are experienced with it. The change is less (Kessler and Chakrabarti 1996; Gerwin and Moffat 2002) and it requires tighter control of schedule and cost, which are known to a greater accuracy. Administrative skills to perform this activity and managerial skills to execute the project plan suffice. New base products and systems in Telco require more product and process changes compared with incremental product modifications, and take longer.

A Telco product itself is a service from end-to-end, and innovation is not limited only to products. Connecting equipment via network links to create the capacity to send information is not an end, indeed, it is a beginning. Processes play a critical role in delivering a communication service and maintaining it without disruption over its life cycle. A system consisting of equipment and links that are not backed up with well designed processes may result in customer dissatisfaction and ultimately loss of market share. If it takes months to activate or a fault is not fixed in a few hours, a Telco

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company must review these processes to remain competitive. Even if a Telco company does not change any product; changes in supporting systems and their processes or business models innovatively to provide services quicker and reduce down time to zero create a big advantage over competitors.

Product innovation and uncertainty go hand-in-hand (Shenhar et al.1995). Uncertainty and the unknown cause fear and discomfort (Thamhain 2004c). Creative solutions require people to confront them and challenge their comfort zones. This is exhibited when people feel free from limitations, motivated and valued (Cleland 1995; Bonner et al. 2002; Thamhain 2003). Telco NPD projects' distinguishing characteristic, deploying a well proven technology with business processes (ordering, activation and maintenance), requires integrating business processes and technology creatively for effective solutions. Therefore, their project managers should have leadership skills to engage team members and other stakeholders to create an environment where creativity is encouraged, or at least not suppressed.

NPD projects on new base products or systems in Telco are generally capital-intensive. Experimentation to prove whether a new technological concept works (Thomke 2003) is out of the question. Projects need to be planned, risks are managed and the right controls and tools are in place to track the project progress and to evaluate its impact in a bigger picture of PPM. Technical skills are required to understand the tasks, and therefore to produce effective plans. Consequently, the project manager in Telco should also have managerial, administrative and technical skills.

Comparing the skill sets in terms of innovations in Telco NPD projects, a precise conclusion cannot be drawn that one skill set is more important than another, in contrast to R&D or routine projects. The project characteristics in terms of innovation – experimentation versus well proven; make work versus prevent fail; many unknowns of a new technology versus some unknowns to integrate an existing new technology; test environment versus big capital infrastructure – make the difference. For new base products and systems, technical, managerial and administrative skills are as important as leadership skills. Technical skills are not necessarily detail-oriented. On the other hand, leadership and technical skills do not need to be strong for product line extensions.

7.3 Technology, product innovation and market

Balachandra and Friar (1997) examined product innovation (incremental vs. radical), market (existing vs. new) and technology (low vs. high), and produced a three-dimensional framework to classify projects, shown in Figure 2.13. He used innovation to involve products only, as clarified in the figure. The term 'technology' is used to define 'the level of new knowledge, systems, processes, and practices required in a new product'.

Product line extensions in Telco are close to low, and new base products and new system deployment are close to the high technology end, since there are several unknowns influencing how to develop and deploy them. Telco companies cannot risk their services by using unproven products. Although a radical innovation, such as a technical invention, may target the Telco industry, it is never used until it is improved significantly to be very reliable. These improvements over time change innovation characteristics from radical to incremental. Market is already well known to meet customers' needs for their data and voice communication needs. When combining all three dimensions, Telco occupies the space indicated with a grey-coloured cube in Figure 2.13.
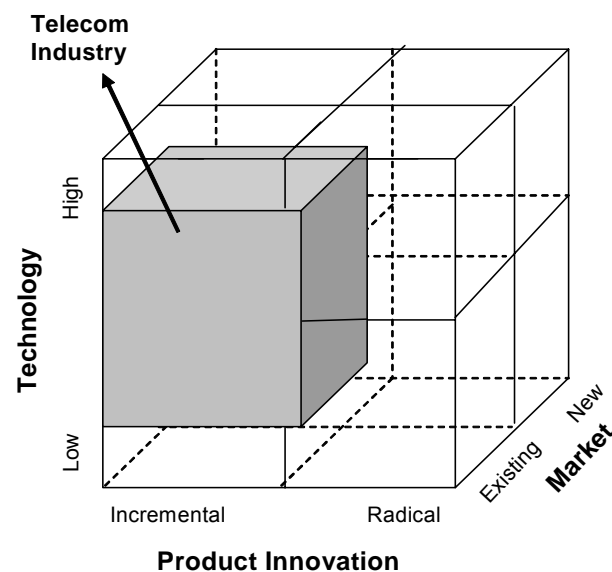
Figure 2.13. The contingency cube for NPD and R&D projects (Balanchandra and Friar 1997:284)

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The subject of Balachandra and Friar's (1997) work was to evaluate project success factors. One of the interesting findings is that R&D projects' significant success factors are external market conditions, whereas NPD projects are internal to a company. R&D projects produce new technologies, and it is unknown whether they will be accepted in the market. On the other hand, in NPD projects employed technologies are developed to an advanced stage, tested and known to work. Their market and customers are well known. Consequently, the emphasis is on internal activities, i.e. organisational factors, of which project management is one.

The framework presented in Figure 2.13 can be further simplified by excluding the market and product innovation dimensions. The Telco industry's existing market is not likely to change in the foreseeable future. Radical product innovations, as in R&D, do not happen and they are not put into practice until they are well proven. It leaves us a single-dimensional framework with two extremes: low and high technology. Counting product line extensions, i.e. adding new features to a base product, as low technology, and developing new base products and deploying new systems as high technology, corresponds to derivative and platform project types, respectively, in Figure 2.12 (discussed in Section 7.2). Consequently, the same arguments hold for project manager skill sets; technical, leadership, managerial, and administrative skills are equally important for an NPD project manager in Telco, with less emphasis on leadership and technical skills for product line extensions.

7.4   Product complexity and technology

Project managers in different industries may have found that NPD theories are too general and they do not explain their circumstances well. Shenhar et al. (1995), Shenhar and Dvir (1996) and Shenhar (2001), in an effort to clarify product and project characteristics, have reviewed the literature and proposed a two-dimensional model that combines system complexity and technical uncertainty (which they call innovation) dimensions on vertical and horizontal axes, respectively. Innovation is now interpreted differently from what they suggested; it is an improvement that creates competitive advantage and may not necessarily be only product related, or involve technology (Andrew and Sirkin 2003; Moore 2004). This study consistently uses the term

'technology' to describe level of new knowledge, systems, processes and practices that remove complexities, unknowns and uncertainties, and ultimately realise a new product. It is already a widely accepted concept, and people commonly speak of low or high technology with the same meaning Shenhar gave to 'innovation'.

Shenhar's two-dimensional model is presented in Figure 2.14, and related definitions on scaling on axes are given as the first rows of tables 2.4 and 2.5 below. He empirically tested and proved his model over a variety of engineering projects from Israeli companies in military and commercial markets. He first provided analysis for products (Shenhar et al. 1995) and for projects a year later (Shenhar and Dvir 1996). The studies were closely related and are combined to give a better view in tables 2.4 and 2.5.

	Low-Tech	Medium-Tech	High-Tech	Super High-Tech
Technology	No new technology.	Some new technology.	Integrating new, but existing technologies.	Key technologies do not exist at project's initiation.
Typical industries	Construction, production, utilities, public works.	Mechanical, electrical, chemical, aerospace, some electronics.	High-tech and technology-based industries; e.g. computers, aerospace, electronics.	Advanced high-tech and leading industries, electronics, aerospace, computer.
Type of products	Buildings, roads, bridges, utility, build to print.	Additional non-revolutionary models. Derivatives or improvements of a product.	New military system; new, first of its kind family of products, within state-of-the-art.	New, non-proven concept, beyond existing state-of-the-art.
Development and testing	No development, no testing.	Limited development, some testing.	Considerable development and testing. Prototypes usually used during development process.	Must develop key technologies together with product. Usually develop an intermediate prototype to test concept and new technologies.
Design cycles and design freeze	Only one cycle. Design freeze prior to project's execution phase.	One to two cycles. Early design freeze, no later than first quarter of execution phase.	At least two cycles. Design freeze usually during first and second quarter.	Two to four cycles. Late design freeze, usually during second or third quarter.
Communication and interaction	Mostly formal communication at predetermined low rate meetings.	Increased frequency of communication, some information increase.	High levels of communication through multiple channels; informal interaction is common.	Extensive number of channels; management facilitates informal interaction.
Project manager and type of workers	Manager has good administrative skills. Mostly semi-skilled workers; a few academics.	Manager must possess technical skills. About half of the workers are academicians.	Good technical skills of manager. Many professionals and academicians on the project.	Project manager is an exceptional technical leader. Highly skilled professionals and a high rate of academicians.
Management style and attitude	Firm style. Management sticks to the initial plan.	Moderately firm style. Ready to accept some changes.	Moderately flexible style. Expecting many changes.	Highly flexible style. Living with continuous change and 'looking for trouble'.
Customer's and user's expectations	Standard product, useful and efficient.	Regular product, built to needs and requirements.	New kind of product. Considerable improvement of effectiveness.	Quantum leap in user's effectiveness.
Product benefits and expectations	Reasonable profit, maintain good reputation.	Good profit, adding more products to existing lines, maintain market share, gain additional experience and reputation.	Higher profits, increase competitive advantage, create new opportunities, new product line, increase market share, additional prestige.	Establish and gain leadership, establish industry standards, acquire expertise in advanced technologies, gain extensive prestige.

Table 2.4. Project/product technology characteristics (Shenhar et al. 1995:185; Shenhar and Dvir 1996:615)

	Assembly	System	Array
Definition	A collection of components and modules into one unit; and performs a single function of a limited scale.	A complex collection of many units and assemblies that is capable of performing an independent function to a large scale.	A large widespread collection or network of systems functioning together to achieve a common purpose.
Operational aspects	A subsystem, serving a larger system; or an independent small-scale product. Limited interaction of man in its operation.	Serving well-defined need or an operational mission. Extensive interaction of man-machine during operation.	Serving a wide-range mission that is achieved by the conglomeration of the various systems. Involving the interaction of many people in its operations.
Customers and Users	Consumers.	All types: consumers, industrial, public, governments or military.	Public organisations, cities, governments or military.
Project organisation	Performed within one organisation, usually under a single functional group. Almost no staff in project organisation.	A main contractor – a project management team and a matrix or project form. Many internal and external subcontractors. Technical and administrative staff.	An umbrella organisation – usually a program office to coordinate independent subprojects. Many staff experts – administrative, financial, legal, etc.
Planning	Simple tools, often manual. Rarely more than a 100 activities in network.	Complex planning; advanced computerised tools and software planning packages. Hundreds or thousands of activities.	A central 'master plan', followed by detailed planning at various levels. Up to tens of thousands activities.
Typical Products	An electronic system's power supply; a signal processing unit; a battery.	A complete building; radar; an aircraft.	A city's highway system; an air fleet; a communication network for a large geographical area.
Control and reports	Simple, in-house control, Reporting to management or major contractor.	Tight and formal control on technical, financial and schedule matters. Reviews with customer or top management.	'Master' or central control; separate additional control mechanisms; many reports and meetings with contractors.
Documents	Simple, mostly technical documents.	Many formal documents – technical and managerial.	Mostly managerial documents at program management office. Technical documents at lower levels.
Management style, attitude and concern	Mostly informal style; family like atmosphere.	Formal and bureaucratic style. Some informal relationships with subcontractors and customers. Some political, inter-organisational aspects.	Formal and tight bureaucracy. High awareness to political, environmental and social issues.
Typical functions and operating aspects	A subsystem, serving a larger system, or an independent small-scale product. Limited man machine interaction.	Serving well-define need or an operational mission. Extensive man–machine interaction during operation.	Serving a wide range mission that is achieved by the conglomeration of operation of the various systems. Involving the interaction of many people in its operation and use.

Table 2.5. Project/product size and complexity characteristics (Shenhar et al. 1995:186; Shenhar and Dvir 1996:618)

The Telco industry covers the shaded portion of the model as shown in Figure 2.14 and tables 2.4 and 2.5. Some descriptions in Shenhar's papers should be interpreted in line with the conditions at that time, and his analysis was oriented towards manufacturing. The Telco industry and its products have gone through a remarkable shift compared with a couple of decades ago. The majority of Telco companies did not then exist, and there was a heavy monopoly in most countries. By looking from an overall perspective, and excluding time dependent details, Shenhar's model helps us select project characteristics that have similarities with the Telco projects today. Although the products or era have changed, the skills required for projects of similar characteristics are unlikely to have changed significantly. An advanced technical knowledge at that time may be a norm today, or project management tools were much simpler, but underlying skills are expected to be the same.
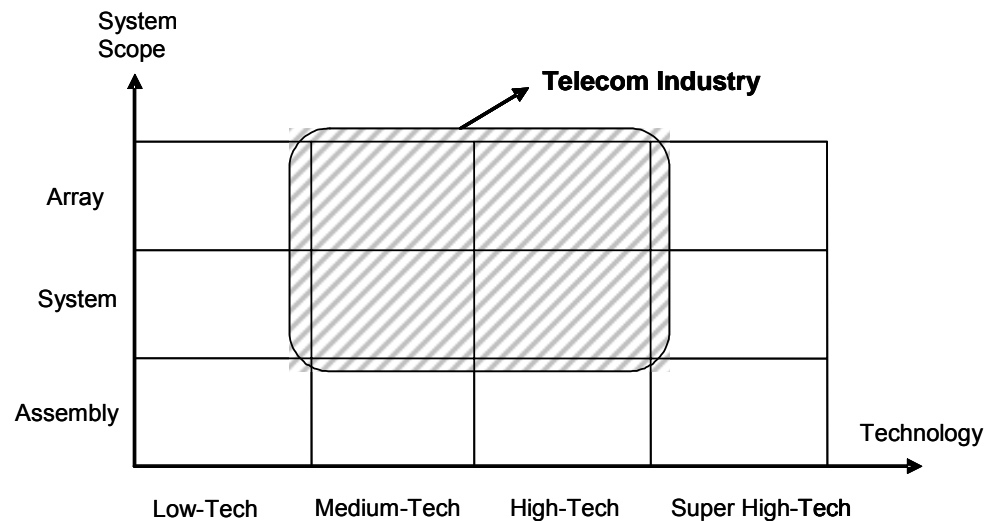
Figure 2.14. A two-dimensional topology of engineering projects (Shenhar and Dvir 1996:610)

As product complexity increases from assembly to array, the number of interfaces and interactions among functions to be designed and integrated grows geometrically or exponentially, thereby requiring effective processes to handle them (Griffin 1997a; Mihm et al. 2003). They show a clear increase in formality, procedures, control,

reporting and bureaucracy, as system complexity increases. They all correspond to administrative skills. Planning is a core activity that is covered under managerial skills. As the capital at risk increases, in proportion to size and complexity of a project, control and planning become more important (Shenhar 2001).

On the other hand, as technology level increases, communication follows a reverse trend: it is more informal and management style is flexible, tending towards less control. In super high-tech projects, the project manager is an exceptional technical person and a leader. Technical and leadership skills are essential (Shenhar 2001).

Examination of the relevant rows for project manager rows in tables 2.4 and 2.5 (planning, communication and interaction, project manager and type of workers, and management style and attitude) reveals that project managers in Telco should have all skill sets. They have good technical knowledge, but not to the level of a specialist in an area; they are moderately firm and flexible; have high levels of communication, both informal and formal; they should control the cost and schedule of projects, and report to a bigger system with company-standard tools and formal communication mechanisms; they should be aware of politics and cooperate with senior management; and they should be an expert in planning. This shows that technical, leadership, managerial and administrative skills are all essential. In contrast to the emphasis on leadership skills in the literature, Shenhar's results show that the managerial and administrative skills are at least equally important. Technical skills are required, but not at a low level as reported by El-Sabaa (2001) and Belassi and Tukel (1996). Shenhar implies the need to understand the issues that projects involve, and to have a holistic view on how project tasks relate and fit together.

The need for communication with external contractors and senior management, and how to handle politics, readily signify the importance of leadership skills. The requirement to be both firm and flexible indicates that project managers should use skills depending on the circumstances, matching the descriptions for managerial and leadership skills in this study. If uncertainties and complexities are more evident in a project, creativity is required to overcome them. Then, project managers prefer leadership skills, since command and control do not work, and even impact negatively. If uncertainty is less and nothing is unknown, they reinforce the project plan, and use positional powers. This

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clearly indicates that project managers' fundamental role has not changed; it is to get the job done.

8   Outcomes of literature review

Project managers are important for project management success. What makes them successful has been investigated in several studies. This research study considers the possession of certain skill sets to judge the quality of a project manager. A skill set is a group of closely related skills, which can be mastered through education, training and experience. The first outcome of the extensive literature review is the theoretical proposition of a new organising framework with four most distinctive and mutually exclusive skill sets; a pictorial representation is presented in Figure 2.15 below.

> **Outcome 1:**   *There are four project manager skill sets: technical, leadership, managerial and administrative. Briefly, technical skills to understand the technologies on which NPD projects are based; leadership skills to influence stakeholders to act in favour of a project by will; managerial skills to produce and execute project plans; and administrative skills to use a company's organisational structures, culture, processes and tools to achieve a project's goals.*

The skill sets of Telco NPD project managers have been examined with respect to several dimensions and triangulated literature findings for different project characteristic classifications: project strategies; innovation; technology, product innovation and market; and product complexity and technology. Each gives different aspects of Telco NPD projects and associated project manager skills.
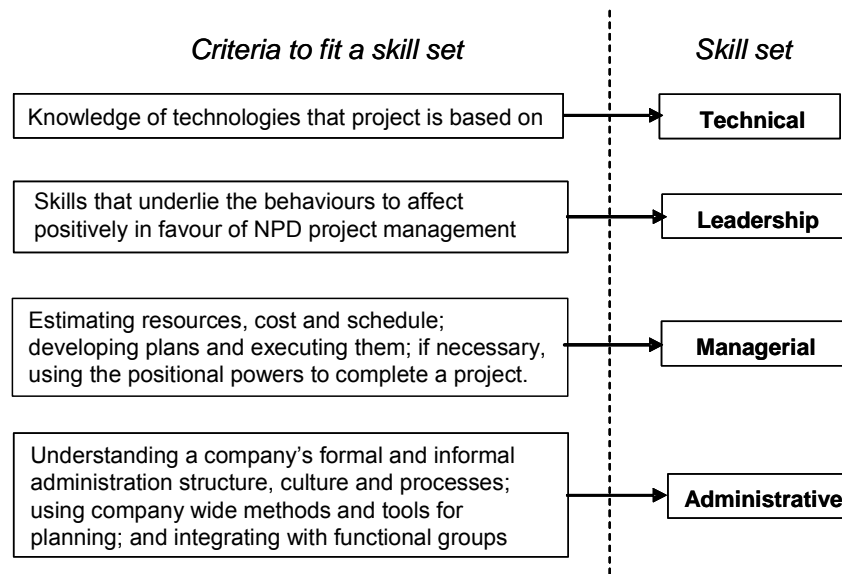
Figure 2.15. Project manager skill set framework

Project strategies are helpful in understanding the impact that NPD project success factors can have on project managers. The success measures are mainly in quantitative terms. For instance, customer acceptance and satisfaction are proportional to market share and demand for a product. Project managers can contribute to them by developing and executing plans that deliver a new product in the shortest possible time with minimum cost and required quality, which highlights managerial, technical and administrative skills sets. With common sense, if a new product involves technological unknowns, they are closer to R&D projects and, therefore, leadership skills are also expected.

New base products and systems require innovative approaches to deploy high technologies in practice. Connecting equipment and network links together does not suffice; incorporated creative processes are also essential to deliver and maintain a Telco product over its life cycle. Therefore, a project manager should build an environment that encourages creativity to find effective and efficient ways for integrating business processes and technology, implying the need for leadership skills. Since Telco projects are capital intensive, technical, managerial and administrative skills are also required. For product line extensions, the innovativeness is relatively less, and consequently less emphasis is placed on leadership and technical skills.

Telco projects involve medium to high-technology products with complexities ranging from system to array that consists of sub-systems. When a project approaches the high technology extreme and array in terms of size and complexity, project managers need to exhibit all four skill sets: technical, leadership, managerial and administrative. If a project has mid-tech and system complexity, the management style tends to be more control oriented.

In general, NPD projects in Telco aim to deploy well proven technologies in new systems and or base products, and to add new features and functions. The theoretical indirect relations between these project characteristics and the skill sets imply the following theoretical conclusions. Therefore, the second outcome is obvious:

> **Outcome 2:** *An NPD project manager in Telco should have all the skill sets: technical, leadership, managerial and administrative skills.*

There are cases where one skill set may have more impact than others, and they are briefly outlined below. However, it should be noted that the most important skill for a specific circumstance alone does not imply successful project management at the end. Considering the benefits of full-time project team members, including the project manager, it is best to have the same project manager throughout all phases of a project. Therefore all skills are necessary, even though they may be used to different extents in each phase.

Technical skills:

There is distinct differentiation between NPD and R&D (or super high-tech) projects. The former is for users external to a company, and the latter is to develop technology, know-how or knowledge, which may be used in future NPD. It has been noted that as technology employed in an NPD project approaches the high-tech extreme towards R&D projects:

> **Outcome 3:** *Technical skills of an NPD project manager in Telco are important, if involved technology is new and not widely used yet.*

Technical skills are required mainly to understand the project issues and how tasks fit together, and to produce meaningful effective plans. As complexity increases in a project, more technical knowledge is required, but it need not be detailed. Project managers with detailed knowledge at an expertise level may have a tendency to divert their attention from project to tasks, and may get caught in action and lose overall sight of the project. Therefore:

> **Outcome 4:** *Technical skills of an NPD project manager in Telco are not required to be detail oriented; however, they need to be at a high level and sufficient to understand involved technologies and project issues.*

The requirements in different project phases may play a role in where to use technical skills. The first two phases, Initial Investigation (II) and Feasibility and Definition (F&D), require a project manager to ensure that the right product and requirements are addressed. The third phase, Development, Implementation and Validation (DIV), requires technical knowledge to understand project issues and to track project progress correctly:

> **Outcome 5:** *Technical skills are critical in II, F&D, and DIV phases.*

Leadership skills:

The uncertainties and unknowns in an NPD project play a critical role, in which management style and related skills are used. Developing new base products and deploying new systems are challenging, as they involve high technology:

> **Outcome 6:** *An NPD project manager in Telco uses leadership skills more for new technology projects that require handling more uncertainties, unknowns and risks, compared with product line extension projects.*

Managerial skills:

As uncertainties are reduced in a project, in other words, what is to be done is known to a greater extent, project managers should focus on getting the tasks done on time:

> **Outcome 7:** *Managerial skills of an NPD project manager in Telco are more dominant in product line extension projects.*

However, it should not be misinterpreted that managerial skills are not important for other projects; producing and executing plans are always essential regardless of the project complexity.

The managerial skills are needed more in the project phases that are associated with developing plans first and then their execution:

> **Outcome 8:** *Managerial skills are more essential in the F&D, and DIV phases than in the II.*

Administrative skills:

Telco companies are usually big organisations, since the increased competition due to deregulations and consolidations in the industry has now left only a few major players. They employ company-wide project management tools and systems, policies and procedures. They are useful to control the progress of product line extensions for their timely deliveries. However, the bigger the project size, the higher the cost, and they are used more extensively. Project managers should also understand the formal and informal organisational structure and culture to resolve issues quickly. Consequently:

> **Outcome 9:** *An NPD project manager should have better administrative skills for high technology projects that develop new base products and deploy new systems.*

Required resources are communicated to senior management during the planning phase of a project through company processes and relevant tools. Most of the resources are used during project execution, and issues must be resolved more urgently so as not to impact on the project schedule. Therefore, a project manager needs administrative skills

to get issues resolved quickly and to use project support systems and tools for planning and reporting:

Outcome 10:   *Administrative skills are more essential in the F&D and DIV phases than in the II phase.*

This section has briefly highlighted the outcomes from an extensive literature. These outcomes will be used as check points for comparison with the empirical investigation results discussed later. It should be noted that, although the researcher intends to check the validity of these findings, he is not biased towards these results in the field study. The skill set framework in Figure 2.15 only constitutes a high level starting point in the empirical research, to indicate what to look for, and to detect any contradictory evidence. This approach aligns well with the research methodology that aims to explore better explanations and closer insight to Telco NPD project and their project managers.

RESEARCH METHODOLOGY

1   Introduction

The literature review in the previous chapter provided an overview of project manager skill sets in Telco New Product Development (NPD) projects. However, only by examining the empirical evidence can one get an indication of what is really happening in the workplace. This chapter addresses the methodology used in this research study to produce such evidence.

First, the chapter briefly describes how the particular methodology was selected. It discusses the research paradigm adopted to address the research purpose, the associated assumptions and implications for the usable methods. The methodology and the research design are then presented, with an outline of the enhancements used to achieve the research goals. The practical issues associated with data collection and analysis, and the reporting and storage of data and artefacts, are explained. These procedures are essential for facilitating sound research and for presenting a robust chain of evidence to support the various arguments. Finally, the chapter discusses the quality of the research, its limitations and delimitations, and the ethical considerations of the research.

2   Methodology selection

Collis and Hussey (2003) recommend that a researcher examines his or her research question, available data sources and research paradigm, before deciding the appropriate methodology (i.e. overall approach to research process) to implement the research. In this case, the researcher started with the question "What is the best approach to explain and explore project manager skill sets in Telco NPD projects?", and only later addressed the assumptions required to align with a specific research paradigm and its limitations.

Otherwise, focus of the research process could easily have been shifted by modifying the research question to align more conveniently with a particular paradigm. For this study, a broad methodology was outlined, then a suitable research paradigm was sought, followed by choosing the most appropriate data types. The assumptions were subsequently reviewed without significant changes, making the overall research process consistent from beginning to end. It became apparent that methodology and research paradigm selections are indeed intertwined, and are not discrete steps in designing a research project.

Management research studies can be divided mainly into qualitative and quantitative approaches, which Collis and Hussey (2003) call phenomenological and positivistic research paradigms, respectively; see Table 3.1 for the alternative terms used in the literature. The main features of the two paradigms are presented in Table 3.2.

Positivistic paradigm	Phenomenological paradigm
Quantitative	Qualitative
Objectivist	Subjectivist
Scientific	Humanistic
Experimentalist	Interpretivist
Traditionalist	

Table 3.1. Alternative terms for the main research paradigms (Collis and Hussey 2003:47)

The phenomenological paradigm is more subjective and focuses on reflecting perceptions of actors to increase our understanding of human activities. In contrast, the positivist paradigm basically involves converting research questions into hypotheses, developing quantifiable measurements, and using statistical methods to test these hypotheses over larger samples. Researchers do not necessarily base their work exclusively on only one of these; their paradigms can be a combination of the two:

> *"the positivistic and phenomenological paradigms are two extremes and very few people would operate within their pure forms. There are a number*

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of alternative classifications and alternative paradigms, most of which underline the fact that there are not paradigms but a whole range." (Collis and Hussey 2003:51)

Positivistic paradigm	Phenomenological paradigm
Tends to produce quantitative data	Tends to produce qualitative data
Uses large samples	Uses small samples
Concerned with hypothesis testing	Concerned with generating theories
Data is highly specific and precise	Data is rich and subjective
The location is artificial	The location is natural
Reliability is high	Reliability is low
Validity is low	Validity is high
Generalises from sample to population	Generalises from one setting to another

Table 3.2. Features of the two main paradigms (Collis and Hussey 2003:55)

Most of the traditional NPD studies aim to produce generalisable theories by adopting a positivistic paradigm. The usual trend has been to analyse the literature or company documents (reports, reviews, etc.), produce a number of hypotheses, and finally accept or reject them with statistical analysis of questionnaire responses from a survey (Cooper and Kleinschmidt 1987a; Griffin 1997a; Song and Parry 1997d). Interviews are used mainly to help design a questionnaire (Yap and Souder 1994; Shenhar and Dvir 1996). Consequently, these researchers may have missed rich and context-dependent information. This approach may be a reflection of the heavy involvement of NPD in engineering, the world of numbers, algorithms and procedures. In the last decade, more studies (Engwall 2003; Thamhain 2004c) have also involved qualitative research components, or more recently, employed phenomenological paradigm (Helm and Remington 2005; Cicmil 2006); however, the positivistic paradigm is still dominant.

For this study, rather than initially choosing a methodology and framing the research question accordingly, the researcher was more concerned with gaining a deeper understanding of the skill sets of Telco NPD project managers. Since the current knowledge of this topic does not extend beyond deductions from a literature review, he adopted a phenomenological paradigm. In line with NPD tradition, the methodology was also selected so the results could be generalised. This research, therefore, differs

from other studies (Helm and Remington 2005; Cicmil 2006) that can placed closer to the phenomenological extreme.

The most appropriate methodologies for the particular research purposes are field research and case study. Field research studies include any study where researchers are involved with research subjects and investigate them in their natural settings. Ferreira and Merchant (1992:4) summarised the characteristics of field research:

- The researcher has direct and in-depth contact with actors, particularly in interviews and observations, to provide a primary source of data.

- Studies happen in the real work environment, not one artificially created as for experimental purposes or laboratory environment.

- Research design is not structured with concrete terms, and it evolves in time.

- The presentation of data has rich descriptions of contexts and practices.

Ferreira and Merchant (1992) limited the possible methods of collecting data and excluded questionnaire surveys as a primary method. Case studies are usually considered under the phenomenological paradigm, but the methods are not distinguished as qualitative or quantitative, as long as they contribute to uncover a research question (Eisenhardt 1989; Yin 2003a). Indeed, field research and case studies do not have clearly distinguishable boundaries (Yin 2003a). Their data collection, data analysis and presentation methods are similar to other qualitative methodologies, such as grounded theory (Glaser and Strauss 1967, Helm and Remington 2005), ethnography (Lincoln and Guba 1985) and hermeneutics (Cicmil 2006). The differences lie in ontological, epistemological and axiological assumptions (Collis and Hussey 2003), and these are open to interpretation. For example, Brun and Saetre (2007) and Pedrosa et al. (2007) collected data for a small number of sample projects, using grounded theory coding techniques to develop theories, but still described their methodologies as case studies.

Despite the significant overlap between the field research and case study methodologies, they differ with respect to their main aims in a research study. Field research motivations are grouped as description, theory building and hypothesis testing (Ferreira and Merchant 1992). Case study also has descriptive, exploratory and

explanatory types (Yin 2003a), but it differs in having the ultimate goal of producing generalisable results (Schofield 2000; Yin 2003a). Simply calling a sample of one a 'case study' and a sample of more than one 'field research' is incorrect and misleading (Ferreira and Merchant 1992). Field research is more interested in "rich descriptions of settings in practice to allow the reader of the research report to consider alternative explanations of the findings" (Ferreira and Merchant 1992:5); consequently "field research sample sizes are typically relatively small, but they should not be used as a distinguishing feature of field research, because sample sizes are not a primary concern of the field researcher" (Ferreira and Merchant 1992:5). Case study recognises the value of single settings under certain circumstances. For example: a critical case can test the boundary of existing theories; an extreme case can be useful if it is very rare; or a typical case is useful if the selected sample is proven to be an average one. Yin (2003a:42) warns that "a potential vulnerability is that a case may later turn out not to be the case it was thought to be at the outset", and relates it to "putting all your eggs in one basket" (Yin 2003a:53). As this research study aimed to produce generalisable conclusions about Telco NPD project manager skill sets, the researcher consequently chose a case study methodology.

Several resources are available for research design (Denzin and Lincoln 1994; Glesne 1999; Flick 2002). Since research methodologies employ similar methods, this case study research adopted the guidelines from the authorities Creswell (1998), Collis and Hussey (2003), and especially Yin (2003a, b). In addition to influencing the choice of case study methodology, the researcher's assumptions also influenced how the methodology was implemented. The following sections present these assumptions associated with the research paradigm, examine the case study methodology in more detail, and address the implementation issues.

3 Assumptions

A paradigm (or philosophy) reflects basic beliefs and assumptions about the world, and sets some rules about how to conduct a research project. Although a methodology has been decided, the underlying assumptions of the research paradigm have implications

on methods and techniques used in the research (Collis and Hussey 2003). This section discusses five such assumptions.

3.1 Ontological assumption

Ontological assumptions indicate how a researcher sees the world and accepts how reality occurs. A researcher can make assumptions along the positivistic–phenomenological continuum which consequently shape his or her research paradigm:

> *"...two paradigms are near the extremities of the continuum; each methodology can be moved some way along the continuum according to the individual researcher's assumptions." (Collis and Hussey 2003:61)*

Management research usually differs from pure social sciences by its tendency to quantify and measure things. In Chapter 2, Section 5, it was noted that skills are defined, classified and divided into parts to train and enhance project managers (Thornbery 1987). By treating skills in measurable terms, as in accounting and economics, research is more likely to take a quantitative approach. However, skills are exhibited through behaviour, language, social relationships and actions. Especially for soft skills such as leadership skills, judging their possession and how well they are utilised depends on the observer's world view. Furthermore, different project managers may prefer different actions and behaviours that require different skills, even under the same conditions. To understand these differences and commonalities and to generalise outcomes, the researcher should not be influenced by either positivistic or phenomenological extremes when selecting the methodology. Ideally, his or her approach would be somewhere in between, but more on the phenomenological side, shown as shaded in Figure 3.1. This agrees with Creswell's (1998:87) view of a case study: "I position case studies at the midpoint of the continuum". The exact position of a case study on the continuum is irrelevant here – the judgment may be subjective; for a qualitative researcher, it may be far away from the phenomenological end, but for a quantitative one it is definitely not on the positivist side at all. The position on the continuum simply indicates where the researcher stands with his assumptions.
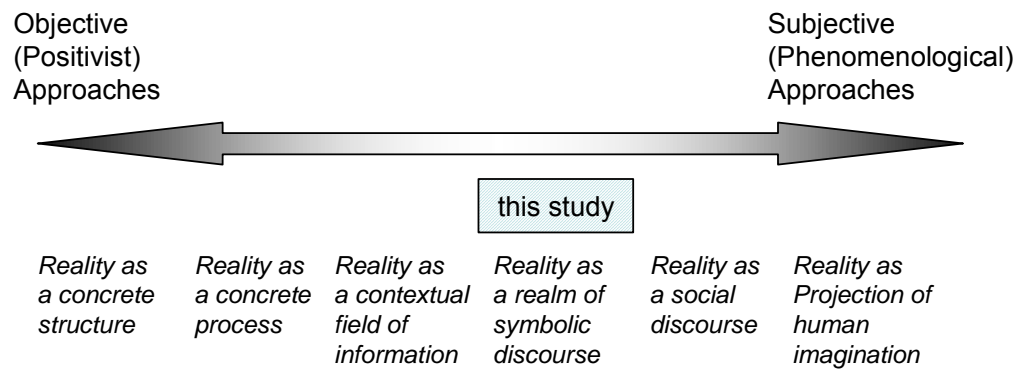
Figure 3.1.   Continuum of core ontological assumptions (Morgan and Smircich 1980:492)

The characteristics of the "reality as a realm of symbolic discourse" assumption are outlined by Morgan and Smircich (1980:494):

- The social world is a pattern of symbolic relationships, and it is sustained through the process of human action and interaction, through which the pattern may change in time.

- The subjective meanings are embedded in rule-like actions. Reality is not in the rule or rule-following, but in the system of meaningful action, which reveals itself as rule-like.

- Humans are social actors orienting actions meaningful to them. They impress by using language, labels and routines, and thereby enacting the reality.

Project tasks require certain rule-like activities (planning, controlling and managing) that may vary in different contexts, such as industries or organisations. This research takes a Telco industry NPD perspective and attempts to understand the skills of the project managers. Skills form language, labels and routines that reflect the reality. Their pattern (i.e. skill sets) may change over time, depending on demands, and it is captured at the time of the research. Consequently, the position of the ontological assumption in Figure 3.1 coincides well with this study.

3.2 Epistemological assumption

Epistemology addresses the relationship between the researcher and the researched. Positivists consider a phenomenon externally observable and measurable with quantitative and objective terms. They try to maintain an independent and distant stance throughout the research study. On the other hand, phenomenologists attempt to minimise the distance and try to see events and actions "through the eyes of participants" (Creswell 1998). Ontological assumptions also influence epistemological ones (Morgan and Smircich 1980). Therefore this research is positioned closer to the phenomenological approach, as shown in Figure 3.2. In other words, this study intends to understand the skill pattern of the Telco NPD project manager, which is exhibited through a symbolic discourse.

Objective (Positivist) Approaches					Subjective (Phenomenological) Approaches
			this study		
to construct A positivist science	to study systems, process, change	to map contexts	to understand patterns of symbolic discourse	to understand How social reality Is created	to obtain Insight, revelation
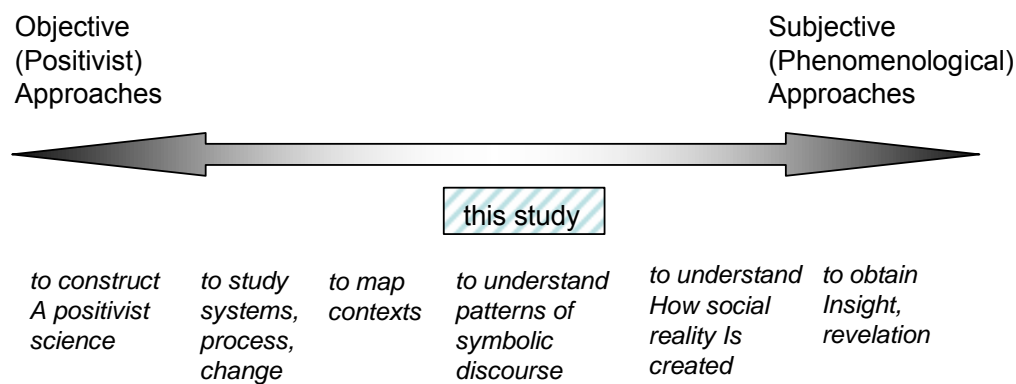
Figure 3.2. Basic epistemological stance (Morgan and Smircich 1980:492)

The most widely used data collection methods in phenomenological studies are observations and interviews (Ferreira and Merchant 1992; Creswell 1998; Yin 2003a). However, the impartiality and quality of observations can be affected by the particular role of the researcher. In this study, the researcher is a project manager in Telco NPD projects. As an active participant observer, there were ethical concerns for his disclosed research agenda. On the other hand, informed actors may change their actual behaviours in a desired way (Bailey 1992). As a passive observer, he may miss key events in another project that he is observing, but for which he is not responsible. In both cases, the volume of work may be such that it may take the researcher days to recall,

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investigate and record exactly what happened. Additionally, the specific project issues and the researcher's own world view are likely to bias his interpretations (Simon and Burstein 1985). This problem can be overcome by careful data collection and analysis. However, it is challenging to keep a constant focus and make unbiased observations during a project. At the extreme, a researcher may become emotionally and psychologically involved, and be unable to distinguish observer and participant roles (McKinnon 1988). More importantly, the number of projects that the researcher can observe simultaneously may be insufficient to draw generalisable results.

Interviews are the other widely used data collection method in field studies (Yin 2003a), but the influence of the observer is felt to a lesser degree. In an unstructured interview, a researcher can probe deeper, whereas in a natural setting, it is not possible to interrupt and question behaviours and their relation to project managers' skills. A researcher experienced in the field can ascertain whether participants' responses actually reflect reality. It is also much easier during an interview to not reveal one's own biases and opinions. Interviews can gather a larger number of participants' experiences and opinions, and produce reliable results for generalisability.

The epistemological assumption affected the data collection method in this study. The researcher concluded that he was too close to the action for participant observations; the analogy 'cannot see the wood for the trees' best explains the situation. Furthermore, as generalisation was one of the research goals, interviews were the ideal method. Data collection is discussed in more detail in Section 5.2.

3.3   Axiological assumption

Axiological assumptions indicate the values that researchers consider in their evaluations and analysis. Positivists accept that the research process is value-free, objective and scientific. They consider themselves, or force themselves to be, detached from the phenomenon under investigation. They are more interested in interrelations among studied objects, which are assumed not to be affected by the research process. This may be the case for natural sciences, like engineering, but is less convincing when examining the activities and behaviours of people. Phenomenologists have values, although they may not be mentioned explicitly in their studies. On the

phenomenological extreme, they recognise facts and interpretations, only if drawn through these values, and become totally subjective. Similar to the other assumptions above, there can be a range of positions, depending on the degree that a researcher is involved in the research (Collis and Hussey 2003).

The axiological position taken in this study is definitely not on the positivist side. However, it also aims to produce conclusions about how Telco NPD project managers use which skills. However, attempting not to emphasise anyone's values, and looking for a generalisation, does not put this study at the phenomenological extreme, either. The axiological assumption of this research is again somewhere in the middle, but tending towards the phenomenological side, as with the two previous assumptions. The researcher took care to ensure his values and biases did not compromise an objective assessment of the phenomenon.

3.4   Rhetorical assumption

Rhetorical assumptions determine the language of the research. Since a positivist paradigm is most often adopted, NPD project management literature usually uses a language to show an objective attitude and separate the researcher from the objects and actors under investigation. Because this study takes a phenomenological approach, language such as "the researcher …", "he …" highlights how the researcher makes specific decisions or interpretations. On the other hand, the researcher's involvement is not central, as in ethnography. Consequently, the study is reported using balanced language that refers to the existing NPD literature or to the researcher, as required.

3.5   Methodological assumption

Methodological assumptions lay the foundation of the overall approach for the research process. A selected methodology reflects all of the assumptions of the research paradigm (Collis and Hussey 2003). For a positivist, the concern is to operationalise the research in such a way that the variables are quantified, and theories are stated in hypotheses to be tested with larger populations using statistical methods. On the other

hand, a phenomenologist uses mostly qualitative data collection methods to understand different perceptions of a phenomenon, and to capture an occurring pattern.

The research question to 'explain and explore skill sets of NPD project managers in Telco' has mainly determined the methodology of this research: case study, focusing on Telco NPD projects and associated skills that are used to overcome their specific challenges. The rest of this chapter discusses the implications of these methodological assumptions.

4 Case study

A case study research methodology is ideal for the research purpose and assumptions. This section takes this subject further and explains the reasons behind this selection.

4.1 Research question

Case study is one of the widely used research strategies in social sciences, (e.g. psychology, sociology and political studies), management, and economics. It is known to be effective in capturing characteristics of real life events and understanding complex phenomena better. Yin (2003a:9) states that "case study has a distinct advantage when a 'how' or 'why' question is being asked about a contemporary set of events, over which the investigator has little or no control".

The research aim, to explain and explore skill sets of NPD project managers in Telco, explicitly attempts to find an answer to the questions '*why* these project managers use some skills, not others, and *how* they use them'. Investigating *why* indicates what project managers tend to use which skills, and investigating *how* shows the associated behaviours and actions that are exhibited under certain circumstances. Sharper and more insightful questions can be developed from a literature review (Cooper 1984). The extensive literature review presented in Chapter 2 served this purpose, and pointed to areas that require further attention.

4.2   Definition of a case study

A common short definition for a case study is "an extensive examination of an instance of a phenomenon of interest to understand its dynamics within a single setting" (Eisenhardt 1989; Cresswell 1998; Collis and Hussey 2003). Yin (2003a) has expanded this definition and also indicated the suitable conditions:

- It investigates a contemporary phenomenon within a particular real-life context, especially when the boundaries between phenomenon and context are not clearly evident.

- It copes with a distinctive situation in which there will be many more variables than data points.

- It relies on multiple sources of evidence, with data needing to converge in a triangulation fashion. Data can be both qualitative and quantitative.

- It benefits from the prior development of theoretical propositions to guide data collection and analysis. However, a researcher is not limited by the initial research propositions. This is a significant distinguishing point from other qualitative methods, such as grounded theory (Glaser and Strauss 1967) and ethnography (Lincoln and Guba 1985), which recommend a researcher goes to the field without any exposure to previous theories.

4.3   Research propositions

Eisenhardt (1989) suggests that theory-building research ideally begins as if there is no theory to consider, or hypothesis to test. On the other hand, she admits that starting with a blank page is almost impossible. Researchers should attempt not to impose any theoretical perspective or propositions during data collection and analysis, so as to prevent any bias and limitation. However, this does not prevent researchers from reviewing important variables in the literature. It can set some expectations about what to look for, and help them sense what is new.

In contrast, Yin (2003a) considers theory development as an essential part of the research design in a case study, regardless of the research purpose. However, the theory need not be proven valid beforehand; rather, it serves as a 'blueprint' for the study and provides some theoretical propositions about why the phenomenon under investigation occurs. Therefore, it can guide which data to collect, and which analysis strategies to use. Yin (2003a) also notes that theory development takes time and can be difficult. Existing studies can form a rich theoretical framework on which to design a case study.

Eisenhardt (1989) and Yin (2003a) have opposing opinions about the value of existing theories for a case study, but they both agree that an initial theoretical proposition or framework is beneficial (Eisenhardt 1989) or essential (Yin 2003a). The study has satisfied this requirement with an extensive literature review of skill sets of NPD project managers and it has derived some outcomes by examining the project characteristics in Telco. Together these constitute a starting point to be explained and explored further.

4.4   Type of case study

Types of case studies differ according to their purposes (Table 3.3). Types include exploratory, explanatory and descriptive (Yin (2003a, b), illustrative and experimental (Scapens 1990) and coincidental (Otley and Berry 1994). However, the boundaries among them are not always sharp (Yin 2003a); although a case study may be very clear in purpose, overlaps are possible to define its type.

Case study type	Purpose / Objective
Exploratory	Gaining knowledge in areas where there are few theories and deficient body of knowledge
Explanatory	Existing theory is used to understand and explain what is happening
Descriptive	Describing current practice
Illustrative	Attempting to illustrate new and possible innovative practices
Experimental	Examining the difficulties in implementing new procedures and techniques in an organisation and evaluating the benefits.
Coincidental	Seizing an opportunity to examine a phenomenon

Table 3.3. Types of case studies and their purposes

The main task in this research study was to understand why and how the Telco NPD project managers use certain skills. If a good fit occurs, they are explained with existing theories. If not, theories are amended, or new ones are proposed. The skill sets, and their relative importance presented in the literature review, were not accepted as complete until the research study was finalised. Consequently, explanatory and exploratory types in Table 3.3 best describe this case study.

5   Case study research design

Research design is defined as "the logic linking the data to be collected to the conclusions to be drawn" (Yin 2003a:19), or giving "a detailed plan which will guide and focus a research" (Collis and Hussey 2003:113). These two aspects of a research design align with the definition given by Nachmias and Nachmias (1992):

- a logic flowing from data to results

- a plan that guides this process, i.e. data collection and analysis.

Collis and Hussey (2003) presented an overview of research design by considering both phenomenological and positivistic paradigms and their methodologies (Figure 3.3). However, they also conceded some steps do not fit well with a qualitative approach. For example, 'developing theoretical framework' is a prerequisite for 'determining research questions', but they later state that "in a phenomenological study, a theoretical framework may be less important or less clear in its structure" (Collis and Hussey 2003:122). An exact definition of the research question may not be required in a phenomenological research, as it may be refined or modified during the research. Similarly, methodology selection comes towards the end of the design, but it is indeed the overall approach that should be considered in a research design. Consequently, their hierarchical model to produce a research design required modifications for this case study, which has assumptions that are more phenomenological.

Yin (2003a) presented another approach to case study research design, which aligns with the researcher's attempt to tailor steps in Figure 3.3 for a case study. This has five important components, not necessarily hierarchically related (Yin 2003a:21):

- a study's question(s)

- its propositions, if any

- its unit(s) of analysis

- the logic linking the data to the propositions

- the criteria for interpreting the findings.

These five components address the first aspect of the research design, i.e. logic from data to results (Nachmias and Nachmias 1992). The first two components have already been discussed above (sections 4.1 and 4.3). The other components are described in the following sections.

```
┌─────────────────────────────┐
│  Identify research problem  │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Determine purpose of research│
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Develop theoretical framework│
└─────────────────────────────┘
              │
              ▼
┌───────────────────────────────┐
│ Define research questions/hypothesis│
└───────────────────────────────┘
              │
              ▼
        ┌──────────────┐
        │ Define terms │
        └──────────────┘
              │
              ▼
    ┌─────────────────────────┐
    │ Identify limitations of study│
    └─────────────────────────┘
              │
              ▼
      ┌──────────────────────┐
      │ Decide methodology   │
      └──────────────────────┘
              │
              ▼
    ┌─────────────────────────────┐
    │ Determine expected outcomes │
    └─────────────────────────────┘
```
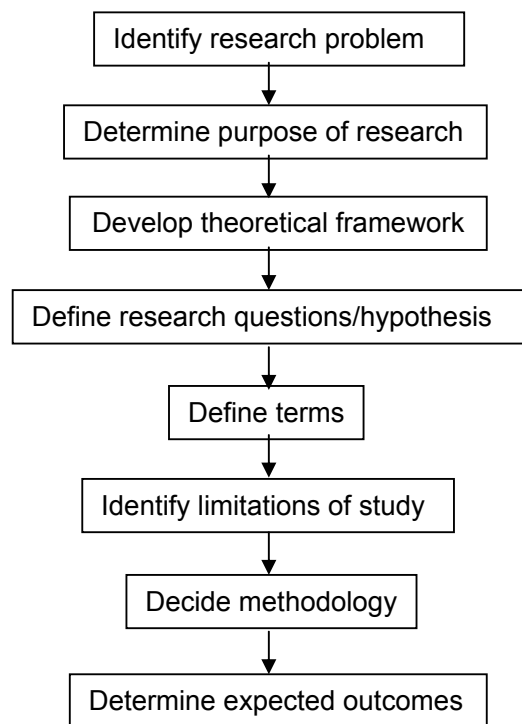
Figure 3.3.   Overview of research design for phenomenological and positivist research studies (Collis and Hussey 2003:114)

5.1 Generalisation from case(s) to theory

Although this study adopted a phenomenological paradigm, generalisability was still an important outcome, causing the adopted paradigm to shift towards the opposite positivistic end. In statistical generalisation, an inference is made from a sufficiently large number of samples, depending on the probabilistic confidence level: the bigger the sample size, the better the results. Yin (2003a) considers this approach a fatal flaw in case studies, because 'cases' are not 'sampling units'. Generalisation in a case study can be achieved only with a thorough analysis among cases. Yin compares a case study to an experiment. As a scientific theory is verified over multiple experiments, multiple cases can strengthen the claims from a proposed theory. On the other hand, he also emphasises that criteria to justify a sample size are not relevant; it varies depending on what is needed for the research.

> *"Even if you can only do a 'two-case' case study, your chances of doing a good case study will be better than using a single-case design. Single-case designs are vulnerable if only because you will have put 'all your eggs in one basket'. More important, the analytic benefits from having two (or more) cases may be substantial." (Yin 2003a:53)*

> *"When using a multiple-case design, a further question you will encounter has to do with the number of cases deemed necessary or sufficient for your study. However, because a sampling logic should not be used, the typical criteria regarding sample size also are irrelevant. Instead, you should think of this decision as a reflection of the number of case replications – both literal and theoretical – that you need or would like to have in your study." (Yin 2003a:51)*

On the other hand, Creswell (1998) does not recommend many case studies, for instance not more than four, since he claims that the idea of generalisability does not hold much meaning for many qualitative researchers.

The 'analytic' generalisation in a case study attempts to prove that the findings are applicable to another setting. A recommended way is to support the same theory by replicating a case study (Yin 2003a). Although more cases are preferable, a sampling logic as in a quantitative methodology is irrelevant; researchers should focus on reflections from replicated cases (Eisenhardt 1989). Even though their results may not agree totally, the empirical results are more potent to explain the studied phenomenon by focusing on differences and commonalities among cases. Yin (2003a) emphasises that two cases are always much better than one, and the evidence is more compelling:

"even with two cases, you have the possibility of direct replication. Analytic conclusions independently arising from two cases, as with two experiments, will be more powerful than those coming from a single (or single experiment) alone… the contexts of the two cases are likely to differ to some extent. If under these circumstances you can still arrive at common conclusions from both cases, they will have immeasurably expanded the external generalisability of your findings, again compared to those from a single case." (Yin 2003a:53)

For this research project, the researcher initially planned a single-case study of his company (single-case design), thus providing easy access for data collection. However, generalising, in order to align with the NPD literature, required a multi-case design, as shown in Figure 3.4. Schofield (2002) calls this approach 'multi-site studies'. If the results from the cases are similar, one can more confidently generalise the empirical results from the study to the whole country. It would be desirable to have a case study of each Telco company in Australia. But, considering the rivalry between Telco companies, and the fact that the researcher is employed in one of them, it was rather challenging to gain access to participants in other Telco companies. The attempts to cover the whole Telco industry resulted in five cases.
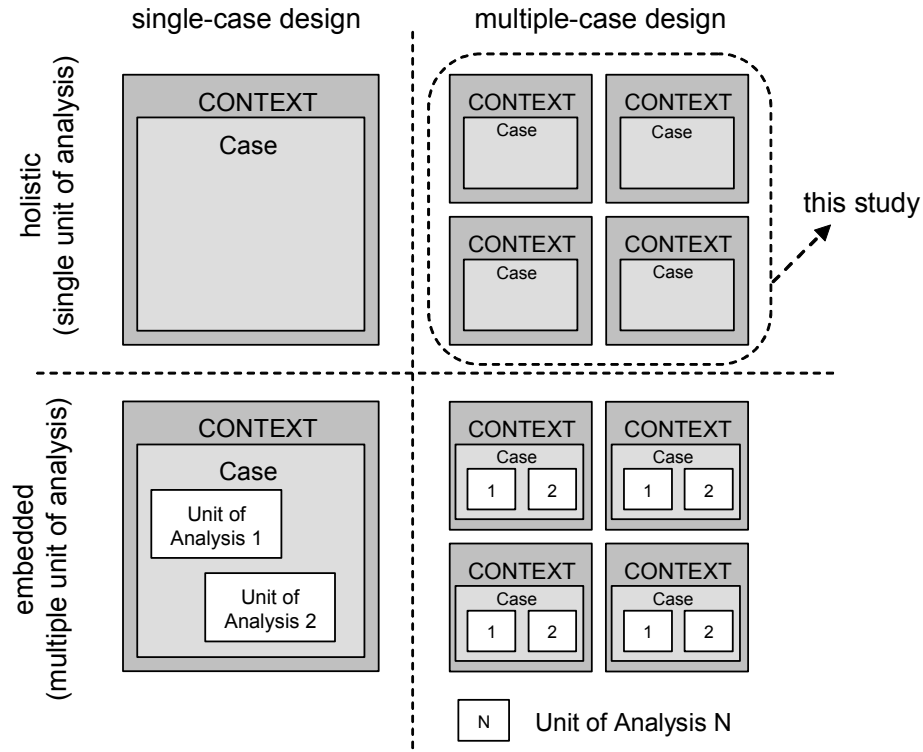
Figure 3.4. Types of designs for case studies (Yin 2003a:40)

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5.2   Selection of cases

A case refers to a particular real-life context, in which the phenomenon under investigation occurs. In this study, the phenomenon is the utilisation of project manager skills in Telco NPD projects, and a case corresponds to a setting where this occurs: an Australian Telco, a similar company, or its business unit that develops new Telco products.

Several participants commented that institutionalisation in the Australian Telco industry is very high, i.e. companies have very similar ways of doing things, and project manager professionals generally gain experience in one company, then move to another. However, there is no empirical proof to claim that any one case is representative and investigating it would produce generalisable results about Telco NPD project manager skill sets. If such a situation were to exist, investigating only one case would be most convenient to the researcher, as he has easy access to data sources in one company. In such a situation:

> *"The case study may represent a typical 'project among many different projects, a manufacturing firm believed to be typical of many other manufacturing firms in the same industry in a typical urban neighborhood, or a representative school, as examples. The lessons learned from these cases are assumed to be informative about the experiences of the average person or institution." (Yin 2003a:41).*

Since no previous research has indicated any one Australian Telco company that is representative or typical of the industry as a whole, this research aimed to use the maximum number of cases possible. Having multiple cases is essential for the success of a case study research:

> *"In general, criticisms about single-case studies usually reflect fears about the uniqueness or artificial condition surrounding the case (e.g. special access to a key informant). As a result, criticism may turn into skepticism about your ability to do empirical work beyond having done single-case study. Having two cases can begin to blunt such criticism and skepticism. Having more than two cases will produce an even stronger effect. In the case of these benefits, having at least two cases should be your goal." (Yin 2003a:54)*

The cases being studied should span across the whole population under investigation. The companies listed in Table 3.4 sufficiently cover the Australian Telco industry, with more than 90% of the market share and employment. Each Telco company or a business

unit corresponds to a single case. Case 5 is not a Telco service provider company, but is heavily involved in Telco NPD projects. It is included to provide diversity among the case studies, and to test the results at boundary conditions. Easy access to the company resulted in greater contribution from Case 1; however, strategies were developed to overcome this unbalance and increase the probability of stronger generalisations with the research design, the selection of participants and the data analysis. Such uneven representation is not uncommon in management research. For example, even a pure quantitative research study cannot guarantee that all responses share the same context to claim 100% generalisability. If the results from the cases are similar, the generalisation can be claimed with analytic replication in a case study. Furthermore, if their overlap is significant with no opposing evidence, it can also be claimed that Case 1 is a typical case to investigate the skill sets of Telco NPD project managers.

Case	Company	Short Description
Case 1	Company A	Large Telco company, a subsidiary of global Telco group
Case 2	Company B	Large Australian Telco company
Case 3	Company C	A Telco business group that was merged with Company A
Case 4	Company D	Large Telco company, a subsidiary of a global Telco group
Case 5	Company E	Australian branch of global Telco professional services supplier

Table 3.4. Short description of the companies in the cases

5.3   Data sources

A data collection method looks for an answer to the question 'What kind of data source can provide rich information about a unit of analysis?'. Yin (2003a) suggests observations, documentation, archival records, interviews, physical artefacts and interviews as possible data sources. The epistemological and axiological assumptions have raised concerns about the researcher's involvement as an observer in the investigation, discussed above in sections 3.2 and 3.3. As a project manager in Telco

NPD projects, the researcher considered active and passive participant observations unsuitable for this study.

Documentation or archival records mostly provide measurable data in quantitative terms about personnel, when and where a project was run, and the cost, size, risks and issues, but they do not necessarily present sufficient and accurate information (Collis and Hussey 2003). As an example, at the start of this project, the researcher investigated a limited number of formal data sources (meeting minutes, reports, etc.) in Company A. Full understanding of the available documents required interpretation from the relevant project managers and other project stakeholders, including explanation of behind-the-scene events in the projects. The records were very brief, and varied depending on who wrote them, as actors are tempted to deflect some issues for their possible hidden agendas. Internal politics generally appeared as technical issues; personality or group conflicts, and subjective and confidential issues were seldom recorded. Actors also have forgotten past events and their contexts; when questioned about the documents, they tend to make associations with current, closer or noteworthy projects for which documents are unavailable. Therefore, documentation and records were not used as data sources in this research study.

Querying actors' interpretation on the project documentation and company records changed the data source to interviewing, the most widely used method in case studies (Yin 2003a). Asking a simple question, "What were the challenges in your projects?" revealed much more information about the real issues in a project, and how the skills helped a project manager to resolve them. The researcher therefore focused on interviews as the main data source.

5.4   Participants – units of data collection

A Telco NPD project has various stakeholders: project managers, their managers, team members, program managers, senior managers, functional line managers, operational groups, etc. However, they may have different expectations due to their roles in a project. Participants who are not involved closely in managing projects – team, schedule, cost, scope, risks and issues – cannot see the challenges project managers face

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and what they do to overcome them. For example, a project manager usually filters information to the team members to let them focus on project work, and so team members tend to evaluate a project manager on technical knowledge only. Similarly, senior managers are mostly concerned with project costs and duration. Additionally, circumstances may force a project manager to balance project tasks in terms of priority, and postpone or cancel non-urgent and less value-adding ones. Therefore, few project stakeholders are likely to have an overall view of the project.

One of the difficulties in qualitative research is to find representatives with experience and knowledge of the phenomenon. For this study, only key stakeholders in project management were included as participants: project managers, their managers, senior managers, program managers and project sponsors. This approach aligns with previous studies that evaluated project managers from the perspective of senior management (Crawford 2005) or team members (Barzcak and Wilemon 2003b) only. The unit of data collection for this study was first degree stakeholders in managing projects, with team members and other second or higher degree stakeholders excluded (Flick 2002).

Selection of appropriate participants is a key to the success of a research project, with snowball and networking type samplings commonly used (Collis and Hussey 2003). For this study, the researcher either contacted candidates directly, or collected information indirectly through his professional network to gauge their potential suitability, before approaching them. The 23 participants were experienced Telco NPD project managers and other key stakeholders, all with at least five years' experience in Telco NPD and tertiary level education, and some had additional formal project management certifications. The profiles of the participants contributing to this research study are presented in Table A.1 in Appendix A.

Table 3.5 lists the number of participants, i.e. units of data collection, in each case study. Detailed information about the participants and their cases are given in Table A.2 in Appendix A. About half of the 23 participants had worked in more than one Telco company, and therefore they contributed to more than one case. Some participants had held more than one stakeholder position in Telco NPD and so were able to provide information from the perspective of multiple roles. Many potentially suitable participants were excluded from the study because of problems with confidentiality; several candidates showed initial interest in the research, but later either declined to

contribute or withdrew from the research. Because the researcher is a project manager in a Telco company, and the industry is very competitive, some potential participants might have felt reluctant to share inside information about their NPD projects in other companies.

Case	Number of Participants
Case 1	21
Case 2	9
Case 3	2
Case 4	1
Case 5	1

Table 3.5. Number of participants contributing to cases

5.5   Telco NPD projects – units of analysis

The unit of analysis is related to the entity that represents variables about which data is collected and analysed (Collis and Hussey 2003; Yin 2003a). It can be an individual, an event, an object, a relationship, a business unit or a group of people (Kervin 1992). Units of analysis may not be the same as units of data collection. A unit of data collection can provide data about many units of analysis, and so a small number of participants can generate a significant amount of data. Since this study aimed to establish causal relations from project specifics to project manager skills sets, 'a Telco NPD project' was the logical unit of analysis. This study analysed a number of projects (unit of analysis) and related their characteristics and life cycle phases (variables) to the skill sets of their project managers (phenomenon).

Table 3.6 gives the number of projects cited in each case study. Table 3.7 lists the numbers versus project costs, as an indication of project size. Further details of project characteristics are given in Table A.3 in Appendix A. Since the participants could not remember exact figures, the project cost (or budget for current projects), and project durations (actual for finished, and an estimate for projects in progress) were approximate, but sufficient for the investigation. The distribution of the projects against their costs was not uniform. Because the results of the pilot study necessitated more

emphasis on projects with particular characteristics, the majority of projects cost more than $1 million, and companies can have only a limited number of high cost projects at a time.

Case	Number of Projects
Case 1	57
Case 2	8
Case 3	5
Case 4	1
Case 5	1

Table 3.6. Number of projects in each case study

Project Cost	Number of Projects
Less than $500,000	5
$500,000 to less than $1m	8
$1m to less than $5m	40
$5m to less than $10m	8
$10m to less than $50m	9
$50m or more	2

Table 3.7. Distribution of projects with respect to cost

The 23 participants cited 84 projects in total, an average of 3.7 projects each, attaining the initial target of around four projects for each participant. Seventy-two projects were referenced by only one participant, and 12 by more than one. Participants were carefully selected so that the emphasis was on projects with a recent history to reflect the status of the industry, and on certain types of projects following the outcome of the pilot study. The limitation of access in companies different from Case 1 is manifested with the number of projects that are covered in cases. The majority of the projects were in Case 1, because the other companies provided only limited access. However, the uneven distribution of projects among the cases was remedied by choosing participants who could provide information for more than one case, and by implementing a research

methodology that iteratively queried and verified the results to reach a generalisation for all cases. These are addressed below in Section 7.

Yin (2003a) pays special attention to the term 'sample'; it is not the same as replication logic in case study methodology. He intentionally avoids this term throughout his books (Yin 2003a, b), and prefers to resemble a case to a separate experiment. Collis and Hussey (2003) consider the unit of analysis the sample for data collection, i.e. a Telco NPD project. The total number of projects was reasonable to produce generalisable conclusions; indeed, in a case study the convergence of the findings is the major concern, rather than the number of projects.

5.6 Strategy for analysis

The overall strategy was basically to link the data to propositions and then interpret the findings. In case studies, data can be linked to theoretical propositions in various ways. Unlike some qualitative methods, like grounded theory (Glaser and Strauss 1967), where researchers follow well defined coding guidelines to reach conclusions, in case studies there is no standard way to examine data and to derive conclusions (Yin 2003a). Analytical approaches should be developed as part of the research design (Yin 2003a), and often the tools or methods used in previous case studies are a useful guide. An overall strategy is required to interpret findings and connect them in a logical way.

Yin (2003a, b) describes three generic analytic strategies in case studies: developing a case description; thinking about rival explanations; and relying on initial theoretical propositions. The first is the least preferable and is used to develop a descriptive framework when the other two strategies are not applicable. The second strategy is useful to test rival explanations for a phenomenon, especially when there is not much historical evidence to support an argument. The third strategy is preferred, and was employed in the current research design. This strategy forms theoretical propositions leading to the case study by seeking answers to why and how questions. The skill set representation, project types and deductions from the literature are the outcomes of this process (see Chapter 2, sections 4 to 7) and, consequently, they have already shaped an analytical strategy. The steps in this strategy are described below: data collection (Section 6), analysis (Section 7) and reporting of results (Section 8). The first two of

these steps correspond to the second aspect of the research design, i.e. a plan guiding data collection and analysis (Nachmias and Nachmias 1992) in Section 5 above.

6 Data collection

Collis and Hussey (2003) present a hierarchical data collection process for both qualitative and quantitative research (Figure 3.5).

```
┌──────────────────────────────────┐
│  Identify variables or phenomena  │
└──────────────────────────────────┘
                 │
                 ▼
      ┌────────────────────┐
      │    Select  sample   │
      └────────────────────┘
                 │
                 ▼
    ┌──────────────────────────┐
    │  Select type of data required │
    └──────────────────────────┘
                 │
                 ▼
 ┌──────────────────────────────────────┐
 │  Choose appropriate collection method(s)  │
 └──────────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────────────┐
│  Conduct pilot study of exploratory research  │
└──────────────────────────────────────────┘
                 │
                 ▼
    ┌──────────────────────────┐
    │  Modify collection method(s)  │
    └──────────────────────────┘
                 │
                 ▼
        ┌────────────────┐
        │   Collect data   │
        └────────────────┘
```
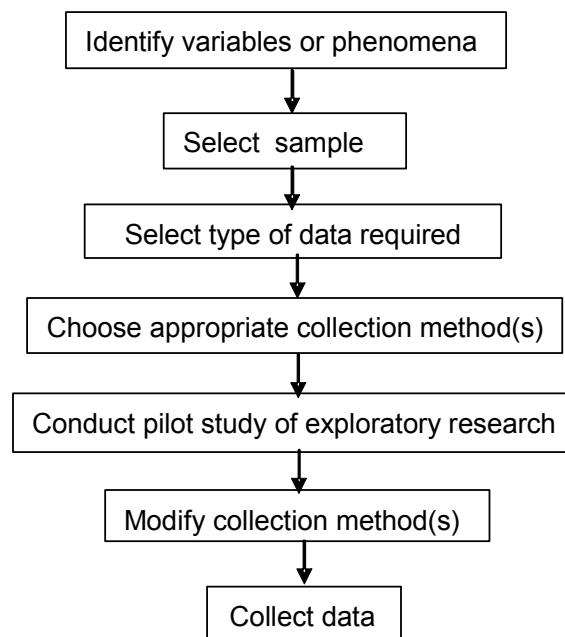
Figure 3.5. Overview of the data collection process (Collis and Hussey 2003:152)

Although it mentions variables in units of analysis, the process lacks an emphasis on qualitative data, and tends to quantify the non-numerical, especially soft, variables: "these different values are capable of being observed and/or measured. For example, 'age' and 'qualifications' are variables which are attributes of individuals. On the other hand, 'number of employees' and 'profit margin' are attributes of organisations" (Collin and Hussey 2003:152). Additionally, what is meant by 'sample' is unclear; following their argument, it could be interpreted as unit of analysis. The researcher again followed

Yin's (2003a) approach, a more convenient strategy for case study research, and addressed the areas for data collection.

6.1   Preparation for data collection

Yin (2003a) indicated five major areas of preparation for case study research: investigator with desired skills; training and preparation; case study protocol; screening cases and individuals; and pilot study. Selection of cases and participants were discussed in sections 5.2 and 5.4. The pilot study is presented in Section 6.3 below.

Because the researcher had extensively reviewed the literature and has been a Telco NPD project manager for some time, he understands contemporary issues in NPD and was able to ask interviewees relevant and probing questions, connecting immediate discussions with previous theories and current trends in project management.

Potential candidates for interviews were initially contacted by telephone or in person. Those who were interested in participating in the research were sent a Microsoft Outlook Calendar invitation, with an explanation about the purpose of the research, the types of questions they would be asked and possible topics that could form part of the discussion, and a consent form (Appendix B). Many at first declined the invitation because of confidentiality and privacy matters, but were reassured by the researcher that no identifying information would be revealed. Once participants accepted the invitation, they were reminded of the interview time and venue a couple of days beforehand. These initial contacts enabled the researcher to develop a closer relationship and build rapport with participants before the actual interview.

6.2   Data collection through interviews

The interview is one of the most widely used data sources in qualitative research. An interview can be defined as a guided conversation, rather than structured queries or informal chat. Both group and individual interviews (Merton et al. 1990; Flick 2002) can provide a rich source of data. Interviewing more than one person can be useful (Glesne 1999), especially for obtaining general information from a small group of

people who have experience and knowledge of the investigated phenomenon (Stewart and Shamdasani 1990).

The (focus) group interview is particularly useful when the interviewer aims to explore the degree of consensus (Morgan 1997; Denzin and Lincoln 2000). However, it has several drawbacks: the dominating group culture may interfere with individual circumstances; and more importantly, confidentiality may prevent participants from being frank about unfavourable experiences (Denzin and Lincoln 2000). Since the research question includes 'success', a subjective concept in project management, it is very likely that no participant wants to openly share their failures and shortcomings with co-workers. Individual interviews are more effective in collecting specific information; indeed, Griffin and Hauser (1993) have found that one-on-one interviews are about twice as effective as focus groups for collecting customer requirements. In this study, only individual interviews with experienced participants were used to closely explore Telco NPD projects and associated skill sets. These are also called 'expert' (Flick 2002) or 'focused' interviews (Merton et al. 1990).

Because a case study looks for answers mainly to questions why and how, interviews are most likely to be open-ended. They are expected to be flexible to investigate a phenomenon from different angles and as clues appear during a research progress; they should not be rigid and unchangeable (Rubin and Rubin 1995). On the other hand, interview techniques need to be consistent among all participants and must focus on the main research question. Semi-structured interviews are ideal for accommodating both these requirements (Bailey 1982). They are appropriate when the aim is to understand interviewees' opinions on a particular matter (Easterby-Smith et al. 1991). Standard questions are followed by open-ended questions to uncover participants' real project challenges and solutions, such as how situations had differed or what the participant had thought about a situation (Rubin and Rubin 1995, Flick 2002). Any ambiguities are clarified with closed questions. Further explanation is prompted by appropriate silence, gestures or body language (Glesne 1999). Issues that have arisen in previous interviews may be raised for comparison purposes.

In this study, all participants were asked the same main questions, for consistency, while follow-up questions varied appropriately to make best use of participants' time and to cover particular areas of interest that might have emerged. Towards the end of

the interview, the researcher asked generic questions about the project manager skill sets or closely related areas in order to summarise the interview discussion and to check anything that was contradictory or that might have been missed. Although the interviewer's familiarity with the research topic was helpful in simultaneously interpreting and responding to the discussion, he paid special attention not to bias or influence the participants.

The semi-structured interviews were planned to last about 1–1.5 hours. The interview protocol is given in Appendix C. Signed consent forms were obtained and the purpose of the research project was explained before the start of the interview. This introduction both set expectations for the interviewee and established the protocol for the interview (Glesne 1999). With participants' permission, the interview was audio-taped. During the interview the researcher noted non-verbal responses, lack of response to a question – and its possible meaning – or silences, as well as any emerging or important subjects to be queried with follow-up questions (Rubin and Rubin 1995). Transcripts were produced immediately after the interview. A number of participants were interviewed a second time for further clarification of Telco NPD project types and their characteristics.

6.3   Pilot study

The pilot study is the final preparation for data collection. It is usually a cut down version of a research study and nearly all relevant practical issues are encountered; Yin (2003a) characterises it as a 'dress rehearsal' or 'laboratory trial'. It serves several purposes: checking on a small scale if a research topic is really worth investigating and differs from what is already known; testing the effectiveness of data collection or analysis methods; and conceptually clarifying the research design. While the scope of the pilot study is limited, it has serious implications for the main research study. In general, convenience, access and location are the main criteria for selecting a pilot case (Yin 2003a). For this study, the researcher selected three experienced project managers and one of their managers from Case 1, where he has easy access to data sources and people, and had already established a rapport with these participants.

The researcher used the pilot study to help choose from three alternative strategies for conducting the semi-structured interviews:

- The interviewer collects data about project challenges, how they were overcome, and then asks questions about relevant projects. The idea is to focus on project challenges, rather than the projects, enabling participants to provide more information about the skills that are needed to tackle those challenges.

- In a more flexible questioning style, the researcher states what information he is seeking with open ended questions, and let the interviewee talk about any issue or difficulty they had in their projects and what they did to address them within the set guidelines. The researcher keeps the discussion focused on the research questions and, as the discussion progresses, he gathers information about the projects.

- The interview is more structured, with the researcher initially asking about projects in which the participant had the most challenges, then requesting more detail of the individual projects, and finally asking general questions about project manager skills.

A subsequent analysis of the interview transcripts showed they all produced similar amounts of information. Although the third strategy appears more structured, it was much easier with this interview technique to connect the information back to the projects and their challenges, and what skills were beneficial in overcoming the problems. It was also noticed that having the participants discuss specific sample projects enabled them to more readily recall past project events and to generalise, which is what this research study was seeking.

After the interviews, the participants were asked for feedback on the interview process consisting of fixed questions followed by open-ended ones. One participant stated that after approximately 1.5 hours his "brain was drained" and he had nothing to add, indicating the interview technique was effective in covering every aspect of the research topic. In fact, extensive questioning of the carefully selected participants in the pilot study revealed a significant portion of the overall research findings.

During the pilot study, participants identified a group of projects with very distinctive characteristics as being particularly challenging. These projects revealed much useful information. The researcher subsequently produced a rough classification scheme to detect such projects, so he could focus on them in the main interviews to maximise the information gained about project manager skill sets. Consequently, the distribution of the projects in the whole research study was skewed towards this type of projects – those with high costs, many stakeholders and newer technologies. Further analysis of the pilot study data revealed justifications for the significance of these NPD projects. Some parameters make those projects rank higher on the difficulty scale, and skill sets become vital to manage them successfully. One of the most important outcomes of the pilot study was to identify those projects on which the subsequent interviews should focus because they reveal the most valuable information.

The other important outcome from the pilot study was its report (Yin 2003a). The initial research findings were circulated among a small group of project management experts for comments. The final version of this report was then presented as a conference paper (Kosaroglu and Hunt 2007), which provided useful early feedback from peer reviews and the NPD research community.

7 Data analysis

The absence of an overarching analytical strategy is one of the dangers in a case study, and research can often stall at the analysis stage if there is no clear plan once the data have been collected (Yin 2003a). In this case study, the analytical strategy was developed before collecting any data and then revised after the pilot study (see Section 5.6 above). This section describes the techniques and methods selected for data analysis.

7.1 Analysis method

Data analysis in qualitative research can be summarised in four processes (Morse 1994): comprehending, synthesising, theorising and recontextualising. These processes imply that researchers should have a deep understanding of the data, which requires a broad

knowledge of the phenomenon from relevant previous studies and long exposure to it in the field (Yin 2003a). The researcher in this study has satisfied both requirements with an extended literature review and he has been a project manager in Telco NPD for many years. Consequently, he is in a state to interpret the data, accumulate the evidence and explain the phenomenon logically.

One of the most widely employed data analysis methods, used in this study, is 'pattern matching' (Campbell 1975; Kreuger 1988; Eisenhardt 1989; Miles and Huberman 1994; Collis and Hussey 2003, Yin 2003a). Then, the question is 'how close does a match have to be in order to be considered as a match' (Yin 2003a). In a quantitative representation, such as graphs, objective mathematical criteria can be easily employed to determine whether the findings match the proposed trends (Groebner et al. 2005); whereas, it is not quite straightforward in qualitative research. In a case study, several pieces of information from cases need to be logically related to a theoretical proposition, and then compared and revised with empirical findings to form a qualitative representation (Yin 2003a). Collis and Hussey (2003) illustrate how cognitive mapping and data display techniques (charts, flow charts, matrices and network diagrams) can develop a pattern pictorially from the data. Yin (2003a, b) suggests similar methods to connect independent and dependent variables to produce a pattern and to represent the findings in logic and network models. In all, the purpose is to capture a holistic pattern from the data. While the precision of the generated pattern cannot be measured scientifically, pre-established benchmarks can help define an accuracy criterion (Yin 2003a).

The pattern appearing from the empirical evidence is compared with a predicted or generated one (Trochim 1989). If the patterns coincide, the validity of the theory is strengthened. In this study, a theoretical pattern to match skill sets had already been proposed from the literature review (the proposed organising framework for skill sets in Figure 2.15 in Chapter 2), showing the relative importance of skill sets with respect to project characteristics and phases. However, these were not complete or the final propositions; rather, they evolved as the research progressed and evidence emerged.

To generate empirical evidence from interview transcripts and notes, the data were displayed in a matrix, called a mapping matrix, similar to the effects matrix of Collis and Hussey (2003). For consistent comparison among cases, project characteristics and

phases were considered as independent variables, which were influenced by skill sets (control variables) for project management success (dependent variables) (Figure 3.6).
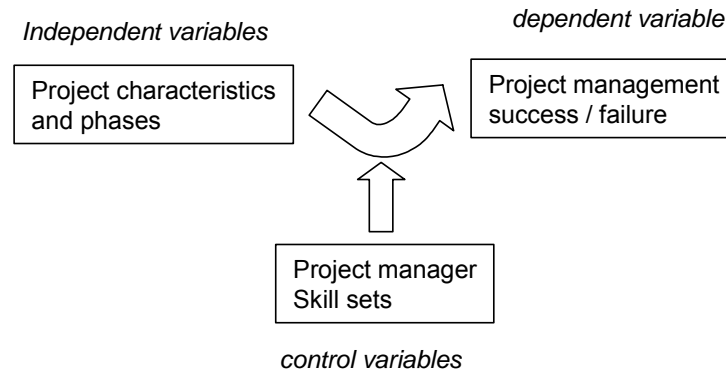
Figure 3.6.   Representation of the casual relations among projects and project manager skills

Especially for a phenomenon that cannot be described in quantitative terms, such as soft skills, it is not possible to produce a benchmark with clear measures. For example, one cannot state 'a project of type A needs 10% better leadership skills than a project of type B'. Such quantitative measurements do not fit the paradigm adopted in this research. However, comparisons can be relative, such as 'Project type A is better managed by a project manager with stronger leadership skills'. The aim in the data analysis is to produce such patterns showing trends, and to emphasise the relative importance of the skill sets.

7.2   Analysis procedure

Phrases from interview transcripts and notes that imply a specific skill set and project characteristics were summarised and recorded into the mapping matrix. As an example, the top shaded part in Table 3.8 represents the example interview excerpt below. Reference numbers, shown in parentheses, were inserted in the original transcript to track results back to the mapping matrix and to the original interview transcripts and notes.

Example excerpt: It was a complex project. An engineer did not finish a task, which was not taken into account during planning (1). He was given another task later, but he was indeed told to work on my project. I talked to his manager and agreed (2) that he would assign another engineer, but delay was unavoidable. Program manager was not happy and I needed to escalate (3) to senior management to formalise the delay in the schedule that we gave in our estimates.

The same phrase could be added to more than one row in the mapping matrix, since a clear-cut boundary may not occur between skill sets, or the way an issue is handled may involve more than one skill. Two mapping matrices, one for explanatory purposes (fitting existing theoretical propositions) and another for exploratory purposes (new findings), were completed for every interview. This tabular information was maintained in Microsoft Windows Excel spreadsheets, which made it easy to display, compare and move information around. As empirical evidence was accumulated, the logic to define skill sets and projects, and the rationale to map skills, were constantly tested. If a common trend occurred in the exploratory data, the theory was amended accordingly. All interviews were processed this way. Reference numbers were removed from the final report; only the page numbers of the interview transcripts and notes were retained to allow for direct tracing from the final report back to the original research data.

Although the data analysis procedure looks straightforward, the amount of data to process and analyse, makes it a demanding task in practice. The semi-structured interviews happen in conversation, with the researcher controlling the speed and topic, and also attempting to cover all possible relevant areas. The content loaded phrases need to be processed properly; all evidence should be analysed and recorded in the mapping matrix, then aggregated data should be examined for any patterns that constitue an empirical finding. The above example presents an ideal case, where clear statements are used, to explain how the data analysis is done. It is impossible to provide the data analysis process for all findings due to the space limitation. An example with real research is elaborated in Appendix D, in which the first three steps show how the data analysis was performed.

SKILL SET	SKILL	PROJECT CHARACTERISTICS	PHASE	SUMMARY OF THE PHRASE	COMMENT (WHY/HOW)	REFERENCE NO
Technical	Technical knowledge	Complex project	F&D	A task not taken into account	Did not include a task in the plans, since it was missed. A project manager with technical knowledge would have not missed it.	1
Leadership	Negotiation	Complex project	DIV	Negotiate on a new source with a functional manager	Influenced a functional manager to give another engineer for an under-resourced project.	2
Managerial	Using position power	Complex project	DIV	Escalated to senior manager.	Dedicating a source was not in his power	3
Technical	Technical	Large projects	II	Generally the main challenges are getting the resource assigned and getting the design and specification correct. Under an NTI, it's absolutely essential	NTIs are generally mid to large size projects. He is also referring his example project 1. Design and specification requires to understand technology.	4
Leadership	Communication, negotiation, writing	Large projects	II		Arranging resources require communications, negotiation, writing memo, etc. with/to senior management.	4
Managerial	Planning, execution	Large projects	II, F&D	Identifying and defining risks at initial stages of a project. Developing mitigation scenarios, which may incur some costs, or other impacts, e.g. time.	At initial phases of the project, plans should be co-operated with risks and their mitigation plans.	5
Leadership	Communication, listening, writing	Large projects	II, F&D	Defining and clarifying the need for resources with the project team. If available options do not allow to finish work in time, it is escalated.	Communicating with the team, and understanding the need for resources.	6
Technical	Technical	Large projects	II, F&D		Investigating the impact and producing solutions	6
Managerial	Planning	Large projects	II, F&D		Producing plans and evaluate options in terms of their impacts	6
Managerial	Escalation to sponsors, and decision makers	Large projects	II, F&D		Escalation up the management ladder to get it resolved	6

Explanatory / Exploratory / Legend /

Table 3.8. Mapping matrix between skills, skill sets and project phases and characteristics

7.3   Triangulation and convergence of evidence

The triangulation of evidence is the key process for producing generalisations from the cases. Yin (2003a) recognises the difficulties of having many reliable and multiple sources of rich data, and encourages new strategies to create multiple sources for cross case comparisons:

> *"Of course, each of these – multiple source – strategies can be modified, creating hybrid strategies in which multiple sources of evidence are more likely to be relevant...However, the most important advantage presented by using multiple sources of evidence is the development of converging lines of inquiry, a process of triangulation." (Yin 2003a:98)*

If data sources are independent and can provide data for only one case, then many data sources for each case are required to increase the validity of the generalised results. Individual interviews were found to be viable data sources, as explained in Section 5.3. However, the researcher also needed to develop strategies for triangulation, as described by Patton (1987). Participants with experience in more than one case were intentionally selected, so they were able make cross case comparisons and produce generalisations from their cases. Their distribution is shown in Table 3.9. The researcher specifically sought the differences between the cases during the interviews. Several participants' direct comparisons between the cases and their first-hand generalisations proved to be much deeper and richer than indirect analysis from independent data sources. Generalisations made by the participants in the last part of the interviews, in particular, were genuine, and they made up a significant portion of the evidence in the main research.

Number of Participants	Cases
7	Cases 1 and 2
2	Cases 1 and 3
1	Cases 1 and 4
1	Cases 1 and 5

Table 3.9. Number of participants contributing to more than one case

With two exceptions, all participants have had experience in Case 1. As explained in Section 5.4, the researcher was unable to involve more participants from other cases. If

Case 1 was known to be a representative (typical) case, then this single case would suffice to investigate the whole Australian Telco industry. As discussed in Section 5.2, if the other cases had provided no opposing evidence and, furthermore, if they had corroborated the findings from Case 1, then Case 1 could have been claimed to be a representative case to investigate Telco NPD projects and their project managers.

In addition to triangulation among cases, more than a quarter of the projects in Case 1 were also triangulated by more than one participant (Table 3.10). It was not possible to find a project cited by more than one participant in cases 2, 3, 4 or 5, because of the inaccessibility of data sources. Detailed information about the participants, and the cases and projects they cited, is presented in Table A.3 in Appendix A.

Number of participants cited	Number of projects
4	1
3	3
2	7

Table 3.10. Number of triangulated projects in Case 1

Explanation and theory building is a step-by-step building process with revisions of theoretical propositions (Yin 2003a). Grounded theory uses a similar process for theory generation by going back and forth between data and theory until a best fit is found (Glaser and Straus 1967). Authorities recommend overlapping data collection and analysis, simultaneously gathering further empirical evidence about the new findings (Eisenhardt 1989). The advantage of this scheme is that data are incorporated during data collection. An interview's transcript is produced immediately, and the transcripts and notes are briefly analysed before another interview, to evaluate if research area was well covered and whether any emerging areas need further investigation and confirmation. This continual review process is essential to keep pace with the research and to ensure there are no gaps.

> *"As you collect case study evidence, you must quickly review the evidence and continually ask yourself why events or facts appear as they do. Your judgements may lead to the immediate need to search for additional evidence." (Yin 2003a:59)*

During the interviews, the researcher would sometimes propose contrary arguments from previous interviews, or look for counter or corroborating evidence from interviewees to clarify a point. To avoid losing focus of the original research topic (Yin 2003a), the researcher constantly checked that the interview discussion was not too divergent from the research topic, while simultaneously remaining flexible enough to gather data from all relevant areas.

The key question in a qualitative research is to know when enough data have been obtained, and when further data collection is unlikely to present anything new. The careful selection of participants in the pilot study had already revealed a significant amount of information. Extending the net to other project stakeholders and Telco companies covered the research area well. After reaching noticeable data saturation by the seventeenth interview, a further six participants were selected to provide information about more than one case for cross-case examination, and to check the consistency of the outcomes by deliberately proposing opposing arguments. This study was similar to that of Griffin and Hauser (1993) who compared data collection methods to understand customers' needs and concluded that one-on-one interviews with 20–30 customers revealed 90% or more of the customer needs. In this research, the first four interviews in the pilot study provided more than half of the findings. After a further thirteen interviews in the main research, the additional new data per participant was negligible; in total, the 23 participants described 72 projects.

A good case study must be 'complete', but it is difficult to describe operationally, since few guidelines are available (Yin 2003a). The completeness of this case study can be demonstrated in at least two clear ways: first, it attempted to check boundary conditions analytically with the selection of cases and the data analysis process; second, convergence was attained through an iterative process until there was no further evidence in the new data.

> *"First, the complete case is one in which the boundaries of the case – that is, the distinction between the phenomenon being studied and its context – are given explicit attention. The best way is to show, through either logical argument or the presentation of evidence, that as the analytic periphery is reached, the information is of decreasing relevance to the case study. Such testing of the boundaries can occur throughout the analytic steps in doing the case studies." (Yin 2003a:162-163)*

"A second way involves the collection of the evidence. The complete case study should demonstrate convincingly that the investigator has expended exhaustive effort in collecting the relevant evidence. The overall goal, nevertheless, is to convince the reader that little relevant evidence remained untouched by the investigator, given boundaries of the case study. This does not mean that the investigator should literally collect all available evidence – an impossible task – but that the critical pieces have been given 'complete' attention. Such critical pieces would be those representing rival propositions." (Yin 2003a:163).

Although some cases had fewer participants, smaller or one sample projects, they are extremely useful for cross case comparisons and to reach generalisable conclusions. The ultimate aim of generalisability had been satisfied by exhausting the evidence from cases and projects until no new information was being presented. In particular, the interviews with the last six participants about their cross-case experiences produced no rival explanations. As such, it can be assumed that the case study was complete.

8   Reporting

Yin (2003a) advises that a reporting (or compositional) structure is better to be in the same way a case study is organised and implemented. He further recommends a number of structures depending on the type of case study. The linear analytic, comparative and theory building structures can be used for explanatory and exploratory types. Most case studies, including this one, employ the linear analytic structure, which follows the sequence of topics in a linear fashion: study subject, literature review, methods used, data analysis, findings and conclusions. It is also the most suitable one for a thesis: "The linear analytic structure is comfortable to most investigators and probably is the most advantageous when research colleagues or a thesis or dissertation committee comprises the main audience for a case study." Yin (2003a:153).

There can be different formats to write a case study research. For a multiple-case one, Yin (2003a) mentions three possible types of reports; however, there is no prescribed way, as long as the report presents the findings with the required emphasis. The first contains narratives for each case, usually in a separate chapter, later another one for cross case analysis; the second answers a series questions for each case, and then examines them for cross case comparisons; and the researcher has used the third one:

> *"There may be no separate chapters or sections devoted to the individual cases. Rather, your entire reports may consist of cross case analysis, whether purely descriptive or also covering explanatory topics. In such a report, each report or section would be devoted to a separate cross case issue, and the information from the individual cases would be dispersed throughout the chapter or section." (Yin 2003a:148)*

If the cases were independent with different participants and divergent evidences, it would be more meaningful to address each case separately. Due to careful selection of participants as part of the research design, many of them already have experiences in more than one case, and they are readily providing cross case comparisons and generalisations, which are indeed the ultimate research goals. Therefore, a type of report having built in cross case analysis is more suitable.

> *"In a multiple case study, the individual case studies need not always be presented in the final manuscript. The individual cases, in a sense, serve only as the evidentiary base for the study, and may be used solely in the cross case analysis." (Yin 2003a:149)*

The researcher takes care to produce the best evidences in the report − that is, this dissertation − that present the convergence resulting from the data analysis. At the beginning, it was not quite clear which data emphasises better the findings relatively. The researcher has compiled the initial versions of the analysis by including all the evidences under the suitable headings without any consideration about the length. Then, he revised and refined the report recursively until achieving the best structure and narrative. Consequently, he has picked the most meaningful segments from interview transcripts and notes to support an argument that became apparent from the data. At the same time, he has tried to convey the voices of all participants equally. However, some participants were more articulate, and similarly, some projects are more striking examples than others to explain a subject. Since Case 1 contributes the most projects, there are more references to them; but it should not be interpreted as a bias in favour of Case 1. Nevertheless, they are coherent and supportive of the overall findings that are triangulated between cases and projects. The researcher has attempted to have the report's composition convincing and easy to follow to present the research outcomes. Appendix D presents an example with real data how the draft report was progressed to the final report in its last two steps, to present an empirical analysis outcome.

"The selectiveness does not mean that the evidence should be cited in a biased manner – for example, by including only the evidence that supports an investigator's conclusions. On the contrary, the evidence should be presented neutrally, with both supporting and challenging data. The reader should then be able to conclude, independently, whether a particular interpretation is valid. The selectiveness is relevant in limiting the report to the most critical evidence and not cluttering the presentation with supportive, but secondary information." (Yin 2003a:164)

9 Case study database

One of the principles of effective research is carefully documenting and organising the collected data, artefacts and reports (Yin 2003a). In this study, the researcher used separate directory structures for collected data (interview records and interview transcripts) and analysis work (processed interview transcript, mapping matrix spreadsheets and research reports), as shown in Figure 3.7 below, in his computer. Interview notes and hard copies of the research data were archived in a dedicated secure cabinet.

Successive versions of reports were identified so that different versions of the study results could be traced. Yin (2003a) considers a well organised case study database analogous to that of a forensic investigation. Maintaining a chain of evidence is essential for a good quality case study, so that other researchers are able to use the original data and, using the analysis procedure presented in the research design, replicate the study results.
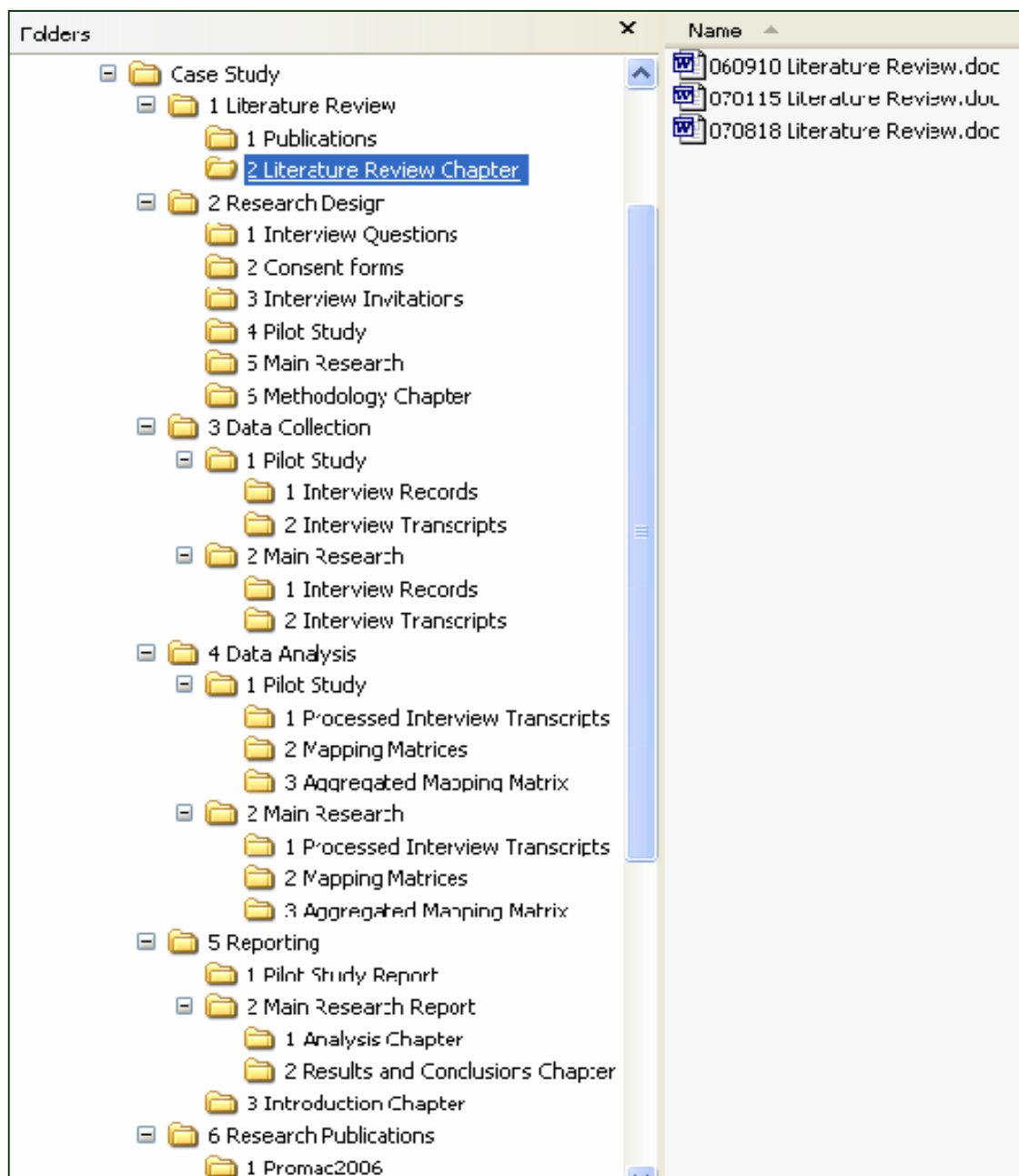
Figure 3.7. Case study database and file structure

10   Quality of research design

Four types of tests are commonly used to establish the quality of an empirical social research, including case studies (Kidder and Judd 1986; Collis and Hussey 2003; Yin 2003a):

- construct validity, also called face validity: correct operational measures are used for the concepts being studied

- internal validity: causal relationships can be established, i.e. certain conditions are shown to lead to others

- external validity/generalisability: findings can be generalised to a certain domain

- reliability: the operations used in research, such as data collection and analysis, can be repeated to produce the same results.

Yin (2003a) has presented tactics to satisfy these tests as shown in Table 3.11. Those tactics used in this study are indicated in italics.

Quality Tests	Case Study Tactic	Phase of research
Construct validity	*Use multiple sources of evidence*	Data collection
	Establish chain of evidence	Data collection
	Have key informants review draft case study report	Composition
Internal validity	*Do pattern matching*	Data analysis
	Do explanation building	Data analysis
	Address rival explanations	Data analysis
	Use logic models	Data analysis
External validity	Use theory in single-case studies	Research design
	Use replication logic with multiple cases	Research design
Reliability	*Use case study protocol*	Data collection
	Develop case study database	Data collection

Table 3.11. Case study tactics for four design tests (Yin 2003a:34)

10.1 Construct validity

A case study researcher needs to develop an operational set of measures sufficient for collecting and evaluating data for the phenomenon under investigation. Especially in research topics that involve subjective judgments, such as soft skills in this study, the interviewees should understand what is being asked to prevent any misunderstanding and collecting data about an unintentional subject (Yin 2003a). Several measures were taken in this study to ensure construct validity:

- The researcher approached as participants for the interviews only experts who were aware of the skills necessary in an effective project manager.

- Interviewees were informed of the research purpose and what information they were expected to provide more than once: at the initial contact by phone or e-mail, and both before and during interviews.

- Interviews were semi-structured. The fixed questions set the expectations from participants and explored the areas to discuss in the open part of the interview.

- Participants from different companies (i.e. cases) comprised multiple data sources.

- An extensive literature review developed a logic to classify skills into skill sets, and their relative importance was compared to produce initial theoretical propositions. In addition, the researcher had been a project manager in the field for many years and was therefore sensitive to issues that may appear new or out of context.

- The researcher paid particular attention during interviews not to digress from the research topic, but also to be flexible to uncover all relevant information.

- Project management experts provided feedback on whether the findings were logical and coherent.

- Participants were given the opportunity to review their interview transcripts to ensure their intended meanings had been recorded.

- The data collection and analysis processes were defined in detail, and artefacts were kept with proper configuration management (date stamp, directory and file naming, etc.) in a case study database so that the chain of evidence was both transparent and readily available for scrutiny.

10.2 Internal validity

Internal validity is mainly a concern for explanatory case studies, where a casual relation is investigated between independent and dependent variables (Yin 2003a). One of the objectives of this case study was to explain the relationship between project manager skills and Telco NPD project management success, similar to that depicted in Figure 2.15 in Chapter 2. However, the literature review findings provided the initial constructs as a starting point. The case study was also exploratory, with no presumption to limit the variables or skill categorisations. If evidence indicated another variable or more logical groupings, the theoretical propositions were amended.

Another concern of internal validity is making inferences from the evidence, such as whether the inference is correct, the evidence converges, or another explanation would be more appropriate. In this case study, the pattern matching method was used for data analysis (Yin 2003a). Section 7.2 described the data processing, with an explicit path for a conclusion to be easily tracked back to data, and Section 7.3 presented the data triangulation method and how results were progressively checked by hinting at counter arguments, until eventually the researcher had ensured that all the evidence had converged.

10.3 External validity / generalisability

External validity deals with generalisability beyond the immediate case study. While case studies can produce generalisable results, this is not in the sense used by positivists, who understand a large population as the sample size. In contrast, case studies rely on analytical generalisation, with researchers attempting to generalise a

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particular set of results to a broader theory (Yin 2003a) or to another sample setting (Vogt 1993).

NPD literature traditionally aims to produce generalisable results. Yin (2003a) strongly emphasises that two cases are stronger than a single case, and multiple cases are better still. Overall, the researcher considered generalisation an important criterion and included multiple cases in the research design.

10.4 Reliability

Reliability ensures that if other researchers follow the same procedures as the original research they will arrive at the same conclusions. The aim of reliability is to minimise error and bias. The pre-requisites are to document the procedures, which Yin (2003a) calls case study protocol, and maintain a case study database. These are the same requirements for internal validity, but for a different purpose. Sections 5−7 of this chapter, in particular, have presented the case study protocol, describing how the research design and implementation enabled all aspects to be covered progressively. Another researcher could start from the research results, drill down to any level of the data and produce a chain of evidence without difficulty.

11   Limitations and delimitations

Limitations are the potential weaknesses in a research study (Collis and Hussey 2003). Data collection methods come with unavoidable limitations (Bailey 1982; Glesne 1999; Flick 2002). One well known problem in interviews is that participants may produce bias towards a desirable position for their own benefit, or may under-represent some areas that seem obvious or not important to them. This can be eliminated to a degree with an interviewer who knows the phenomenon well and uncovers it with proper probing questions.

Data analysis employs the pattern matching method, based on a mapping matrix, described in Section 7.2. The interactions among skills make it hard to define the

granularity and boundary among the skill sets. However, judging if a skill is classified correctly, or a new skill set category is appearing, depends on the researcher's skill and sensitivity. This possible limitation was addressed in this study by the researcher undertaking an extensive literature review and having been exposed to the phenomenon in the field for a long period. Therefore, he is familiar with Telco NPD projects.

Case study generalisations are different from statistical generalisations (Schofield 2000). The larger the number of cases, the stronger the arguments (Yin 2003a). The researcher selected participants who could provide rich information on the research subject from as many cases as possible covering the whole Telco industry. However, access to other data sources from competitor companies was difficult, and limited the number of participants from other cases due to confidentiality and privacy matters.

Delimitations explain how the scope of a research study is focused on a specific area (Collis and Hussey 2003). This research study examined Australian Telco project managers, and therefore its scope encompasses only Australia. However, since industry business conditions, deregulation and tough competition are similar in developed countries, the results of this study may be indicative for other developed countries.

12   Ethical considerations

The research topic was general Telco business interest and no personal information (age, gender, ethnicity, etc) was required or collected. Participants were briefed about the purpose of the research project and voluntary contribution by attending interviews. A signed consent form was obtained before the interviews. The venue was any location that participants select, providing that it is convenient and free from distraction.

Several candidates who initially showed interest subsequently declined the invitation for an interview, or withdrew when questions were directed about the reasons behind the project management failures. These candidates were removed from the case database, and their records were deleted and not used in further analysis, as outlined in the ethics rules. One participant did not want the conversation recorded, and the researcher took notes only during that interview.

After the interview, participants are asked to review the transcript. They could omit or modify sections they felt were confidential or inappropriate. Once reviewed, audio records and transcripts were saved in the researcher's computer, or on a CD, without any identifiable reference to participants.

This research is fully compliant with Macquarie University ethics guidelines.

13   Summary of research design

This chapter has presented details of the methodology and research design. The nature of the research problem and a desire for deeper and richer information prompted the adoption of a phenomenological paradigm. Among the possible methodologies, the researcher selected the case study. A similar methodology, field research, lacks guidelines for consistency, and does not specifically serve the aim of generalisable research findings.

The assumptions associated with the research paradigm were discussed. This research is placed on the phenomenological side of middle in the positivist–phenomenological continuum, as an indication of the overall approach of how the research was conducted.

Case study was chosen as the most appropriate method for this research for several reasons:

- It is applicable to answering the research question of why certain skills are used and how they are used in Telco NPD projects.

- The connection between the skills (i.e. phenomenon) and Telco NPD project management success (i.e. context) is not immediate and explicit.

- It requires initial research propositions to extend the previous knowledge further. This was achieved by an extensive literature review. Some other phenomenological methodologies assume almost no a priori knowledge before entering the field.

- Case studies have an inbuilt design structure for analytical generalisations with multiple cases. This case study is a holistic multiple-case study (five cases). The unit of analysis is Telco NPD projects.

- The selection of suitable participants results in a sufficiently large number of project samples to derive conclusions about Telco NPD projects and their project managers. The number of variables under investigation is larger than the number of data points.

- Evidence was collected from participants with one-on-one interviews, and many of these also provided direct cross-case comparisons.

Explanatory and exploratory case study types align well with the research purpose, which is to examine the Telco NPD projects' challenges and the skill sets of the successful project managers to address them. The most suitable units of data collection were found to be the Telco NPD project managers themselves, their managers and other first degree stakeholders – senior managers, program managers and project sponsors – as they have a close overview of all aspects in project management that cannot be provided by other stakeholders. The data analysis employed the pattern matching method to evaluate the interview transcripts and notes, with a referencing procedure to track the findings back to data.

A pilot study, conducted in Case 1 with a few participants, helped to finalise the decisions on appropriate methods, and indicated the characteristics to select Telco NPD projects that can reveal more information about project manager skill sets. The researcher also gained experience in how to use the time effectively in the interview and cover all relevant areas. The pilot study report shared the findings with project management experts and with the NPD researchers as a conference paper, thereby gaining feedback early in the project. Later, the main research extended to other cases that cover the majority of the Australian Telco industry.

The key to generalisations is the way the research is designed to facilitate direct cross case comparisons, i.e. triangulation of the cases with different participants with experience in more than one case. After the pilot study, a recursive process was followed until convergence was achieved. Interview transcripts were produced immediately and briefly analysed before the next interview, ensuring no new or

negligible findings were missed in additional interviews. Interviews with the last group of participants, after convergence was reached, particularly served this purpose; the researcher checked the results by sometimes suggesting counter arguments and confirming that earlier results were valid. Figure 3.8 overleaf provides a holistic view of the overall research design, with references to the most relevant sections in this chapter in italics.

Finally, tests and precautions for achieving a quality case study were discussed. One important criterion is a case study database with a configuration management that consists of a pre-defined directory and folder structure and date stamped file names in the researcher's computer. Limitations arising from the data collection and analysis methods were outlined. The researcher, as a knowledgeable and experienced project manager in the field, can compensate for them to a great degree. The research is delimited to Australia, but its results may be indicative for other developed countries.
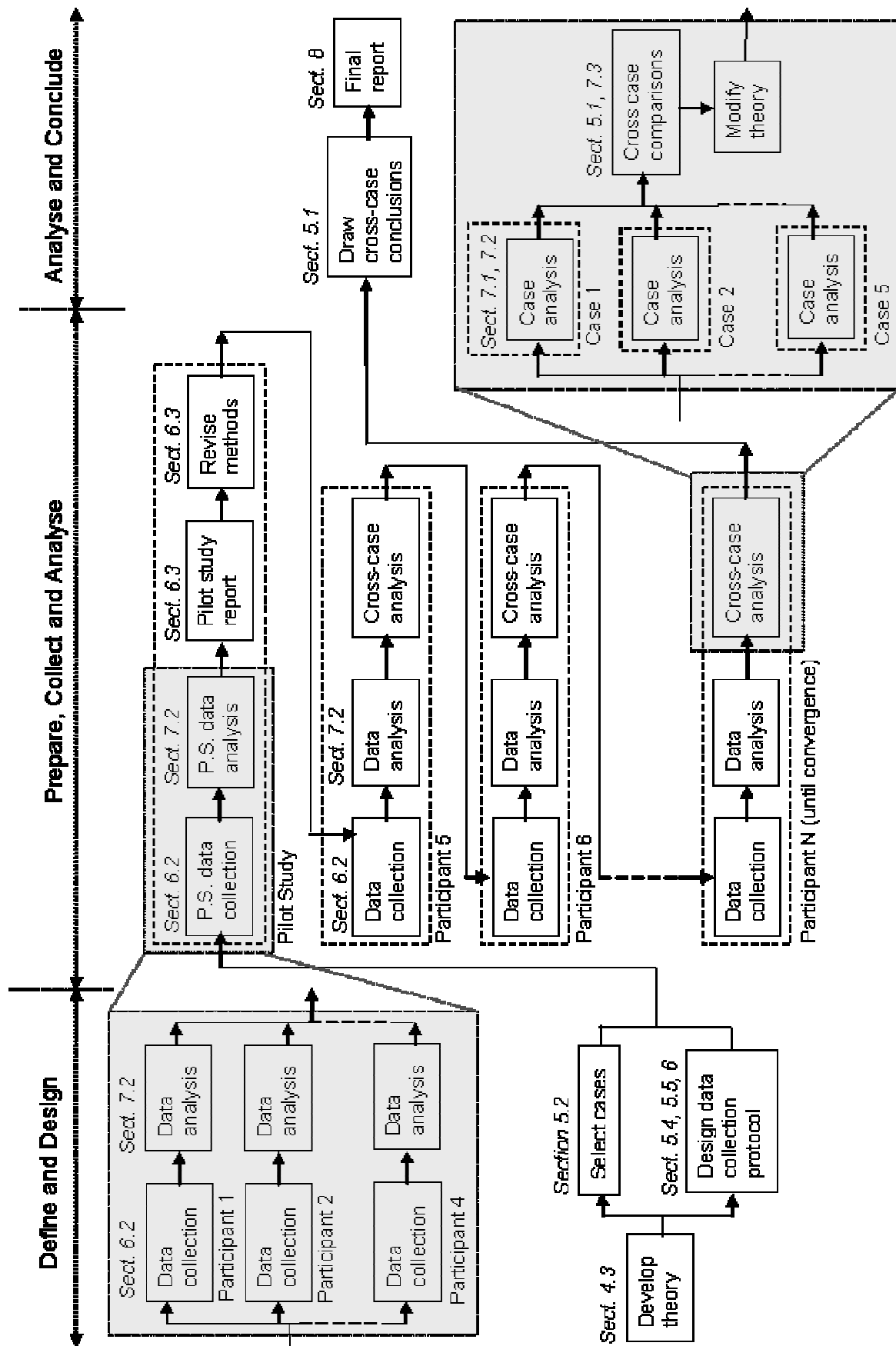
Figure 3.8. Overall view of the case study research design

ANALYSIS

1   Introduction

The literature review comprised three major steps: first, examining the literature about skills, and developing a skill set framework; second, undertaking an overview of Telco industry, its products and specifics of NPD projects; and third, determining the skill sets of Telco NPD project managers. The empirical part of the research had the same consistent approach. The skill set outcomes from the first step of the literature review constitute the theoretical model subsequently tested by the empirical investigation. This chapter presents the empirical findings and the supporting evidence. These findings are summarised and highlighted in the following chapters.

The empirical evidence provided here consists of excerpts from the research data, transcripts of individual one-on-one interviews and the researcher's notes taken during the interviews. Each excerpt is identified with the following convention in parentheses for direct traceability back to the original data: *participant id; role perspective; case(s); project reference no (if any); page number in the interview transcripts or notes*. The project references are not included if the participants make generalisations that are valid for all projects mentioned as examples. Confidential or identifying information is omitted and indicated by square brackets, as is additional information that was added later for clarification. The supporting evidence is presented in a triangulated fashion from different cases and role perspectives. The few differences between cases on a particular topic are also mentioned.

The chapter first presents the differences among the cases in terms of the organisational structures and NPD processes, selecting the most contrasting examples to show organisational variations. Some of the cases are running long-term transformation

programs in order to be more agile to respond market to demands faster, and this chapter presents their status at the time of this research (2006 and 2007).

The empirical analysis of the project manager skill sets starts with the investigation of the NPD projects that the participants have given as examples during the interviews. It illustrates the environment in which the project managers are operating, and corresponds to the second step. The Telco NPD projects are examined with respect to different criteria: first consumer versus business products, and then the types defined in the industry. The commonalities among the projects are sought to understand the variables that create challenges in project management, and to classify them in order to better explain the skill sets. A brief look at project management before market deregulations, which caused significant changes in the industry, is followed by an outline of the challenges faced by the Telco NPD projects today, and the practices undertaken to manage these challenges.

The third step examines the skill sets and makes connections with the challenges of the Telco NPD project management. Here, instead of theoretical propositions from the literature, the analysis is based on research data. The analysis is extended to the NPD project phases, with mapping project activities to the widely used four-stage NPD process in the industry.

Finally, the overlap between the project manager competency standards and the Telco NPD project manager skill sets is examined by mapping relevant project management activities. By the end, several sections will have examined Telco NPD projects, their challenges and the required skill sets, and the match to the competency standards. This chapter is concluded without a summary or outcomes section. These are left to the next results and conclusions chapter, where the summary of the results are presented with the comparisons with the literature review outcomes.

2   Organisational differences between the case studies

All Telco service provider companies operate in the same market conditions, with nothing externally specific to a company that distinguishes one case from another.

However, some companies are internally different with respect to organisational structure and NPD processes, and Telco companies commonly undergo frequent organisational changes. For example, cases 1 and 2 are currently experiencing large transformation programs, and company C was merged into company A. Cases 1 and 2 are the most contrasting examples, and have been used to illustrate differences between cases. They are the two biggest Australian Telco companies, consisting of a number of business units that have further minor variations; however, only the major organisational differences relevant to this research are discussed here.

2.1   NPD project management organisational structure

All cases have matrix organisational structures to manage NPD projects. Project managers are given resources from functional groups, and are held responsible and accountable for delivering a new product. This section describes two extreme variations of the matrix structure found among the cases.

Case 1 was reorganised about a year previously to streamline product development, and to place technical decisions and responsibility for projects onto a product development group. As part of this change, the NPD project managers report to the same senior manager of a functional engineering group, as shown on the left of Figure 4.1. They are responsible for managing the project team, budget and schedule. They also represent technical engineering groups to a program core team that consists of all other stakeholders impacted by NPD: marketing, financial, training, etc. managers. This team is headed by a program manager from the program office, forming another layer of matrix structure, shown on the right of Figure 4.1. The product marketing manager is also the business owner and project sponsor. The project and program managers report to different managing directors, thereby completing a matrix structure at the highest level. They are both accountable for the project, and therefore have overlapping responsibilities. The project manager fulfils two roles: the first as the owner and head of an NPD project, a role internal to the product development group; and the second representing the project team in co-ordination and co-operation with other stakeholders of the company. The project manager acts as a gateway to the product development

group and the project core team with its environment from a project's point of view. Other cases, except Case 2, have a very similar structure to Case 1.
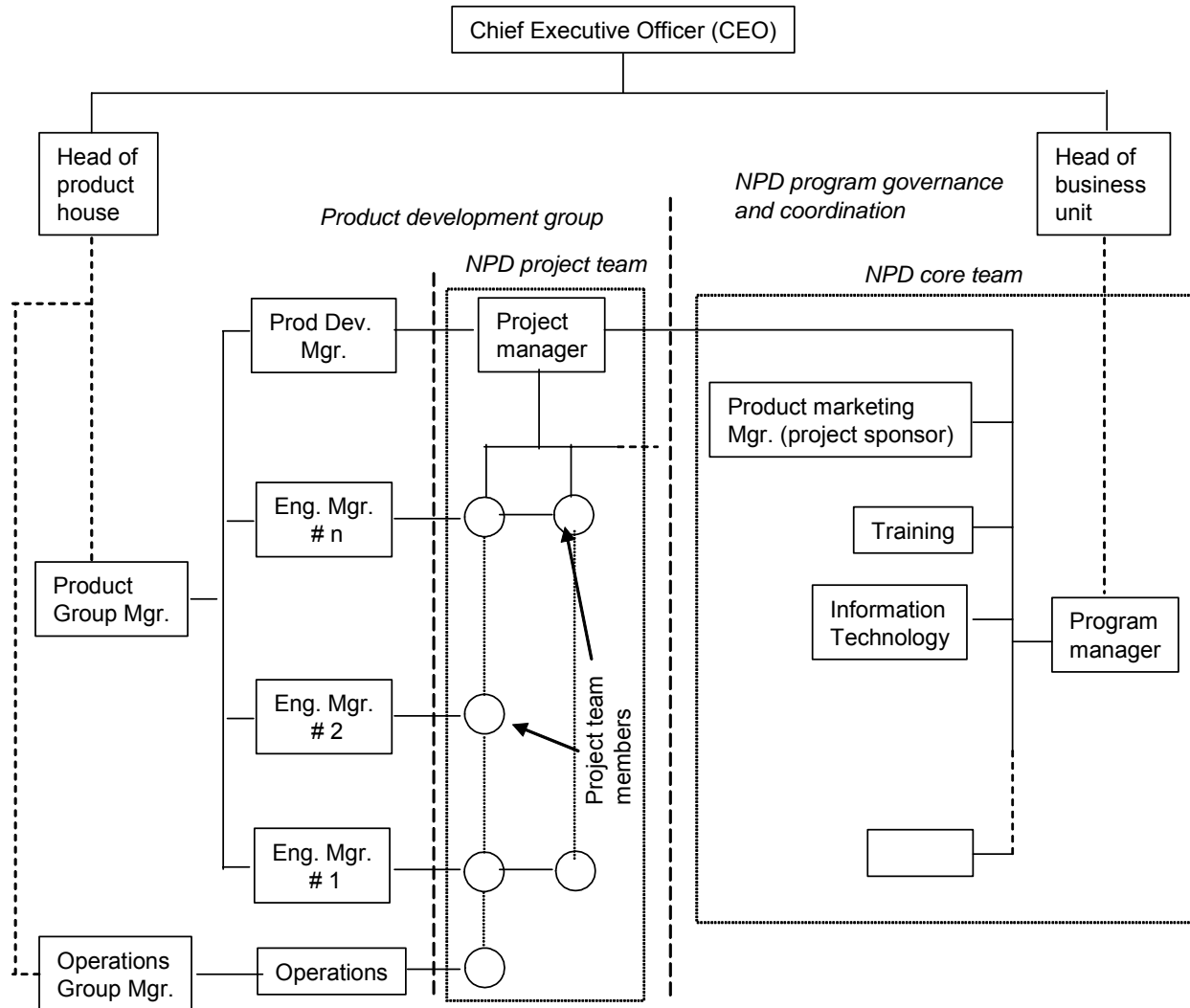
Figure 4.1. Case 1 – Organisational structure for project management and governance

Case 2 is historically an engineering-driven organisation, rather than a marketing organisation like Case 1. Due to the increased competition with market deregulations, it is currently undergoing a long-term organisational transformation, and the representation in Figure 4.2 gives a snapshot of the current organisational structure. The platform owners are technical people, and they act as project sponsors. They receive

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information from marketing managers, who are business owners, about what the customers demand, but at the end, the platform owners have the final say about what to include or exclude in an NPD project's scope.
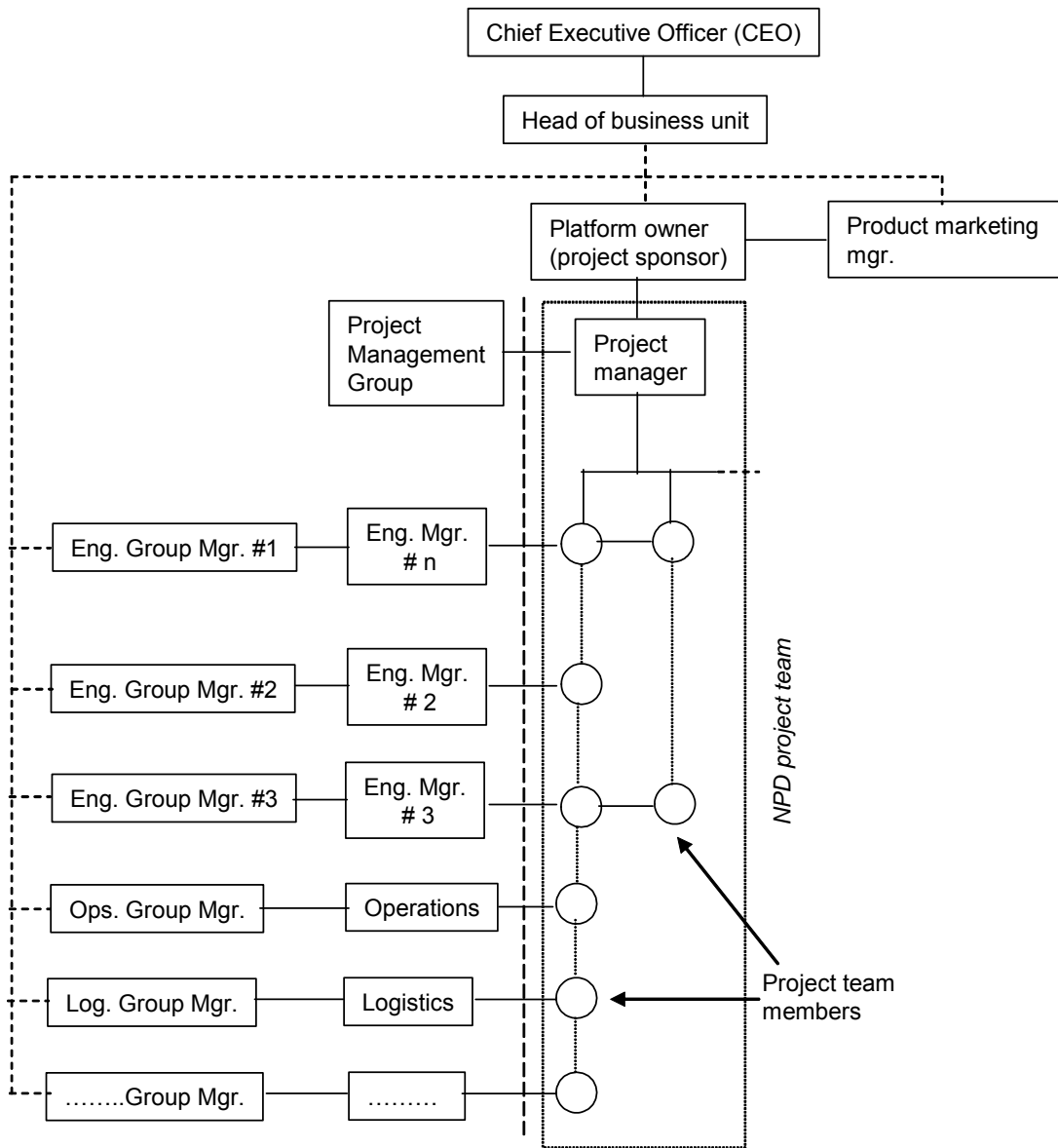
Figure 4.2.   Case 2 – Organisational structure for project management and governance

When the platforms owners decide to start a new project, they engage relevant functional groups to allocate resources to form the project team, one of whom is the project manager. After this point, a project manager takes over daily management of an NPD project until project delivery. In the structure and governance, project managers report to the platform owner for an NPD project. However, both Case 1 and Case 2 follow similar project selection criteria, and the project managers interact with the same engineering and operational groups to deliver a new product. They perform the same project management and relevant activities in a matrix team structure, therefore their project's immediate environments and challenges can be expected to be similar, although they are externally different to a project.

> *"Their [Company B] platform owners work with the product managers, who provide marketing information. They are engineers, and they say these are the things we need to do, since that's happening in the market. They own the money, and they are responsible for the project. It is his job to make sure that right people are put together in the team: project manager, infrastructure delivery manager, etc." (Participant 23; project manager; case 2; interview transcript: page 2)*

> *"My role there [Company B] was different. I was working with two people who had kind of a similar role to us [Company A]: product specialist was like an architect, and it was the project manager who was bringing the team together. I was from technical platform side, and I was talking a lot with the project manager. He might have technical skills, but he was counting on technical representatives for the development work." (Participant 19; cases 1 and 2; project manager; interview transcript: page 17)*

> *"In [Company B], we were doing similar portfolio management, determining the projects that benefit the company the most with minimum cost and maximum functionality. That was program management; they give you the money, and they say we want all of this and that. Under a program, you have many projects. Similar to [Company A], where I was reporting to the management, when the products are coming, and when is the business realisation happening." (Participant 20; program manager; cases 1 and 2; interview transcript: page 5)*

The organisational structure defines marketing personnel in Case 1, and engineering personnel in Case 2, as the project sponsors. The simple saying 'who has the gold puts the rule' indicates the authority who makes the final decisions on project related matters. The project teams consist of mostly technical people; the different approaches of technical and marketing personnel often leads to tensions between them. Case 2 experiences less tension because the sponsor is already a technical person. However, this tension, unless destructive, can be beneficial to the company in that it helps it to better meet customers' demands; neither structure is better or worse, each has its own merits.

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"I believe, there is less of politics in [Company B]. Here [Company A], the program manager tends to take sides with marketing. That does not offer a spirit of co-operation and teaming with the other people. We [Company A] have a very strongly KPI [Key Performance Indicator] driven culture. When I was in [Company B] and [Company D], that was not the case. People will be fairly ruthless here, if someone cannot make their KPIs, which may drive behaviours that are not necessarily for the benefit of the company, harmony, co-operation, or collaboration. This is a big observation, the difference between [Company A] and [Company B]." (Participant 7; manager of project managers; cases 1, 2 and 4; interview transcript: page 9)

2.2   New Product Development process

All the Telco cases employ stage-gated (or phase-gated) NPD processes, presented in Section 3.2 in Chapter 2, but with different numbers of gates. All the cases, except Case 2, have adopted the common four-stage NPD processes. In this study, the project activities of all cases are mapped to the four NPD phases – II, F&D, DIV and Closure – for consistency.

Case 2 has a six-stage NPD process with different names. It has two different versions, standard and fast (the latter with fewer stages to save time and to avoid bureaucracy). However, the NPD process can be clearly compared with Case 1, as shown in Figure 4.3. Several participants with experience in more than one case indicated they had very similar gating processes for NPD.
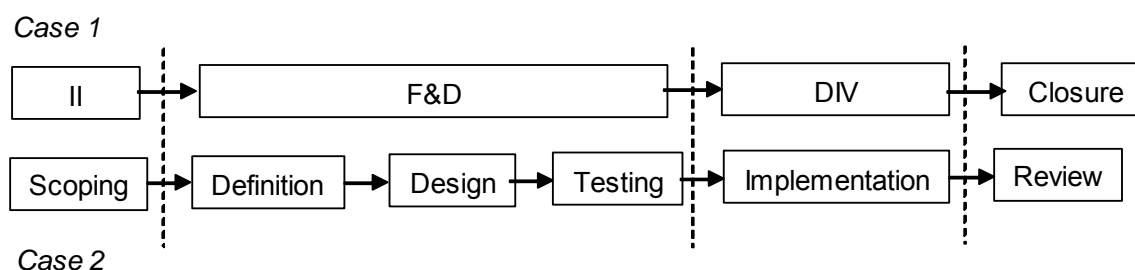
Figure 4.3. Mapping between the NPD phases between Case 1 and Case 2

"I strongly suspect the gating process that we are using here [in Company A], has come from [Company B]" (Participant 12; program and senior manager; cases 1 and 2; interview transcript: page 2)

"In [Company B], we had a similar NPD process, but it was named differently. They had financial reviews, where you had cost estimates and benefits." (Participant 14; project manager and manager of project manager; cases 1 and 2; interview transcript: page 15)

"In [Company D] we had very similar processes, but less hurdles, because the company is smaller. We also had II, F&D, DIV. etc. exactly the same. Whereas here [Company A], the company is bigger, and there is more process." (Participant 22; program manager; cases 1 and 4; interview transcript: page 12)

3   Classification of Telco NPD projects

The analysis of Telco NPD projects included a preliminary pilot study with a small number of the most experienced project managers and one of their managers in two business products development groups in Case 1, where the researcher had easier accesses to data sources. The pilot study led to classification of the projects at a high level, and indicated projects that required closer examination to better understand the project manager skill sets. Careful selection of participants ensured good coverage of Telco NPD projects; however, the pilot study's limited number of participants and projects compromised the generalisability of results, and it covered only the business product market segment.

The main research covered the whole spectrum of the industry. It included more cases, a larger population of participants with different roles in NPD projects, and NPD projects on consumer products. Associated project types were further refined in terms of the defining variables. In the interviews with the participants, who were experienced in both business and consumer products, attention was paid to discovering differences among the product and project types, particularly in certain projects identified in the pilot study as being particularly revealing about project manager skill sets.

The research findings presented below include results from both the pilot and main research. First, business and consumer products are compared, since the marketing literature generally divides products almost in any industry into these two broad categories. Next, the projects types, as commonly described by the majority of the participants from different cases, are presented. Since participants did not reveal

sufficient information to establish an apparent relation with the project manager skill sets, the projects are then reviewed and classified with a scheme appropriate for the analysis. Finally, the project types and this classification are mapped.

3.1 Telco business and consumer products

Telco, described as a service industry, is different from other pure service industries due to high technology and engineering content in its products. However, there are subtle differences between consumer and business Telco products; this section examines and compares these products and discusses implications for their management.

3.1.1 Consumer products

For consumer products, the market is based on volume and price. With increased competition after market deregulation, price is now one of the main drivers for market share. A Telco company must have a sufficient volume of customers, and then make small profit margin out of each to reach a justifiable business case. This is the single major factor why there are a few big players, shaping the market as oligopoly. Expensive capital investments needed to build a telecommunications infrastructure that supports a sustainable business make the cost of entering the market high. In recent times, even the rival Telco competitors are forming joint ventures or co-operations to reduce the cost in their investments. For example, cases 1 and 4 have recently announced an agreement to share the same next generation wireless 3G technology infrastructure. This is indeed an interesting example, because Telco companies have thus willingly become each others' business-to-business customers, not only due to the forced collaboration obliged by the compulsory regulations in the industry.

The consumer market segment requires a more careful analysis for new product definitions and requirements, because individual Telco companies must determine what customers want, and fund product development. In one case, a new product that had not been investigated well, even though being technologically advanced and with successful project management, did not reach break-even volume; the company had made over-optimistic assumptions about a new product without a reliable market survey.

"A [new multimedia feature in mobile systems] finished in time and budget, and on the scope. But, it cannot make money, its benefits are not realised. I think it is because of the content. It is $8 a month, but you watch it free on your TV. The business case was not well thought; they were too optimistic." (Participant 22; program manager; case 4; interview transcript: page 11)

As the number of customers can succeed or fail a business case, the timing for product launch can make a difference in the consumer market. Telco companies watch each others' marketing moves very closely, and develop products to get ahead of the competition. As the Australian Telco consumer market is relatively stable, they cannot afford delays in delivering a new product. If not delivered in time, customers can go to a competitor. Therefore, they have to launch new products on time, even leaving unresolved minor issues that may affect customer satisfaction or that do not impact on the product's main functionality.

"There are some studies that say time-to-market is key. That's true for a very competitive consumer type mass market product. For example, where introducing a new handset, product bundling or a new product, if you cannot get in front of your competitor by a day or week, that makes a difference." (Participant 18; senior manager; case 1; interview transcript: page 15)

"We knew that we had problems with data streaming in [a mobile consumer product], its quality was not the best, and extended work after the product launch was needed to address it. When people complained, we said we are working on it." (Participant 21; project manager; case 3; project 67; interview transcript: page 10)

Telco consumer products have few product variations, because a good level of standardisation is needed to support scalability over a big volume. Therefore, there are fewer selections in the features offered to users, and associated processes are simpler and cost effective. Because of the size, dedicated specialist groups own one type of product, and its systems and processes.

"We had an internal department for certain works. So, we had an application interfacing. Project managers either in consumer or business have to work on processes. In consumer, for example, there was [a new wireless technology] service activation team that took care of all those things. On the consumer side, there are separate project managers, responsible for activation only. Because of the size, the way it is structured." (Participant 21; project manager; case 3; project 69; interview transcript: page 16)

3.1.2 Business products

At the other end of the spectrum are the business products, the more lucrative and smaller segment of the market. Although they might use the same telecommunications infrastructure or base products as consumer products, they require customised solutions that meet the specific demands of a customer group. In some cases, they contribute to new product development costs, sharing the financial burden on the company.

> *"In business products, you have more revenue coming from a small number of corporate customers. You will make your business case, since the profit margin is higher. And, you can also have one of your big customers, and do a joint venture to develop a new product. In consumer, you cannot; you have small money from each one, and you try to make the volume of the customers." (Participant 22; program manager; cases 1 and 4; interview transcript: page 12)*

The business products are a livelihood for many business customers; any failure in the product is directly related to their financial loss. To prevent it in the first place, they usually came with clearer and more detailed product definitions and requirements, as they had their technical experts to support their operations. Therefore, the customers' demands were known to a greater degree, the marketing risk was lower than the consumer products. However, they still have challenges; unlike the consumer market segment, business products cannot have a 'one size fits all' concept. The support systems and processes show a significant variation over the business product range, where the product positioning is the key. Ranging from a low level entry business product to large corporate level, where the service must be working without degradation and disruption, there needs to be a high level of congruity between technologies and business processes.

> *"It depends on where the product is going to be positioned in the market, as to what is more important. If you are offering a lower end product, where you are targeting inexpensive equipment and best effort support, quality is not really that important, you do not need to bullet-proof. Processes may be important to scale up for thousands; close to cheap commoditised type products. If you are building a more robust and reliable product at the corporate niche, the target is high quality, high performance, then technicals become more important." (Participant 16; product manager; case 1; interview transcript: page 15)*

As there is more emphasis on the quality of business products, unlike the consumer market, some delay in the new product delivery is affordable to improve quality and better satisfy customers' requirements. However, it does not imply that a delay to perfect a product is acceptable. Time constraints, ongoing financial relations with

business customers, and limited numbers compared with the consumer market, exert pressure to be more sensitive to the product quality and its support.

> *"Generally speaking in business market, a month delay is very rare to cost you millions in the revenue. You can spend that extra month to discover and fix more faults, so the quality of the product is much better; you have got to get an acceptable level to the market. The net result is long term, impacts on customers and your company's reputation. Putting a faulty product may upset a bank, and that failure lives with you for many years. But, you still need to make a compromise; don't be late for six months."* (Participant 18; senior manager; case 1; interview transcript: page 15)

3.1.3 Impact of product types on project manager skill sets

The diminishing profit margins with increased competition force Telco companies to take cost cutting measures, and to make use of their infrastructure shared among products, either consumer or business. The technology is advancing and facilitating convergence of Telco products to benefit a common high speed packet data networks. Therefore, boundaries between consumer and business NPD projects are becoming less clear cut. For example, one case re-used a new product in the other market segment with process re-engineering.

> *"One business unit of [Company A] wanted to re-sell another [another product of another business unit]. I worked in process development; apparently, some process changes are required."* (Participant 4; project manager; case 1; project 16; interview transcript: page 7)

The differences in product characteristics between the consumer and business products raise the question of whether managing their associated NPD projects also requires different skills. In addition to analysing individual projects, the participants, who have managed NPD projects for both market segments, were asked to compare them. To minimise potential product bias, participants were first questioned about the challenges in their consumer and business NPD projects, and then requested to compare if and how they managed these differently. They responded that they had similar challenges regardless of the product type, and used the same skills to overcome them. The rest of the research reflects this outcome, an NPD project can be either a consumer or a business product.

> *"With consumer, it is the type of product it differs from business market. But they have the same targets. Comparing project management in between, you are still*

responsible for the solution, for putting the processes and for project management."
(Participant 21; project manager; case 1 and 3; interview transcript: page 1)

"In consumer segment, you are alone by yourself. So, the marketing manager must be clued up what is wanted in the market, and how to sell. There are also users under a corporate business customer, just added up in one big account. The NPD project processes are still exactly the same." (Participant 22; program manager; cases 1 and 4; interview transcript: page 12)

"It started as a New Technology Introduction [a project type], and the funding was allocated within platforms, as they were the sponsor. Therefore we had to look at it again, who is beneficiary of this. We realised it was not just business, and consumer and mobile also had a component. They needed to use this functionality." (Participant 19; project manager; case 1; project 54; interview transcript: page 7)

3.2   Telco NPD project types

The participants did not consider that all the NPD projects were the same, and they referred to different project types. An introduction to these types is useful to better understand what is involved in Telco NPD project. After reaching data saturation, the researcher examined the sample projects in the interview transcripts, and conducted a second short interview or discussions with a couple of experienced and knowledgeable participants about the definitions of the project types and their importance as a variable for the skill sets. They categorised the NPD project types according to how a Telco company responds to market demands, as shown in Table 4.1.

PROJECT TYPE	DEFINING VARIABLES			
	Product	Technology	Process	No of stakeholders
New Technology Introduction (NTI)	?	X	X	High
New Customer Product Development (NCPD)	X	?	X	High
Enhanced Product Development (EPD)	✓	?	?	High
Small projects	✓	✓	✓	Low
Bids	?	?	?	High / Low
Small product customisations (SPC)	✓	✓	?	Low

X: Does not exist in the company yet, **?**: May or may not exist, or impacted, ✓ : Already available.
Grey rows: Specific to business products.

Table 4.1. Detailed project types and variables used for definitions

It is worthwhile to note that they did not define only one variable, like technology, to describe a type. The last two rows are valid only for the business market segment, depending on the extent of the product customisation.

3.2.1 New Technology Introduction (NTI) projects

As the demands for new products grow, network equipment and supporting systems need to be updated to accommodate the possible new features and increased capacity. They modify the underlying infrastructure, or employ new technologies that can offer more scalable solutions to handle the growth, but the associated products must stay the same from a user perspective. These requirements have been realised in NTI projects. In some instances, when full backward compatibility could not be provided, a product redevelopment work was needed to minimise the gap between the old and new technologies in the products. In some sense, this is equivalent to an NPD effort with the specifications imposed by the existing products in the market. For this reason, the 'Product' column in Table 4.1 is indicated with a question mark.

> *"The vendor promised it could replace everything the existing system could do. There were incompatibilities that we detected during testing. When you enable a feature, another feature cannot be enabled. Because of the way features work due to the differences in the new technology. In the old one, you can have both, but now you cannot." (Participant 17; project manager; case 1; project 38; interview transcript: page 14)*

> *"This product was supposed to replace all the earlier similar products. But it did not have the identical functionality. So that also impacted the implementation. Suddenly, targeted customers were separated into: some will accept the technology, some will not." (Participant 20; program manager; case 1; project 25; interview transcript: page 9)*

The NTI projects generally involved external vendors (i.e. technology and equipment suppliers) selected through a tendering process. Heavy regression tests were performed to guarantee that critical key requirements are satisfied with no or minimum impact on the existing products. Training internal development and operation engineers and knowledge transfer were important to gain the internal capability in order to support new technologies.

> *"The technology supported in every product used an access [electrical connection to customer premises]. It had a major impact. There was a lot of testing that had to be done for each of those products. It was just a replacement for the existing*

platform, and would not change the nature of the products at all. But we had to be sure that our support groups could continue in the same way as before. There was pressure to make the contractual requirements and to roll out the services in a short time frame." (Participant 7; manager of project managers; case 1; project 21; interview transcript: page 3)

NTI projects did not have the same urgency as in New Customer Product Development (NCPD) if there was no direct customer contact. They did not have the same priority in the company, and senior managers were little concerned with the project. They preferred the resources to be used in financially rewarding projects. NTI projects attracted attention only when they might have significant financial impacts. As the technologies reach end of their life cycle, their manufacturers stopped providing technical support and equipment spare parts, with the potential to create serious operational issues. Similarly, when old legacy systems reached their limits they could not carry the increasing load; in case of a service disruption, a Telco company faced the risk of losing customers and incurring penalties due to the contractual agreements. Regulatory compliances, which similarly do not have customer facing changes and financial benefits, were also subject to certain legally mandated completion dates. Such system and platform replacement and regulatory NTI projects needed to cross a threshold to be given priority. Resources were usually allocated too late, when possible consequences had become unacceptable; time for development work was then scarce and the pressure to finish in time increased.

"It was just additional redundancy in the network. There is no marketing involved in this project, it was for internal only. We did not have time pressure. The difficulty was that there is no real drive. They had some concept idea, but they did not produce the detailed requirements. It did not have any clear budget, control, or any clear time target, even it did not have a proper team. I do not think that senior managers cared too much about it. In this project, there is no proper II, F&D and DIV phase. At the end, it is delivered with a delay. But, it did not have any senior management attention, because it was not a high profile project." (Participant 21; project manager; case 3; project 68; interview transcript: page 12)

"Being a regulatory, it did not have proper funding, they did not have their own budget. By such a date, you need to comply with it, and no profit at all. It started with [a business unit], then it moved to [another business unit], where it was finally realised." (Participant 19; project manager; case 1; project 54; interview transcript: page 9)

It is desirable to switch to new technologies effortlessly. However, the required development work sometimes had the same level of complexity as if developing a brand new product. Since the operational groups were structured around the technologies, the business processes also needed to be reviewed to adapt to the technology changes. In

some cases, the underlying mechanism of a product changed in such a way that structural changes were also unavoidable.

> *"This product [from switching to packet data technology], when initially planned, was thought to fit very well within the existing organisational structure. But, when the product was developed, we found that we need to modify the organisational structure it. It comes to the processes issue; different groups interact for different activities. It is passing from a group, finishing the activity, then another group doing something, and both groups do the testing together. This is fundamentally shifting the way they work. Because it was new technology, it required a lot of change in existing process. It got across just about every platform, group and operational group." (Participant 17; project manager; case 1; project 38; interview transcript: page 15)*

> *"Because it was very new technology, it required lots of changes to existing processes and change in the support groups. It got across every platform and operational groups." (Participant 18; senior manager; case 1; project 38; interview transcript: page 16)*

The NTI projects were usually engineering-driven projects and the technology, hidden from users, did not dictate many options. Therefore, the scope in NTI projects was usually clearer than in NCPD projects. They had short initial phases and generally went directly to implementation stage. However, all NPD projects should align with the company's business growth strategies. The business units, serving different market segments, had disagreements and required contradicting features. Therefore, drawing boundaries to align with the strategy was not always easy. This again indicates that it is not the technology, but again dissimilar business requirements that influence NTI projects.

> *"Because we replaced the old platform, we did not have any issue with the scoping to define what was required. We did not have F&D, and directly went into DIV. Generally, not for transmission or access NTIs. A bit more is known about what needs to be done. It does not have many options necessarily. I do not think that there were major issues with scoping, it was well understood. It took sometime, because of other projects; [a business unit] always knew these issues from the beginning, but [another business unit] did not define the requirements for what they wanted." (Participant 7; manager of project manager; case 1; project 22; interview transcript: page 3)*

3.2.2 New Customer Product Development (NCPD) projects

NCPD projects deliver a new product that had not previously been on the market. Some NPD projects require only process re-engineering of an already existing product to be

adopted in the target business group's operational structure. Since the technology uncertainties would have already been addressed in previous NCPD projects, these are cost effective to implement instead of having to be developed from scratch.

In theory, NCPD projects seize market opportunities. However, in practice this was not always the case. Different business units had contradictory expectations and pushed for their agendas, as their survival and growth depend on new products. Considering that several NPD projects were competing for shared resources, very optimistic business cases were sometimes produced to catch senior management attention and to gain priority over other projects. Even with successful project management, some of those NCPD projects led to new products that have insufficient demand and were therefore set for failure from the beginning.

> *"They need to come up with new products, otherwise they may not have a job. They propose new stuff to do, it often does not seem to have a good rationale. There are lots of other reasons why they keep a huge list of products all the time. Many of their developments do not work well. Even if they were completed, 80% do not make money. For example [a Telco product] cost millions of dollars, and I think it went to a couple of customers only." (Participant 13; project manager; case 1; interview transcript: page 3)*

> *"[Project 39] did not have any justifiable business case, or was not properly done. This project progressed to late stages, just with the pressure from marketing senior managers. At the end, it was withdrawn, with around 2.5 million dollars sunk cost." (Participant 5; manager of project managers; case 3; project 39; interview notes: page 2)*

Many of the NCPD projects involved technology transfer to the company. If the technologies were mature and were already being used elsewhere, defining a project scope was relatively easy. Another benefit was to find many vendors, already experienced with the product. The unknowns could be resolved with adjustments to suit local needs in the company. Vendors have usually met similar problems elsewhere, and already have the solutions or workarounds to overcome them. These projects had shorter II and F&D phases, because what was required to implement the technology was already known a greater degree.

> *"The scoping was fairly straightforward. The standards were much better understood for [a voice product on a data network]. It was already mature in other markets oversees. This was more of a mature technology, readily available by numerous suppliers, and many implementations already visible to us." (Participant 14; manager of project managers; case 1; project 44; interview transcript: page 12)*

"It was a new technology to the company, and relatively new to the market, but the vendor was experienced. We knew the requirements clearly. It had a very short II phase." (Participant 17; project manager; case 1; project 50; interview transcript: page 6)

Industry competition did not let Telco companies employ only tried technologies, where all problems were already resolved. It is practically impossible to perfect any technology; boundaries are always further expanded and superseded. In several cases, it required relatively newer technologies that were not yet widely used. However, these should not be confused with R&D projects. They had completed their product innovation cycle, and had been proven under limited working conditions. Or similarly, they had been well proven individually, but had not previously been integrated in a Telco-specific application. NCPD projects involving new technologies had the most uncertainties and risks among the example projects; they had to address not just technology, but also resultant organisational changes. These projects also possess NTI characteristics, adding more complexity. They occupied the majority of the sample projects encountered during the research interviews. This was expected, as the researcher intentionally enquired about participants' projects with the most challenges.

"[A new voice product over data networks] was leading edge technology three years back, and it is still new technology. It was like science fiction in another words that time. No-one had known what was all this about. People had their isolated views. The vendor made this box, it works as gateway for this technology. Marketing itself again didn't know much about it. They just read a couple of articles, and brochures from the vendors. In America, people did it in a very limited fashion. Not enough information, skilled people were not available, saying that this is what I can do. " (Participant 8; project manager; case 1; project 25; interview transcript: page 3)

"This is how it would work: the basic known was that it came with a platform, say the content factory; this comes out of the box functionality. Another part transcoder converts information into another format suitable to transmit the data. All these components do specific functions. Some parts of the project were to connect the dots together, and ensure that the flow is as per requirements; that was the tricky part." (Participant 21; project manager; case 3; project 67; interview transcript: page 9)

Conventional project management practices, which are basically defining scope, developing plans and tracking for completion, were not effective in these projects. The vendor specifications helped drafting requirements, but they were on paper. As the project team played with a new technology, understood its limitations, and better estimated cost and duration, several assumptions had changed during the project's progress. Early theoretical scope definitions were not applicable. Flexibility was needed

in the project management to accommodate those changes for a more realistic product that would be acceptable in the market. This was indeed an iterative cycle rather than following a straight path, as the team explores what is realisable and re-defines the product accordingly.

> *"It was a green field technology, which nobody played, touched or had seen before in the company. They started to work in the standard model. There was a lot of tension, because people did not have the knowledge. After six months, everybody realised that we are just learning, we cannot apply our standard way. In reality, this is a question of understanding, as you go along. If you know what you do not know, that's fine. But, the things that we do not know are the problems. We went back and scratched the entire requirements document and wrote all of it again. The scope was changing as we were learning more the technology." (Participant 8; project manager; case 1; project 25; interview transcript: page 2)*

> *"Since this was a new technology, we did not close the scope, although the project progressed. By the time we delivered the basic function, the perception of the marketing changed, so they wanted more and more features and options, to make the product more sellable." (Participant 17; project manager; case 1; project 50; interview transcript: page 8)*

3.2.3 Enhanced Product Development (EPD) projects

EPD projects incorporate a new or existing technology and processes to enhance a product. They are product line extensions, or new varieties of the same product with different feature sets. Adding new functions to improve customer experience was another common example cited by participants. In these projects, the requirements were usually clear, since the product was already in the market, it had completed its normal development cycle, and most of its issues in the field had been resolved. However, they had similar process implications and some compatibility issues with a new technology, if needed in the enhancement. Since these projects had considerable financial benefits for a comparatively small investment, the same delivery constraints as for NTI and NCPD also applied.

> *"I remember a couple of things about [a product feature issue], and we needed to change it. To make it compatible with the previous version of the product, we had to start another enhancement project for this." (Participant 15; product manager; case 1; project 13; interview transcript: page 5)*

3.2.4 Small projects

Small projects were for improving aspects of customer contacts, process fixes to increase efficiency and Life Cycle Management (LCM) – small enhancements over a product's life cycle. Their major differences were their smaller costs, and process and revenue impacts. The required changes were confined within a couple of groups, without changing interfaces with others in the company. Since they did not have significant revenue impacts, their priorities were low and delivery times were flexible. Nothing was unknown about the required changes, and they directly went to implementation stage.

> *"Generally speaking, something a life cycle project is going to be small. You then have an appropriate skill level, that's sure. Normally, that's given to less experienced engineers in any case." (Participant 2; project manager; case 1; second interview transcript: page 4)*

> *"Small projects tend to be a bit loose. You have mainly some regular meetings, phone calls, just to keep the things on track, and trying to address any problems that comes, as best as you can." (Participant 1; project manager; case 1; interview transcript: page 6)*

3.2.5 Bids

These are the most lucrative projects serving for a small niche in the business market. Some customers, who are usually corporates in private and public sectors, require highly customised solutions that cannot be satisfied with consumer or standard business products. New solutions are developed for their specific requirements by using new or existing technologies and products. Using standard products has negligible impact other than tailoring processes to their service levels. They sometimes require dedicated processes to ensure minimum service disruption. The other extreme requires a brand new solution and a new product not previously in the market. Then, bids can be the same as NCPD projects, with the delivery time frames defined in contractual agreements.

In contrast to consumer products, where the company has to fund development costs from its own resources, customers fully meet these costs for bids. This arrangement was beneficial in more than one instance. When the cost of a NCPD project that produces

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similar new products was not justifiable with its market demand, a bid's outcome could be re-used, making it feasible with smaller differential development costs.

> *"We did a project, a private network solution for a major customer, a big financial institution. It was one of the early products in that area. Marketing presented a demo version of the product to the customer, and they liked it. It was very innovative product, and we had nothing else doing that capability that time. Later, we developed other similar standard products." (Participant 18; senior manager; case 1; project 52; interview transcript: page 9)*

3.2.6 Small Product Customisation (SPC)

When a standard product cannot satisfy a business customer's demands, and only small one-off changes are required, business processes can modify the product. Generally Telco companies do not like to make such changes, but customers' buying power or profitable cases, justify them. Since these changes are generally straightforward to implement, they do not need project managers' heavy involvement.

> *"SPC is specific to a customer. Product support does not change, process-wise it may not change. Only some features that are not in the standard product change for the activation. If it costs high, they consider it as a bid." (Participant 2; project manager; case 1; second interview transcript: page 4)*

3.2.7 Impact of project types on project manager skill sets

Project types share similarities: an NTI project may have similar consequences to an NCPD one, if the technology changes touch several products. NCPD projects may include NTI components. Bids may initiate NCPD projects to meet the specific demands of business customers. Therefore, the project types commonly referred to in Telco do not give a clear indication of the challenges faced, or the project manager skill sets required. One of the participants, who was specifically interviewed about project types and how they influence project management, made it very clear.

> *"[Researcher summarising the discussions:] Managing projects is more related to the complexity, not the type of the project much. When you look at the complexity, currently the processes are overwhelming, because of the shortage of the technology in today's conditions. Accordingly, it is directly related to the size of the project. If there are too many stakeholders, managing that is more challenging, not dependent on NPD, EPD or LCM. [Participant:] Exactly, this is irrespective. It is*

not the type of the project, it is the complexity of the project; that's the matter."
(Participant 2; project manager; case 1; second interview transcript: page 11)

"There are always challenges. I am just finishing one project. It came out as an NPD, or other EPD. We were replacing platform components [NTI], and it emerged as a product [NCPD]. It started about 2–3 years ago, and I picked it up from other project managers. This was a long one, with several releases" *(Participant 19; project manager; case 1; project 56; interview transcript: page 4)*

"The time frame was difficult, because we had a time frame in place for us, because management had made a decision not to deploy the existing [equipment] from another vendor for [a] bid. There was pressure on us to make the contractual requirements of the bid. We first had NTI completed, so they could roll out [a new product] services [NCPD]." (Participant 7; manager of project managers; case 1; project 21; interview transcript: page 3)

"[Participant describing challenges in NPD projects at a high level in company B] We had both the technology, external competition, and of course, funding problems [for any kind of NPD]. Behind that is also a sufficient business case to get hold on." (Participant127; program and senior manager; case1 and 2; interview transcript: page 3)

More than one project type can share the same characteristics, and so those project variables that best explicate the skills sets have been investigated.

3.3   Classification of Telco NPD projects for skill sets

The analysis of projects has concentrated on project characteristics that best illustrate why and how the project managers have benefited from their skills. This section presents the classification of the projects to better explain the project manager skill sets in Telco NPD, and their indicators. Special focus is given to the kind of challenges that project managers are facing, to identify the skill sets essential for successful project managers.

Telco NPD projects fall into two categories: small, and large and complex, as shown in Table 4.2. This classification, drafted after the pilot study, was verified in the larger study as providing good indicators for judging the difficulty of the NPD projects. The term 'small' should not be confused with 'small projects', discussed above in Section 3.2.6. It corresponds to a broader category of NPD projects, sharing the same characteristics. Small projects are fundamentally different from large and complex projects, and are treated accordingly.

"Those were old platforms, old technology, existing products. Nobody really gave them a second thought; small projects with small budgets. They had some impacts on the products, but not serious. Small changes and enhancements on the product, not impacting the revenue too much. Compared to a higher priority project, you can stop these ones, and focus on it." (Participant 21; project manager; case 3; interview transcript: page 15)

"When it gets to small projects, it is mostly at the operational level, basically to improve the efficiency. And their priority is low. The managers want it to be done, but they're not particular to do it immediately, because it is not giving any revenues, or may not give huge benefits." (Participant 2; project manager; case 1; interview transcript: page 4)

	PROJECT TYPE		
	Large and complex		**Small**
Stakeholders	Many		One or two
Cost	High		Low
Revenue impact	High		Low
Duration	Long		Short
Time-to-market	Fast		Flexible
Technology	New	Known	Known
Description	New technology introduction to the market	Incremental product modifications	Life cycle management
			Customer facing product improvements
			Process fixes

Dark grey: new product development that involve technology projects. Grey: NPD with many stakeholders. Light grey: small projects.

Table 4.2. Comparison of large and complex versus small projects

Large and complex projects are usually new technology introductions, which may or may not involve a new product to the market, or incremental product modifications of an existing product that impact many stakeholders. New technologies in Telco are not generally employed until they are mature enough, and proven to be reliable. However, they can still contain many unknowns for deployment in practice, and impose changes on many groups, how they work and interact with each other.

"More complex products from suppliers in turn generate more technologies. More technologies are managed by more people. More people mean, because the way the Telcos are organised around technologies. So, once you get that boundary set up,

then you get boundary issues to develop a new product that involves technologies."
(Participant 4; project manager; case 1; interview transcript: page 14)

The technologies usually work satisfactorily, otherwise the product would not reach this level of realisation in the industry. Technology is neither the only nor the dominant factor creating complexity. A solution can often be found to overcome technology-related challenges. The real challenges are integrating and aligning the technologies with business processes in a short time, imposed by competition. In Telco NPD projects, business processes outweigh technology concerns. An incremental product modification that involves many stakeholders also requires similar changes. Large and complex projects consequently cost more and require better planning and longer durations. If external parties are involved, their experts are often out of direct control of the project managers, who need to be cautious and aware of risks. Because of their impact on the bottom line by creating additional revenues and high costs, these projects tend to be more visible within the company and attract senior management's attention.

Other industries have projects with similar characteristics; the comparisons made by several participants highlighted Telco's distinguishing characteristics. Several participants who had worked in other industries, also compared NPD projects and emphasised the differences in Telco.

> *"Compared to IT, Telco is external and work with real customers. IT is internal and focused on developing an application. In Telco, it is processes, plus support after product launch." (Participant 9; senior manager; case 1; interview transcript: page 10)*

> *"Because of the dynamics in Telco, direction changes more frequently. In banking, we have legacy systems, cost cutting exercise or improvements. You need to lower the costs, not to the extent in Telco. I would say Telco is much tougher." (Participant 20; program manager; cases 1 and 2; interview transcript: page 18)*

> *"In IT, the user has to think, how do I get my requirements to an IT project. Then, they are translated into specific code segments. But for Telco, you need to think about how I can change the processes, which groups need to get involved. It is not straightforward as software development. Do I need billing and customer service? A lot more than technical work, it is a relationship process." (Participant 21; project manager; case 1 and 3; interview transcript: page 19)*

> *"Telco is much different from IT and R&D. Our vendors do R&D, we are not doing that here. We are putting bits and pieces together from others, whether they are third party carriers, network interfacing, equipment, and trying to package all of the capability. But, what a customer sees is a plug. Different project management styles, because the content and context are different in IT, R&D and Telco. You are not producing equipment, but you are putting them together." (Participant 7; manager of project managers; cases 1, 2 and 4; page 12)*

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Some participants mentioned other criteria for classifying the projects: the priority dictated by the senior management among the projects, and project risks and unknowns are two examples.

> *"I think, one of the critical things is the visibility within the company. When initially looking at the project, whether small or large, we need to ask the priority to senior managers. What is the priority of this particular project?" (Participant 2; project manager; case 1; interview transcript: page 7)*

> *"Even for a big project, if you know something that has to be done, you can put down a fairly accurate kind of plan. I suppose, what gets to be unknowns in that. If you know the technology, your risks, your knowns and unknowns, it is going to be different." (Participant 3; manager of project managers; case 1; interview transcript: page 11)*

In larger NPD projects, the stakeholders are many and the cost high, and therefore they get senior managers' attention. On the other hand, small projects, with little financial benefits, can be far from their sights. By taking priority as a criterion for distinguishing projects, the participants have indirectly described large and complex projects versus small projects. In the second example above, the researcher further clarified what the participant meant. In small NPD projects, risks and unknowns were far less, since similar work has been done before, and how long it takes is known to a greater degree. Likewise, there may be very large infrastructure growth projects with no unknowns, and therefore no risks, but they are not necessarily NPD; it is a matter of logistics only. These participants have indirectly described large and complex projects versus small projects. They are limited to describing a couple of the dimensions in the project classification in Table 4.2.

Other research has similarly noted that not all projects are the same or require the same attention. Among the project manager competency standards, GAPPS was the first to recognise differences among the projects, in that some are inherently harder to manage than others. It has a classification named Crawford-Ishikura Factor Table for Evaluating Roles (CIFTER) (GAPPS 2006) for assessing competency, regardless of the industry or project type. When the projects cited during the interviews were rated with CIFTER complexity factors on a scale from 7 to 28, their differences once again became clear. The scoring of small projects ranged from 7 to 10, and large and complex projects between 20 and 25 points, as shown in Table 4.3 (details of CIFTER assessments are available in Appendix E). According to GAPPS, the projects rated less than 12 CIFTER points cannot be used to evaluate project manager competency, since they do not

provide reliable evidence for assessing it. One of the pilot study outcomes was therefore to focus more on large and complex projects in the main research, as they exhibit the project challenges better. Consequently, the majority of the sample projects (65 out of 72) are large and complex. There are no clear-cut boundaries, but considering CIFTER ratings, they cost more than $1m, last more than nine months, and have 10 or more stakeholders. It was also clear from the participants; when asked for the projects in which they had challenges, that they did not identify small projects.

Project Management Complexity Factor	Descriptors and points			
1. Stability of the overall project context	Very high (1)	High (2)	Moderate (3)	Low (4)
2. Number of distinct disciplines, methods, or approaches involved in performing the project	Low (1)	Moderate (2)	High (3)	Very high (4)
3. Magnitude of legal, social, or environmental implications from performing the project	Low (1)	Moderate (2)	High (3)	Very high (4)
4. Overall expected financial impact (positive or negative) on the project's stakeholders	Low (1)	Moderate (2)	High (3)	Very high (4)
5. Strategic importance of the project to the organisation or organisations involved	Very low (1)	Low (2)	Moderate (3)	High (4)
6. Stakeholder cohesion regarding the characteristics of the product of the project	High (1)	Moderate (2)	Low (3)	Very low (4)
7. Number and variety of interfaces between the project and other organisational entities	Very low (1)	Low (2)	Moderate (3)	High (4)

Dark grey: large and complex projects. Light grey: small projects.

Table 4.3. CIFTER evaluation for small and large projects

3.3.1 Mapping between project types and NPD projects

The characteristics of the project types that the participants referred in Section 3.2 were tentatively matched to the classification produced for the project manager skills. It

produced an indication of the difficulty of a project on a scale between the two extremes: large and complex, and small projects, as shown in Figure 4.4. This approximate representation again proves that it is inappropriate to consider project types to evaluate the skill sets.

Large and complex   Small

| NTI |
| NCPD |
| EPD |
| Bids |
| Small, SPC |
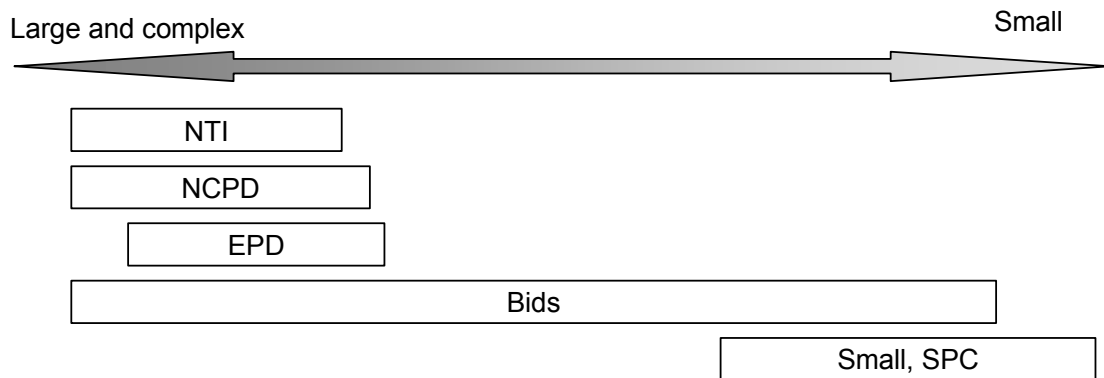
Figure 4.4.   Mapping between types of sample projects in this study and classification of the projects for skill sets

4   Telco NPD project management challenges

The empirical investigation has shown that large and complex projects with the characteristics in Table 4.2 provide more information for studying the skill sets. This section investigates the challenges in these projects to have a better picture of the conditions that the project managers had to deal with, before analysing for the skill sets.

Although specific questions were not posed, some participants readily provided information as to how the deregulations had changed the NPD in Telco. First, a short summary is given about how was the NPD project management historically. Then, its challenges in today's NPD projects are examined, and finally, what the Telcos are doing to improve the key areas is discussed.

4.1   Project management before industry deregulation

More than a decade ago in Australia, Telco services were provided by one state-owned company. It was a cash-rich monopoly with vast resources. Some project phases were used, but they were not mainly for financial purposes. Even though project management tools were used to track cost and duration, their priority was neither of these, but rather to deliver a product with very high quality; the main goal was technical excellence. IT project management methodologies had been well established for a long time, and very similar processes to IT had been adopted to manage Telco NPD projects. They had lengthy review and documentation procedures at every step, since cost or time were not major indicators for project management success. The R&D group had owned the NPD in Case 2, indicating that it was not considered as a project with tight project control and management.

> *"Compared to the quality, cost was not considered. We got tight quality control and auditing. Product was delivered with a best effort, time was not critical. We had waterfall type of approach for product development, which IT has already established. We used to do like IT: user requirements specification, systems requirements specification, then develop system and functional modules to be tested against the specifications." (Participant 17; project manager; case 2; interview transcript: page 3)*

> *"They [company B] actually implemented their [a new technology that time] through their R&D labs, who provided the technical expertise, not other parts of the organisation." (Participant 2; manager of project managers; case 1; interview transcript: page 2)*

> *"We had quality assurance systems and processes, and ISO 9000 certification. You have to measure what you are doing. You are doing it at every stage for process improvement." (Participant 6; project manager; case 2; interview transcript: page 3)*

The researcher also visited a European Telco company that was privatised about a year previously, and interviewed one of the consultants to the company. He stated similar observations, and gave examples of some old projects that were successful technically, but without any clear goals about what to offer customers. The whole organisation is currently being reformed by establishing a program office and project management divisions to form an organisational matrix structure, instead of the old functional one.

> *"They had product development, but never sold. For example, they have two MPLS networks [a shared IP network technology], but they have not been used at all. They were technically fine, but had no clear purpose for doing it." (consultant to a European Telco company; interview transcript: page 10)*

4.2   Current challenges in Telco NPD projects

The toughening competition has eroded profit margins after the market deregulations, and there has been a holistic shift in the way NPD is performed. Telco companies now have defined groups, management structure and a more systematic approach. It is now treated as special projects with strict budget and time constraints; quality is no longer the only expected outcome.

> *"The market has changed. I was with [company B]. They had similar issues. I put them down to the nature of the industry. Probably if I worked for them, I would still be experiencing the same sorts of things." (Participant 1; project manager; cases 1 and 2; interview transcript: page 2)*

The above sections that presented project types and classification for the project manager skill sets have already given clues about the challenges in large and complex Telco NPD projects. Many of the projects experienced multiple simultaneous challenges, compounding their impacts. Each NPD project has its own conditions, and the challenges may vary. This section explores the major challenges that fundamentally shape Telco NPD projects.

4.2.1   4.2.1   Business processes

What often appeared to be routine project management activities obscured what were, in reality, significant challenges for the project managers. The researcher specifically asked participating project managers to compare the difficulties they met in their NPD projects, and describe those on which they spent more effort, or he queried other participants on what they observed about project managers. The consistent answer was the integration of technologies with business processes; a new product is complete only when complementing support processes and systems are in place. Furthermore, the feedback from the project sponsors indicated that good processes and systems can often compensate for the technical limitations, increase customer satisfaction, and influence a new product's success. The business products, especially, require very reliable and robust processes, since any failure in the products is directly related to the customers' financial loss.

"There are two sides: technology and processes. Even with the technology limitations are there, if the processes are good and supporting the technology, product can still do well. Service assurance becomes the most vital factor." (Participant 11; product manager; case 1; interview transcript: page 4)

"The technical is important, in regards of the quality of the end deliverable. But, processes and systems that can be scalable with the product are the most important. From the technical perspective, this project was a success, but from a business perspective it was a total failure. If you do not have the appropriate processes, which are too labour intensive and complicated, the product cannot be provisioned, or fixed in a short time, it does not meet customer expectations. You need to be able to handle the volume." (Participant 16; product manager; case 1; project 31; interview transcript: page 15)

"When you introduce a new technology, there may be issues or problems, but you can work on them. The process is mostly the challenging one, because the people used to have one mode of operations. It sometimes require paradigm shift in minds." (Participant 17; project manager; case 1; interview transcript: page 9)

"They were not used to this type of product. We needed to write the work instructions, and also to advise what processes are required. There was a multi-team effort, that is, fault diagnosis became another complex process. Then, we had a system integrator, an external vendor, to commission the network at the customer site." (Participant 18; senior manager; case 1; project 38; interview transcript: page 6)

"There was always alarm requirements, and everything else. What we were doing is extending the same piece of kit, and putting in the customer premises. Operationally, it totally had a different requirement. This thing was new, from operational perspective, assurance, it was completely new, and therefore we had a lot of policy issues around, who is going to look after. This has started the centralisation of a lot of controls. Then, you had political disputes, started to come in. Organisational changes and issues coming out. Process and people were most challenging. The technology is someway black and white." (Participant 12; senior manager; case 2; project 59; interview transcript: page 7)

As more organisational groups were involved in process changes, the possible interactions among them increased exponentially. Each group has its preference, and reaching an agreement among all required significant effort. In some projects, a dedicated project manager was assigned specifically to handle process aspects. Therefore, the number of stakeholders is an indication of complexity in Telco NPD projects. The fewer the stakeholders, the less the complication among the interfaces, and the easier it is to manage. At the extreme, an organisational structural change was required to support a new product. In this case, project managers had bigger challenges, and needed senior management support to implement them.

"The technology, although it is complex, usually involves a smaller group, like three or four engineers, get involved in technology issues. The vendor, software engineers, testers, etc., usually a small team. When you get to process issues, it cuts

across multiple groups, and it is harder, much more challenging to get those groups into a room, all understanding the process change, and how they are contributing what can be done better. Then, they have to go back and train their people, who are going to use the process. Especially, when the process change means there is going to be some organisational changes to support the new product, that's much harder." (Participant 18; senior manager; case 1; interview transcript: page 14)

"Of course, the fewer people you get involved, it is easier. Fewer interfaces in the processes, the less complexity. Especially the complex projects sometimes had two project managers: one was doing more of the project management role, the other one was doing more of the process. In some projects of mine, I was having other project managers for me; one was working on the processes only." (Participant 19; project manager; case 1; interview transcript: page 18)

4.2.2 Technology

The advances in computing and electronic technologies are leading changes in several industries, and Telco is one of the best examples. In a decade, with open technology standards in mobile (e.g. GSM, 3G) and data communications (e.g. Internet Protocol, Ethernet), they have caused significant changes in the industry. The cost of bandwidth (i.e. virtually a pipe to carry data) has dropped drastically. Telco companies are coming up with new products to consume this expanded capacity, and offering new applications and services.

Telco equipment manufacturers extend their products frequently with new attractive functions to create new business opportunities. They advertise their benefits to everyone via magazines and the Internet, contributing to the competition between Telco companies. When Telco companies intend to exploit a technology opportunity, they need to act quickly before getting caught by another wave of technology cycle.

"You get new technologies all the time, and you want to take advantage of these technologies quickly. You cannot make decisions, two or three years in advance, because the technologies may change. The industry does not let you do that. If you wait too long, then you may end up with a technology, which is out of date, or a solution which has to change. That's the challenging part, where the requirements are very fluid. In a week, you start thinking of requirements, at the end of the week, they are out. Speed is very fast in this environment." (Participant 4; project manager; case 1; interview transcript: page 3)

"This is the problem you get in Telco space; things are moving extremely fast. Any long project, that has not been delivered, gets run over in time." (Participant 12; senior and program manager; case 1 and 2; interview transcript: page 14)

The first challenge with a new technology to be used in a new product was to get all stakeholders' agreement on a project scope. Different expectations and assumptions about a new immature technology with many unknowns caused delay, risking delivery date and even the whole project. Once a product idea was justified with a good business case, it needed to be focused and delivered in a short but realistic time. If a project was halted for some reason, technology moved forward, and a complete scope revision was needed to meet the customers' current demands. Even if a project progressed to later stages, then had a long break, it was necessary to virtually restart the project phases from the beginning. A technology that was considered as leading when a project started became obsolete in a couple of years. It is sometimes more meaningful to terminate a project, and start over again with a new scope to make use of the latest advances.

> *"There were assumptions on the requirements, costs and time frames. This was not well communicated to the rest, both vendors and the team members. The project budget was cut, but its scope was not adjusted. There were also many changes done by the business owner. This is where the disconnect started. In DIV phase, I stopped everything, no more changes. Let's go back to square one; go back and do all over again, after three years. In terms of the technology, lots of things have also changed." (Participant 14; program manager; case 1; project 43; interview transcript: page 4)*

Technology is a challenge not only in NCPD projects, but also in NTI projects that do not have direct interactions with the customers. A system or platform upgrade took longer, their supporting technologies also moved with time. The project targeting a specific technology needed to re-visit the requirements. From a technology perspective, NCPD and NTI projects with a new technology are quite similar.

> *"There were different upgrades that we had to do. You may start from a point, you plan for the future, but within six months or one year, the technology may change. When they started, they were doing upgrade version 5, and it took a long time. Then, actually version 6 came out. They bypassed it and went to version 7 at the end, because other components were compatible with this version. This technology is driven by Cisco, after two years, they decided it would be good to have latest version. There is still the problem, because they are already coming with some new releases very soon." (Participant 19; project manager; case 1; project 56; interview transcript: page 12)*

A new technology might look good on paper, and it could be tested only in a limited development environment, which is a limited replica of real life conditions. One of the benefits of having many stakeholders in large and complex projects was that they examined a project from different perspectives and provided early feedback as to whether that technology was really suitable and what kind of changes were required in

practice to adopt it. How the product behaved in the real world environment was known only when a new product was deployed in the field, called the production network in an analogy with the manufacturing industry. Participants mentioned many kinds of technology problems that they needed to address during deploying the solution for a new product.

> *"In the testing environment, you need to be validating new network or equipment. And, they come along the production environment. There can be production problems, because the environment is different. But, I hope that would be minimal." (Participant 9; senior manager; case 1; interview transcript: page 5)*

> *"Technology in the sense, because of the things that do not exactly work you expected. They were new, and not done before." (Participant 19; project manager; case 1; interview transcript: page 13)*

> *"There were lots of issues all around [a new mobile Telco technology] as a new technology. Unfortunately, there were glitches that were found out and fixed during the Closure. For example, we had a problem with content delivery. When congested, it took a long time to get to the provider. Eventually, it was fixed." (Participant 21; project manager; case 3; project 67; interview transcript: page 10)*

When Telco companies select an area to beat their competitors and open the gap between them, they offer totally new technologies. However, being the first often comes with a cost; not only paying a high price for such an untested technology, which would be cheaper in a few years and replaced with newer technologies, but also the cost of solving early adopters' problems. In some examples, they expected their customers to value the new technologies when the product was launched; however, it turned out to be a product with a high price tag without any customers.

> *"They delivered the basic function, but later they did not find any customer to sell. With [a new technology] coming to the market, with all product features will need to be done on customer equipment. So, it lost the attraction. They compromised along the way, because they were so desperate to get the revenue earlier. Probably, the original concept and assumptions from the marketing were probably wrong." (Participant 13; project manager; case 1; project 42; interview transcript: page 4)*

> *"We were told that customers' networks met the required specifications. In many cases, their devices cannot carry the traffic, because they did not follow the requirements we have given them. They did not want to do this, because it costs to do so." (Participant 18; senior manager; case 1; project 38; interview transcript: page 6)*

Technology changes were not always bad and unwanted. Some examples were given of how they had removed a product deficiency or technical limitation in some old products, and made them more sellable. When a new technology replaced previous products with better functionality, it let the project managers have a fresh start. In other

words, new technologies became a rescue to solve outstanding product issues and problems. Due to the nature of the industry, the products quickly became obsolete, and newer technologies with better functionality superseded old ones in a shorter time than that may be needed to perfect a product. Project sponsors and senior managers also preferred NPD projects, rather than fixing a product that would already be discontinued.

> "We delivered the project in time according to the specifications, but nobody bought it. The forecast data coming from sales seemed not correct. Then, they changed the connection to be done over IP; a technology upgrade made a difference later, and it was sold." (Participant 15; product manager; case 1; project 45; interview transcript: page 4)

> "A new product is going to come and take over this product, which had so many holes in its technology. I think we'll shut them anyway, because it is not worth it anymore. Two years ago, there was nothing coming up on that product." (Participant 11; product manager; case 1; project 33; interview transcript: page 4)

4.2.3 Competition: time-to-market

The technology life cycles require Telco companies to deliver NPD projects in a short time, but it is not the main reason why fast time-to-market is crucial. The global Telco equipment manufacturers make new technologies known to everyone, therefore competitors in the industry are aware of what each other is working on. Time-to-market in new technology NPD projects is then very critical in order to grab a market share before competitors. Large and complex incremental product modification projects are treated similarly. Their technology life cycle is already shortened, and an earliest product launch is demanded to reach break-even sooner. The researcher questioned the project sponsors as to what was the most important key performance indicator in NPD projects. They consistently emphasised time-to-market with an acceptable quality. This has consequently influenced the way NPD projects are managed. There is a race to be one step ahead of the rival Telco companies. The NPD projects have now become more critical than before, because there is not much room to fail under strong competitive pressure.

> "The same product was deployed at the same time with a major competitor. [Company A] and [company B] were doing at the same time. There was a race, it was driven by competitive pressure to be out first. There was a big pressure to get out and sell. As soon as it was tested, it was being sold." (Participant 14; project manager; case 2; project 61; interview transcript: page 16)

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"Time-to-market is a big influencer. The program management team wanted to move ahead the project without being ready for it to the market." (Participant 10; manager of project managers; case 1; project 31; interview transcript: page 4)

"Telco is now on slippery slope of being commoditised, not a special niche anymore. It used to be a great business with big fat margins. We used to provide a private circuit for somebody, it cost you an arm and a leg, to get from one part of Sydney to another with 9.6kbps. We are only talking about 20 about years ago. It used to cost a monster. Now, with packet data technologies, bandwidth is not a problem anymore. Customers are going to pay for the services they want. Because it is so competitive; it is a fallacy that we can develop more products that the users will pay us more. We're going to add new things more and more, but they will not pay for extra for it." (Participant 13; project manager; case 1; interview transcript: page 11)

"The problem with the current project is the fact that the goals are very aggressive. No analysis was done up front in order to determine how challenging the project is going to be. Since it did not start early enough, we are having to rush to the finish line." (Participant 4; project manager; case 1; project 14; interview transcript: page 3)

"The most difficult part was coming up with the development environment where you can get new products out in two weeks time to support the service provider [company D]" (Participant 6; project manager; case 5; project 72; interview transcript: page 5)

The project sponsors attempted to match the project scope to the latest demands from the market during a project's progress, and amended the requirements to close the gap. Sometimes, a project varied from the original plans, especially when the delivery date was delayed for various reasons. The impacts from changing customer requirements during a project life cycle were among the challenges; the longer a project ran, the more changes occurred in the project scope.

"There were many changes being done by the business owner over time. Because they want variations, and later we understood they cause 20% increase in the cost. Effectively, we did scoping three years after the project started. Indeed, I recommended to kill it, and write-off the cost, since it did not meet any of the objectives; scope became unknown, and increasing the cost." (Participant 14; program manager; case 1; project 43; interview transcript: page 4)

"The project started early, but for some reason, they put it on hold. Within two years, the conditions changed in the industry, we reviewed the requirements, and were given a short time to deliver a product." (Participant 20; program manager; case 1; project 25; interview transcript: page 9)

"It was very difficult for the business to understand what features and capability they wanted to go to market with. One of the big challenges was to lock down the scope of what could be delivered within budget and the time frame. Once the project got going, the business kept trying to extend more and more features into requirements. So, the risk of not being able to deliver on time and budget started growing, on top of the pure technical risks of having a brand new technology. It

had lots of risks." (Participant 18; senior manager; case 1; project 38; interview transcript: page 3)

Business market opportunities became more financially attractive by offering totally new customised products to meet special requirements. Once an opportunity was seized, the bid process was employed to develop those products. Sales personnel sometimes needed to commit to a delivery date with a fixed cost, mandated in the contractual agreement. If it involved a new technology or processes that were not used and tested before, they increased the risks of the delivery on time. If a business customer was unsatisfied with the time, there were ramifications: not only contractual obligations, but also lucrative future business with them.

> *"This was a case of product that started life as a more or less as a sales proposal to a major corporate customer, with very little idea of how it would be designed. We went from concept, straight to sales proposal to customer, and accepted. So, a concept design was put to the customer without a lot of engineering a solution behind that. The challenge then became how to realise that solution, and to deliver it to some very tight budget and time frames. It was a high level scope. That has just been accepted, now we go and build. And, the question was, go and do what, what has just been sold. Somehow, it went from concept to locking time frame and locking cost, straight into DIV. This was one of the highest risk projects that I worked on." (Participant 18; senior manager; case 1; project 52; interview transcript: page 8)*

4.2.4 External parties' involvement

Whenever a new technology was involved in a project, the supporting capability was often not yet in the company. Consequently, it required more collaboration with vendors that supply new technologies. This produced its own challenges. First, in some cases vendors did not disclose any drawbacks or limitations on their equipment. They exploited the competitions among Telco companies, and pushed them to adopt new – maybe untried – technologies. In such projects, the project managers thought that their companies were like a test bed for a vendor offering a new immature technology. It was also seen as a cost to be first in the market with that technology. A good risk calculation had to be done, before taking steps into such a technology. Several project managers complained that marketing groups took every sales pitch very seriously, and invested in unrealisable business benefits.

> *"It always takes longer than they want. What they fail to take into account, is that they are victims of the vendor hype. The marketing people are just falling over*

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themselves time and time again in being abused by the vendors, and the industry hype. The magazines have to sell copies, the vendors have to sell products. They lack perspective and scepticism, and then promote illogical ideas, and they push with unprofitable business plans that show us brilliant things. What happens, the vendor lies to them: 'Oh, yes there is a bug in this, we got software upgrade coming'. They are not going to tell them the truth. They come up with software upgrades and stuff, but the thing fundamentally does not work at all. " (Participant 13; project manager; case 1; interview transcript: page 6)

"We had lots of problems. This particular vendor had beta releases. We were trying to find the bugs. We were close to the delivery date, and supposed to launch. We could not roll out the equipment, because of software problems. They needed to upgrade it. There were whole variety of issues." (Participant 19; project manager; case 1; project 56; interview transcript: page 5)

Second, once vendors achieved a toe-hold in the company, they tried to create a dependency for future business opportunities by enforcing their proprietary standards, instead of open ones. Therefore, Telco companies needed to be careful what they were introducing into the company, in case it could block future growth in a business area.

"We had an issue with the vendor basically. The vendor's standards were different from the open standards. In their lab, it worked OK, but when we put in the production network, we had lots of problems. When we set a couple of pilot customers, more things started coming out. We had to get the vendor fix their operating system to suit our requirements." (Participant 17; project manager; case 1; project 51; interview transcript: page 7)

"Especially with new technologies, it is very difficult to differentiate promises from reality. The vendor wants to sell you what they have done. I have not seen many products having scalability. So, it works with 5 people, but it does not for 500, because they never figure it out from the beginning." (Participant 20; program manager; cases 1 and 2; interview transcript: page 14)

Third, vendors' experts and resources were out of reach, and the project managers had no direct influence on them. The co-operation with them was determined in contractual terms, and specific procedures needed to be followed for proper engagement. Tender contracts were important, when introducing a new technology or equipment. If a vendor did not deliver, Telco companies applied contractual agreements to change or terminate the contract with minimum loss.

"It was new technology, supposedly worked according to the vendor. When we put in our environment, we had a lot of difficulty in getting into work as per requirements. In fact, we ended up with one working aspect of the overall requirements. Then, we chose to cut the losses and not do it any more." (Participant 9; senior manager; case 1; project 28; interview transcript: page 6)

"[A vendor] kept promising and promising. They underestimated the requirements. In F&D phase, we struggled. In the DIV phase, we had problems again. The solution did not work for several business units. Although there was a strong

business case, the top management decided to write off, as results have not come through after a long delay." (Participant 22; program manager; case 1; project 57; interview transcript: page 9)

Last, but not least, some big projects involved more than one vendor, which meant more external stakeholders with additional interfaces to be managed, and therefore more complexity. The workload on a project manager increased significantly for co-ordination and proper planning among them. A widely used approach was to assign another company experienced in such professional services, and sometimes selected among the vendors to carry the overall external responsibility. This turn-key agreement gave space to project managers to focus company internal changes to align processes and operational groups, and to manage other vendors through a single point of contact. However, this came with its problems: adding an intermediary distorted the message going to other vendors; some control was lost, as the main contractor pushed their agenda in the project, rather than the company's benefits; and consequently compromises were made along the way. Outsourcing was a good option in some cases, but saving costs in this way could result in losing control of these projects. Senior and project managers preferred in-house development, especially for key projects, because they could exercise much more control and flexibility.

"There was a complexity we were managing. The contract was signed with a system integrator. They in turn signed back to back contracts of the delivery with the third parties, who are were the actual solution designers. We put another layer to the real resources, and had one for all relations. It was easier to do, everyone saw the benefits. It was better than interfacing with six vendors. But later, they took away some control that we could exercise directly on other ones. We needed to verify with the developer vendor understood our requirements, which caused delays. The system integrator chose the easiest way for implementation at that time. There were lots of compromises." (Participant 21; project manager; case 3; project 12; interview transcript: page 7)

"There was so much at stake on that project, it was so high, it needed a high level of project management skill set. With technical understanding, it had to be run internally, we could not have brought in an external person, because they wouldn't have had the support of the team, and urgency to deliver it. Otherwise, we had no chance." (Participant 18; senior manager; case 1; project 52; interview transcript: page 10)

"If I were dealing with an external vendor, I would have to go ahead with much more details spec, and we have not thought through everything at that time. What would typically happen is 'Oh! we have not thought this, we've got to change'. It ends up blowing the cost. Vendors charge a lot for each change in the contract." (Participant 13; project manager; case 1; project 40; interview transcript: page 15)

"We had very minimal dependency on external vendors. What all vendors delivered to us was equipment only. We insourced everything; we were running on time, and

responsible for the scope and deliverables. When you get control of the resources, you can generally run things according to the time and design." (Participant 6; project manager; case 2; project 58; interview transcript: page 3)

If external vendors' involvement is unavoidable, their selection criteria should include only their technical capability, prior to cost and other business concerns. Such vendors not only lighten the burden on the project managers to get the right work done, but also save failing projects. In one instance, a strategically critical project, which lasted more than four years, was only completed when a capable vendor was finally chosen.

"The vendor had to re-design and test, before I could implement. The underlying data table structure was not able to support; the original design was wrong. So, the vendor involvement saved the project. So, we had to work closely with the vendor. Since, they were not there from the beginning, they could not pick up quickly. I think, the first one was not good." (Participant 22; program manager; case 1; project 47; interview transcript: page 5)

External parties' involvement in NPD projects was not limited only to vendors. Due to the nature of the regulated industry, Telco companies are legally forced to share their infrastructures, but they do it at a minimum level to stay competitive and keep attractive product features to themselves. This unavoidably imposed limitations on a product that crossed over a competitor's network. Although their interfaces had to satisfy minimum criteria, they needed to co-operate with the rival Telco companies to make a new product work properly.

"The difficulty with that one was a contract with [company B]. It had to be negotiated, we were limited with what we could do in the course of contractual stuff. There was a fair bit of work to resolve issues. There were a bunch of issues with getting those builds, and getting them provisioned, and getting [company B] confirm that they did the right work." (Participant 7; manager of project managers; case 1; project 23; interview transcript: page 6)

"The number portability project, which was absolutely critical, had to be delivered on a certain date, because of the industry requirements. We had to overcome issues during DIV phase, and they were mainly not internal. It was relying on getting the intercarrier agreement on time, and we were mainly dealing with outside, [company B]." (Participant 1; project manager; case 1; project 4; interview transcript: page 7)

4.2.5 Senior management involvement

Senior managers own company resources on behalf of shareholders, and it is one of their main responsibilities to use them for yielding a high return of investment, and

developing new products that contribute to a Telco company's strategic direction and growth. At that level in the organisational hierarchy, stakes are high to complete the projects in time to respond to the competitive pressures. Their intervention in NPD projects creates a sense of urgency, thereby driving the project management success.

This is the explanation frequently encountered in the literature why senior management involvement is important in NPD. In addition to the examples validating this, several other examples were cited where senior managers' engagement had wrecked the NPD projects. In some large and complex projects, there were many stakeholders, and each of their senior managers pushed for their own benefits. As identified in the well-known agency theory (Eisenhardt 1989), their own agenda and political concerns behind the scenes, and biased decisions that did not align with the project goals caused the projects and their team members to suffer. If they aligned with NPD project goals, their impact was positive; but if not, they were destructive.

> *"The project was given to wrong hands from the beginning. It was treated as a platform upgrade, but in fact the scope was really much bigger, mainly a reverse engineering application development. They had limited project management experience, had not dealt with external vendors before, had no control over the budget, and no defined scope. The director did not question, when they reported the project as going on track even a month before the deadline. My recommendation was to split the project into more manageable pieces, and to increase the budget. In return, I was ordered to deliver the project with total budget less than $5 million, and I immediately said I could not. Then, I was kicked out from the project in the next week. For a project manager, it was lose-lose. For political reasons to save the face of the director, he did not want to report to his boss that he has made wrong decisions and exploded the cost and time. I heard that this project was completed four years later with a much higher cost. If he acted on my recommendations, it could have been delivered much earlier." (Participant 16; project manager; case 1; project 47; interview transcript: page 7)*

In some NPD projects, senior managers overruled project managers' recommendations, since they considered other criteria that were not relevant to the project. For example, they selected vendors who provided better financial deals, or with whom the company had reciprocal business relations, rather than because of their technical capability. This increased the burden and stress on the project managers and team members. The projects were often delayed, a major revision in the project scope was needed, or the vendor was later replaced with a technically expert one. It required tremendous effort and a long time for project managers to bring such projects to a successful end.

> *"It started to come out was the vendor selection, it was made on a decision not on most suitable vendor, but on the basis that there was other business benefits for*

selecting the vendor. So, then we found out that the vendor was incapable of doing many of the developments. I made a recommendation either we kill the program, and change the vendor; or continue down the path with this vendor, and assist to get as much as we could get through micro management. The recommendation was the second, since they had tight reciprocal business relations with them. This particular vendor had many more releases to get the product to an acceptable level. Considering each takes minimum of 2−3 weeks, it took more time, compared to an experienced vendor." (Participant 12; program manager; case 1; project 27; interview transcript: page 5)

"There was a RFP [Request for Proposal for a tender] conducted, and reviewed with several vendors, and out of that, matching to the scope of the requirements to the vendor. The recommendation was for another vendor. When this one was put forward the management committee, there was already a financial better arrangement negotiated with the vendor who won the outcome of the tender, compared to others. And, that decision was made on financial arrangements." (Participant 14; program manager; case 1; project 38; interview transcript: page 7)

Senior managers did not always view NPD projects the same as the project sponsors, who aimed to differentiate a new product from competitors by offering value-adding features. When evaluating the projects, senior managers tended to lower these features' priority, as long as the basic functionality was delivered, and to lose the focus on those differentiating features. Furthermore, they allocated resources to other projects waiting in the queue that could create more revenue, leaving a half-delivered project from the sponsor's point of view. This again shows that senior managers' focus is usually short term, and predominantly financial only.

"They do not understand how [a product feature] is impacting the customers. Once people promise 5 or 10 million dollars revenue, you are asking half a million. Then, it goes to director or higher level, they are saying this is not my urgent priority. There is no focus on fixes. But for us, this is the main differentiator from our competitors. They never realised how important it was." (Participant 11; product manager; case 1; project 31; interview transcript: page 5)

4.2.6   Project financial processes

Large and complex NPD projects contain many uncertainties and unknowns. Although in the initial stages of a project NPD processes assume there would be cost and duration variations, the Telco companies' annual budgeting processes did not reflect these impacts properly. This mismatch forced project managers to commit to a delivery date early in a project. With this anticipation, project managers usually added buffers in their estimates. Sometimes, after a detailed technical analysis or during development, even

those extras put in place did not always suffice. Small impacts were easier to absorb in the plans. For large variations, they needed to justify the increase to senior management who have the power to shift the resources across projects.

> *"Let's talk about generic issues for one second. We do scoping in an hour workshop, and its report provides the cost and date the project would be delivered. Theoretically, this has some tolerance, and it improves as the project progresses. When we do yearly planning for the next financial year, they lock in the revenue generation for this product by the date defined in the scoping report. So every month, you slipped that date, it jeopardises the ability to deliver its expected revenue." (Participant 16; product manager; case 1; project 52; interview transcript: page 10)*

> *"They [marketing group] went to the senior management fairly early, during II or beginning of F&D, and committed a delivery date, then approval was given to go ahead. To change the date, you have to do a lot of homework. When they went to the board, there were significant unknowns and risks. We should have highlighted the risks and the level of accuracy in the estimates." (Participant 18; senior manager; case 1; interview transcript: page 4)*

Increasing a project's budget in the middle of a financial year was very challenging. Their project managers had to go through several bureaucratic procedures, and produce reports as to why the variance occurred, and how to address the deviations from the original plans. Their attention shifted to get their project back on track, and eventually their projects halted. As there were other projects competing for the same resources, the functional managers allocated them to other projects that had funds. Even if project managers succeeded in getting the additional support, they had a second challenge to get resources back into their projects, which was much harder than getting them first time. Depending on the incremental budget change, the bureaucratic approval procedure for the amendments sometimes took many months; the longer the break, the more difficult to bring a project back on track.

> *"Because we ran out of the funding. We had IT development group disengaged. They got changed four times; they had to move to other projects, during we were seeking additional funding. We had a disruption in terms of resources, and there was further trouble. I had to go through numerous escalations to get them back. So, the project ran late." (Participant 19; project manager; case 1; project 54; interview transcript: page 8)*

> *"Insufficient checks and balances at the beginning. You cannot do annual budget forecast, when the numbers are put up. You only have a vague idea of implementation. They are basically chiselled in stone. They are very hard to change later on." (Participant 13; project manager; case 1; interview transcript: page 7)*

A financial discipline was observed in the majority of cases. Their processes did not allow the purchase of any equipment before a project reached the stage where the

solution had been reviewed and was understood to satisfy the requirements. However, this was inconsistent in product development groups in the old state-owned Telco company in Case 2. In some projects, they bought their equipment without even waiting for an approval or finalisation of project requirements; in some others, they made sure they obtained every signature. This is related to how those groups follow formal project management processes; the first group had a tendency to bypass the NPD processes, and usually ran their NPD projects ad hoc. This is a mixed picture, as the company is passing through a big transformation to adapt to the changing industry conditions.

> *"There are guys, who have a lot of money and who are of the opinion that, you just put something and fix it. They do cut corners, and risk their networks. There are also engineering groups, who operate according to the engineering processes. There is a big gap, they should be following the processes; but they choose not to. I think they will change, as the company reduces in size, they are going to realise and transform themselves." (Participant 23; project manager; case 2; interview transcript: page 5)*

4.3 Practices to cope with time-to-market challenges

Telco companies already have or they are planning to employ some practices to shorten the NPD project cycles, as time-to-market is very important. They are not only specific to Telco, but its conditions have some implications that need project managers' attention. These practices found during this research are described here.

4.3.1 Phased product delivery

Once a project is approved, the clock starts ticking to the delivery date. Even though the scope might not be very clear from the start, time is too valuable to stop everything until all details are defined. The most common approach to use time effectively is to deliver project outcomes in multiple releases, usually called phased delivery. The basic functionality requirements are determined first, and the development work is started. During the project's progress, the rest of the requirements are agreed, and the project plan is extended to accommodate them. Closely related works are grouped together to form a product release. This creates room for meeting marketing demands and ultimately delivering a complete product at the end.

"We divided into multiple phases. Because the original requirements were broad, we said we do this first, then do the second, then the next; managing the scoping in stages." (Participant 6; project manager; case 1; project 19; interview transcript: page 11)

"The shorter the project, the better. If you keep it short and contained, you can start, implement, and finish. Then, you can do the next part, start, stop and finish." (Participant 12; program and senior manager; cases 1 and 2; interview transcript: page 13)

"We thought the requirements were clear that time. We started with the basic function that is written in tender contracts. There happened several change requests, but we drew the line; anything after that would be in phase 2. Because of the time-to-market pressure, we had to deliver the product. At least, we had a launchable product in phase 1. Then we assessed everything on its own merit, then put big developments in phase 2." (Participant 21; project manager; case 3; project 69; interview transcript: page 13)

A number of issues were observed in projects that had phased delivery. First, the development work ended up having incompatible patches, and each deployment required a complete review of the product. Second, once the base product was launched, senior management wanted to allocate resources to other projects in the pipeline, thus terminating an NPD project without completing its scope. Third, if the delivery phases were spaced far apart, technology advanced and the original requirements had to be reviewed. Consequently, a release should be defined with clear boundaries in a whole product delivery road map, and project managers should consider where a new product may conclude.

"This project was broken into two phases. Phase 1 delivered the basic function. Later, as a result of the delays, it was decided to abandon phase 2. Indeed, we could not, there was no money left for phase 2 anyway." (Participant 7; manager of project managers; case 1; project 22; interview transcript: page 5)

"It took 1.5 years to get the project on the road again with the agreed requirements. We selected the vendor and started DIV phase. Later, a number of different requirements, which could be delivered in another phase, came. They made the cost higher and the business case scarce. The resources were on and off, and the budget was fluctuating; delays and delays." (Participant 21; project manager; case 3; project 69; interview transcript: page 12)

4.3.2 Modularising product development

There are a variety of systems due to legacy reasons in Telco. For example, a global equipment manufacturer announced their views to remove old ATM (Asynchronous Transfer Mode) technologies, which were considered as state of the art in the 1990s, and

co-operate the similar functions in newer IP (Internet Protocol) technologies (Nortel 2004). Although the Telco companies intended to use the newest technology for maintenance and cost saving reasons, it was not possible to phase out all the previous systems due to the switching costs. Cases 1 and 2 are currently consolidating their networks onto a limited number of standards, which can also help by simplifying products into fewer basic components that facilitate more convenient modular designs.

A modular approach defines a product in terms of modules (i.e. what they do, and the interfaces to its neighbouring modules), and confines the development work into pieces with well defined boundaries. Therefore, any new product or incremental product change can be scoped down into individual modules for concurrent development. Smaller chunks of changes are simpler and faster to implement. It also makes an NPD project's artefacts usable in other projects. Even though a product may be unsuccessful in the market, its modules may be reused in another product. Theoretically, this sounds logical; however, several disadvantages were identified during this research: defining modules was not easy, because different products required a variety of interfaces; it limited customisation especially for business products; and a new product inherited all the technical and operational limitations of the modules that it relies on. Considerable effort that extends beyond the original project scope was needed to make a new product work in modules.

> *"The program was never designed to be split to ensure that modularisation is across all products. Then we needed to split them into multiple programs, because of the size. We are still trying to keep them together for reporting and accounting points of views." (Participant 11; product manager; case 1; project 34; interview transcript: page 8)*

> *"We built modules focused towards those delivery mechanisms. Modular design is absolutely essential in rapid product development environment. You need robust and reliable modules. We weren't changing 50% of our code, maybe 1%. So, big infrastructure, little application." (Participant 6; project manager; case 5; project 72; interview transcript: page 6)*

4.3.3 Process automation

One of biggest challenges in Telco is the complicated business processes that are tailored for each product. As the number of products consists of fewer and standard components, process automation becomes more cost effective and efficient, providing

reliable and faster customer service. Consumer products have reached a high level of standardisation, and the volume necessary for process automation. However, it is not quite as easy for business products, where customisation is the norm. Although a degree of automation can be achieved, it seems to take longer to eliminate manual intervention in the processes.

> *"The network channel is ready in a mobile [a consumer product]. If you add another service to it, you do not need to set up another process for it, you are indeed adding a new feature only." (Participant 21; project manager; case 3; interview transcript: page 15)*

> *"If you look at the activations side, there are multiple business products to do the activations on. Each one has got a peculiarity. They have multiple systems to work with. They hand over to multiple team. I think it is pretty complex and it needs experience." (Participant 13; project manager; case 1; interview transcript: page 20)*

4.3.4 Flexible project management processes

NPD project management processes were not followed completely in any of the cases. Time-to-market was the main reason for having this flexibility; time is too valuable to satisfy every process requirement. Although all cases had well defined processes, when it came to practice, every project had variations. Blindly following the processes did not guarantee consistent project management success; they either missed delivery dates, or had a new product with many missing features. All project sponsors opted for time-to-market and flexibility to accommodate changing requirements, rather than full compliance with the processes. Delivering projects in phases is therefore a natural consequence.

To cope in such a dynamic business environment, the processes were taken as guidelines, not mandatory. Project managers were all aware that going faster increases the risk of making mistakes, and they made a compromise between satisfying key processes and time-to-market. The freedom to apply project management processes required skilful and strong project managers to decide what to do and what not to do, to develop quality new products in challenging time-to-market goals. Consequently, Telco NPD project managers attract attention, and need investigation. It ultimately comes back to the original research question of this study: what skill sets Telco project managers should have to be successful.

"You cannot go far with quick and dirty, and not following any processes; you need to balance. You have to tell [managers] the risk of bypassing or not doing properly. It is faster, but a clean-up phase is required with a risk of not satisfying every requirement. Or, it takes time, then you take less risk. First of all, if you do not meet time-to-market and business benefits, there's just no point of doing them." (Participant 22; program manager; cases 1 and 3; interview transcript: page 14)

"We are not producing widgets, a regular product. This is a creative business, and you cannot box it. There is an element of bureaucracy needed, because you do not want to throw money at these projects. They have made a decision not to have rigid processes, because it does not work. You can have a formal process that would generate products; whether it ends up a good result or not is completely a separate matter." (Participant 13; project manager; case 1; interview transcript: page 24)

"It is your description whether to combine the two gates, elongate two phases, or run the project in different phases. That's all dependent on your experience and complexity of the project. What we are doing is the standard product development process. But, how you use again, you need to show some innovation. Sometimes, I skip F&D, and directly go to DIV. Sometimes, I elongate F&D and shorten DIV." (Participant 2; project manager; case 1; interview transcript: page 2)

"At the end of the day, the final delivery has to be a quality product that customer would like. It does not matter whether you went fast or slow. The customer does not accept it, since it fails. They faster you go, higher the risk of major faults, when you go to market. So, it becomes a judgement call, how much risk you can afford." (Participant 18; senior manager; case 1; interview transcript: page 15)

"In Telco, in general, people just focus on time-to-market, it is the most important. We are in a very competitive business. I guess, processes always come second to time-to-market. But it does not mean that we should close our eyes and ignore it; but try to do enough." (Participant 21; project manager; cases 1 and 3; interview transcript: page 18)

5 Skill sets of Telco NPD project managers

One of the objectives of the empirical investigation was to test the skill set framework developed through an extensive literature review. The previous sections set the scene for the kind of challenges Telco NPD project managers are facing. This section addresses the final step, checking the validity of the theoretical proposition of a new organising framework for skill sets. Separating skill sets could be difficult, since they interact during a project execution, and an activity can overlap more than one skill set. The researcher paid attention during the interviews to obtain clear descriptions of participants' specific experiences, and what they aimed to achieve with their activities.

The empirical evidences strengthened the proposal for the classification into four skill sets: technical, leadership, managerial and administrative, and their definitions. The

proposed four-skill set organising framework presents a satisfactory, logical and representative classification. Separating the managerial and administrative skills was expected to prove difficult, and the researcher specifically sought for a clear differentiation between these two. The following sections summarise the justification for each skill set and provide the empirical evidence.

5.1   Technical skills

Some participants named technical skills as 'technical acumen' to describe the adaptability to different technologies in an NPD project. Interestingly, all of the Telco companies in the cases hired project managers with a technical background. In addition to mandatory managerial skills, a threshold on technical skills was emphasised, even though the managers were not expected to perform any technical work. Having managers with good technical knowledge confers several benefits. The main challenge in the Telco NPD projects was integrating business processes of different work groups and the technologies that a project involves. Project managers with both managerial and technical perspectives resolved conflicts quickly, which is critical in projects with fast time-to-market targets. The individual team members focused on their parts, and did not have end-to-end visibility. Project managers, who oversaw all business processes and technical capabilities, acted as a quality assurance mechanism by questioning the project team's decisions. If there was no one with the complete product view, which often happens in small projects with only a couple of team members, they filled the system architect role, as in Case 1.

> *"Actually, it is a technical acumen in the area that you are dealing with. You are then able to start relating to people that you are working with. If you do not have a technical architect somebody overall technical, the project manager fills some of the role, relating and bringing all the work together. We wanted them with technical background." (Participant 3; manager of project managers; case 1; interview transcript: page 6)*

> *"You have to have competency in understanding the technical design, but it is not your priority. It is always important to have." (Participant 4; project manager; case 1; interview transcript: page 18)*

> *"Project managers are doing normal project management work: minutes, action and issues register, etc. Effective ones are not necessarily better than others, but they had some technical experience, they were able to understand and question an*

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engineer when an engineer says something." (Participant 23; project manager; case 2; interview transcript: page 6)

Project managers, as the title implies, were expected to lead to deliver a new product successfully. Relating with the project teams, and creating rapport first required communicating with them in the same professional language, showing that they listened, understood and empathised. In an NPD project, crossing several different technologies, it is quite normal not to know details in every project work; however, the project managers were expected to have at least basic understanding of what was going on in the projects. It ultimately led to gaining credibility from the project stakeholders: senior managers, team members, project sponsors and operational groups. This in turn increased the project managers' ability to influence and lead.

"You get to understand how things are going to get down to operational level, and talk to those people at the end of the day. You've got to create rapport to get things done." (Participant 6; project manager; case 1; interview transcript: page 14)

"If the senior management talks technically, well he talks comfortably and credibly about what's happening in the project technically. All those things together build up the project manager's reputation, in terms of credibility in the sight of the senior managers." (Participant 4; manager of project managers; case 1; interview transcript: page 16)

The project stakeholders in the cases, especially, emphasised technical skills for two reasons: a project manager should be able to guarantee that the right work is done, and to rationally judge the duration and effort required to complete the project. It was not project managers' responsibility to examine each task and produce estimates for it. There were technical people in their teams, who contributed with their feedback, and the project manager collated them to produce the overall project estimates for the schedule and costs. In some instances, engineers interpreted the project work wrongly, or gave unreasonably long or short timeframes, based on previous similar work. Although past experience can give an indication of timeframe, the differences in a new product need to be understood. In some cases, engineers were biased and produced optimistic estimates, and sometimes overcommitted, as they were assigned to more than one project. The stakeholders relied on project managers to detect such abnormalities, and therefore they expected project managers at least to have a high level technical knowledge so as not to miss major problems in the estimates and required work.

"Good understanding how long it takes to do the things. Quite often, they commit to stuff they are not going to be able to deliver. Or, misjudge and not being able to

deliver. You do not need to be an expert, but you detect the guy who gives incorrect information. So, it is knowing enough, and also knowing enough to know the people who know what they are talking about. So, you can determine who your subject matter experts are, who are the key. Understanding who you can trust, when they are explaining an issue, if they are actually telling the truth." (Participant 7; manager of project managers; case 1; interview transcript: page 11)

"Technical skills will help a project manager to do his job, if he has got a reasonably good technical understanding of the area he is dealing with. He does not need to be an expert, but it will help him pay attention on areas that may need focus. And, it will help him avoid being misled by information intentionally or unintentionally given." (Participant 18; senior manager; case 1; interview transcript: page 16)

"If not know how to technically deliver it, at least technical understanding what the product is, and work to make sure what is actually delivered. The project manager needs to understand technically what they are delivering, but they do not need to understand the coding." (Participant 11; product manager; case 1; interview transcript: page 8)

The other extreme, being too technically oriented, was also considered a handicap in managing a project. A technically biased project manager may tend to focus on technical work, and miss the overall picture for product delivery. Project managers were not asked to resolve technical challenges in projects. Even though they had strong technical background in some area, they were better to not get too involved in the relevant work. Being occupied with the technical aspects in a project prevented them from performing fundamental project management duties, like scoping and risk management. When a project manager needed to make hard decisions to meet time-to-market goals, he lost his objectiveness in favour of a technical matter that he was familiar with.

"In this project, the risk assessment of not landing the requirements document, was not appreciated by the project manager, or how serious that issue was going to be. If you do not quickly lock that down, you're going to miss your dates, and probably the budget. That project manager focused on the technical area. He was putting more emphasis on the technical design side, and instead of focusing on the schedule and the risks with equal priority." (Participant 18; senior manager; case 1; project 38; interview transcript: page 6)

"It is not like, if I change this, what will happen... You got other people to do it. If you do it, it is a detriment of running your project. That's why I got specialists in the team. That's what they eat and breath, and whatever they know. I cannot keep up that level. If I do that, I cannot still run a project properly." (Participant 19; project manager; case 1; interview transcript: page 15)

As there were many stakeholders and constraints to satisfy in large and complex projects, many possibilities could satisfy project requirements. Among them, engineers

usually wanted to choose technically challenging and desirable ones. Project managers' external voice with a broader perspective helped the team members think outside the square to produce better solutions, not only technically, but also feasible ones in the required time-frames. At some stage, a judgement had to be made about what is enough, otherwise with a perfectionist approach, an NPD project was endless. The major constraint is time; nothing can be let go forever. They listened to their technical people, whose priority was to produce the best design, but did not leave the final choice to them. Sound decisions definitely required a good level of technical knowledge.

> *"Everything can be tested, and beaten to death. Because quite often, in projects there are not clear cut answers, and you need to make a judgement call, for instance like testing. You can test a technology years and years, and still keep on testing. Always, there are another ten test cases. Somewhere, you need to apply your common sense in your business judgement saying 'this is good enough, I do not do anymore'." (Participant 8; project manager; case 1; interview transcript: page 7)*

> *"Design should have been completed by end of December. I made a judgement: design phase 90% completed, and I just ask the developer go to the development phase. I can go back and re-track some of them with an extra time. Taking a calculated risk, that's important." (Participant 17; project manager; case 1; project 51; interview transcript: page 22)*

When a project reaches implementation stage, it implies that an NPD has already passed through several decision-making processes, and evaluated to be financially viable. In some instances, a few projects with flawed assumptions progressed to this stage. If such projects were to deliver new products, they would end up with no or insufficient customers in the market. Project managers with good technical skills pointed out the deficiencies in a proposed product and got such projects terminated before they reach the market.

> *"I have got a couple of projects killed, but it was basically, because they were flawed ideas at the outset. It wasn't due to project management type reasons. That just did not pan out as being worth doing. They got their funding withdrawn basically. It is not the engineers cannot do it, and project managers cannot make it happen. It was not a great idea in the first place, or the assumptions were wrong. Technical skills do make a difference. When you look at things, in looking for problems particularly, you can pick things." (Participant 13; project manager; case 1; interview transcript: page 2)*

5.2 Leadership skills

Leadership is generally associated with teams. Project managers wanted to know their team members' concerns, conflicts and motives; however, they were more interested in getting the job done. Other project stakeholders expected project managers to set the direction for the project, and to influence the team members to co-operate. The conventional leader–follower relationship, which is more associated with helping individuals to excel personally and professionally, does not hold for project managers. Project managers did not have any intention to look after the team members, or help them progress in their professions. In many instances, a different kind leadership role has been emphasised[3].

> *"Project manager can be a leader, but he does not assume a leadership role. Line manager is different [from] the project manager role, in the sense, they [project managers] are in charge of day-to-day function. Whereas you are looking at delivering a piece. Basically, even with negotiation and persuasion, you are trying to get their acceptance, and willingness to work with for you. You could be a good influencer."* (Participant 17; project manager; case 1; interview transcript: page 24)

> *"They should be a leader, in the fact that they are accountable to drive the delivery of a project. Their role is to guide a project from start to finish. They have to provide direction, where project stakeholders are not clear about the work. So, from that perspective, project manager is a leadership role, because they are the driving force between success and failure."* (Participant 16; product and project manager; case 1; interview transcript: page 19)

> *"If you do not have leadership, you cannot lead. You have got to lead a group of people to get somewhere. You cannot be only a task manager, you also need to be a people manager. The influence is quite important."* (Participant 22; program manager; cases 1 and 4; interview transcript: page 13)

> *"His [project manager's] main goal is to get the job done. The interest is the project, it rules. When the priority comes, project comes first."* (Participant 20; program manager; cases 1 and 2; interview transcript: page 17)

> *"In a way, you need to push the direction where the project is going, and to achieve the milestones. Sometimes when you see that they are not sure about this and that, you need to ask for a decision; you do have to lead in a certain direction. Leadership as a direction setting, but in a consultative way. You have to discuss a bit more and more opinions, and then, make an informed decision. But, you have to be strong if required: OK, we talked enough, now let's get something going."* (Participant 19; project manager; case 1; interview transcript: page 20)

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[3] The empirical finding in this paragraph is used to elaborate the process of how data analysis and reporting were performed in Appendix D.

Another participant, who did not spell out the word 'leader' during his interview explicitly, went further, and ignored it totally. He saw the project manager role does not have much to do with leading, but more delivering a project in time.

> *"After completing the interview, and switching off the audio recorder, the researcher wondered why he did not mention any leadership topic, as he attempted to bring leadership and team motivation subject into discussions. Although the participant mentioned examples of closely related subjects during the interview, he stated that he was well aware, and did not mention intentionally, since he believes that project manager role, as a leader, is very limited in project settings."* (Participant 4; project manager; case 1; interview notes: page 19)

There are two main reasons why project managers could not fulfil a full leadership role. First, the organisational settings that result from roles and responsibilities in the matrix organisational structure did not give project managers authority over anyone. Although they were mostly senior employees, they did not have functional team members directly reporting to them. By getting involved in individual matters, they might cross the boundary with functional managers. Second, projects were short-term and temporary endeavours, and they did not have much opportunity to establish long-term relationships. They usually had high other priority matters on their agenda to meet tight project delivery dates. In all cases, team building kind of activities were not mentioned at all; again it indicates the priority and focus dictated to the project managers. They owned issues and conflicts in the team, and attempted to resolve them, but only to a certain extent. When they seemed not to reach a quick resolution, they engaged functional groups' managers; they were not there to take care of the team members.

> *"If people had only one thing, then they would deliver it. When, they have time pressures doing multitude things, conflicts; they do not know how to do the things in this environment. Project managers come with a direction; it is a sort of a leader to make sure that everyone is also focused, and delivering what is needed during a project."* (Participant 14; manager of project managers and program manager; cases 1 and 2; page 20)

> *"My role, I don't see it as a sort of line manager. I am not a line manager. It is my problem to the extent that I can solve it. That's why I would talk to the team members first. But at some point, there is a point, and I may reach that point quickly. I don't try to spend time on this issue. There is a point where I get: 'Look these guys cannot decide, I cannot make them agree'. I need the line management to get them agree."* (Participant 4; project manager; case 1; interview transcript: page 14)

Functional line managers sometimes might not agree about the priority of a project, and allocate their resources to other projects or tasks that they valued more important. When project managers' attempts failed to get them back, the only way to resolve this conflict

was to engage senior management. In a dynamic business environment, where priorities change frequently, the time to recover the resources was taken from the project's duration. Since this was some kind of a normal mode of operation for project managers in a matrix organisational structure, they had to be persistent not to be beaten by pressure from the daily matters, to keep project goals in front of everything. If a project had difficulties delivering in time, project managers had to communicate the impacts clearly and early enough to the project stakeholders. The continuous senior management support in the organisation was always the first condition for any project to get the deserved attention.

> *"If you do not see a way to align senior stakeholders, and they are asking for unreasonable delivery, not providing you appropriate resources, not providing you the appropriate budget to deliver the program, you hit against the brick wall. Rule number one, for any good project management, you should have senior stakeholder alignment, even before you worry about budget and resourcing, and time frames."* (Participant 16; product manager; case 1; interview transcript: page 7)

> *"When the senior manager supporting a big budget project left the company, nobody took ownership, and even asked the project status. Another deal was done with another sponsor not to write off the cost, and project was delivered with a much reduced scope."* (Participant 5; manager or project managers; case 3; interview notes: page 8)

> *"If you've got a line manager, who doesn't believe that your project is a higher priority, the only way around that is to engage your senior management. Because, it is perfectly valid for a line manager to say 'this is not my highest priority', and it is up to senior management to decide what it is."* (Participant 10; manager of project managers; case 1; interview transcript: page 2)

> *"Project managers have to be very even handed, not get flapped. They have to be very strong. Because, they come under a lot of pressure by one group or another. And, they have to be seen to be very professional, unbiased, and just deal with the facts. In fact, the project manager has to think of themselves everyday, as more than a very experienced consultant. They cannot take sides, but they have to be strong enough to pull out the risks."* (Participant 18; senior manager; case 1; interview transcript: page 13)

As for any managerial position that requires interaction with people, project managers need relevant skills to relate and work with people. When asked for specific instances where they used those associated skills, e.g. communication, negotiation, etc., the participants gave lengthy descriptions of what happened in their projects, how they communicated and engaged project stakeholders, especially with the senior management, to resolve project problems. Under time pressure, people might tend to keep away from arguments. Successful project managers ensured that the project team and other stakeholders have clearly understood what is expected of them; and if

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necessary they did not hesitate to confront. Otherwise, misinterpretations ended up in disarrayed views and confusion, which, in the end, impacted on the product delivery. Project sponsors, program and senior managers considered continuous and open communication as critical for the projects' success. They wanted to know issues beforehand, as they might impact on the scope or delivery time. When there were external parties with different processes and cultures, and remote team members, it became more important to manage the project risks effectively. Although contractual agreements defined what vendors are expected to provide, grey areas and conflicts usually arose as the project progressed. Then, it required good negotiation skills to reach an agreement in a short time.

> *"I do not mind if the time slips, as long as, it is clearly communicate when it is identified the time of slip, not when a program is due. I do not care if the budget goes over, as long as it is clearly identified the reasons why. They may be acceptable reasons: time, cost, resource and conflicting issues. You need to define priority, and set expectations of stakeholders." (Participant 16; product manager; case 1; interview transcript: page 19)*

> *"You need to be able flush out all these early problems, not try necessarily to solve all the problems." (Participant 12; senior and program manager; cases 1 and 2; interview transcript: page 5)*

> *"There were two or three people creating obstacles in the team. They said for six weeks do not talk to me anything. I said no as an answer from day one." (Participant 20; program manager; case 1; project 26; interview transcript: page 12)*

> *"The risk goes up, when you got vendors who are not on shore. So, further away your providers are, timezone-wise and language-wise, your level of risk just increases exponentially." (Participant 18; senior manager; case 1; project 53; interview transcript: page 11)*

> *"We had not defined to a very detailed level, how things were to be coded or displayed for customers. It is what you call variation management. The vendor tries to get additional charges, and you are saying that's already covered. Contract management, negotiation skills are crucial to go over and avoid the time and cost impacts." (Participant 14; project manager; case 2; project 61; interview transcript: page 5)*

Organisational boundaries did not stop project managers from resolving an issue holding up a project's progress; networking and some politics helped. It was beyond their influence to control the political environment around their projects. Because of their role, it was always required to cross the boundaries between groups. Organisational cultural variation was also a cause for friction. Project managers were sensitive not to take any sides, except for the success of the project. Even if they were

not actively involved, they had to be aware of the politics. For example, they sometimes detected product deficiencies and limitations, and informed the stakeholders, but they could not always get support to stop a project. Other counter-arguments, like over-optimistic short term sales forecasts, influenced senior managers' decisions. Then, the project managers did not have any choice, other than managing such projects to deliver the new products, without questioning the rationale behind the business decisions. Project managers accepted the politics as part of organisational life; they made their reservations and moved on.

> *"Project manager should understand their culture, and broadly what the groups do, what their priorities are, and how to talk to them in their communication styles."* (Participant 11; product manager; case 1; interview transcript: page 14)

> *"You've got to have lots of friends. Friends are very important. That informal network is very important. Because, you do more through informal than formal ways."* (Participant 22; program manager; cases 1 and 4; interview transcript: page 14)

> *"We were impacted of course, we spent a lot of resources. I mean there was one key area. Six months just for politics, justifying to management, why we are doing this and choosing that."* (Participant 21; project manager; case 3; project 69; interview transcript: page 6).

> *"You like it or not, sometimes you have to be political. You're dealing with people. It's politics, there is push and play. Some places, your technical skills good enough to take you to the next level. In some cases, knowledge is not good enough. You have to be political to get what you want."* (Participant 8; project manager; case 1; interview transcript: page 3)

> *"I do not believe the function of the project manager is there to make that decision on the priority. The project manager is there to accept that decision on the priority, and to implement it."* (Participant 10; case 1; manager of project managers; interview transcript: page 2)

> *"We challenged product marketing, there is no market for this product, what so ever. But, it turned out there was a great rush for it, and we delivered in time anyhow. You are pulling all stops to get something done. There is now no customer to use it."* (Participant 6; project manager; case 1; project 20; interview transcript: page 8)

Having continuous support for a project within the organisation required keeping its visibility high, especially among the senior managers. Team members were also more motivated, when they saw themselves in the spotlight. Even giving that impression to the team with good marketing skills served the same purpose. It was a continual effort from beginning to the end of a project, selling both to the team and to the senior management, being an agent and lobbying in favour of the project.

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"I think there are a number of factors: critical one is the involvement of senior management, and more importantly the perception of involvement from senior management. What I mean is the people working on the project have to perceive that this project has a high priority. When you have an environment, where people are always multitasking, anything new is put at the bottom of the list, unless a lot of fanfare is created to bring it to the top of the list. It is really priority setting. You cannot do it in one announcement, it is a continual marketing effort, if you like, for your project." (Participant 10; manager of project managers; case 1; interview transcript: page 1)

"You've got to sell what you're doing. you've got to show a level of confidence, competence what you are doing, otherwise, people do not want to know what you are doing, you have to sell it." (Participant 12; program and senior manager; cases 1 and 2; interview transcript: page 15)

In some cases, escalations become unavoidable to meet the challenging delivery times. It might be acceptable to take hours to explain an issue to a peer or a team member, but it was not so for senior managers. Project managers then needed to be more careful in their written and verbal communications with them. Good project managers framed the information precisely and concisely: it included a brief summary, background, the issue in question, and most importantly what alternatives actions need to be taken, and their possible consequences. Senior managers wanted the facts and evidence, explained in plain English without technical jargon.

"You have to change the approach for the person you are trying to get the information to. If you're going up to another level, well probably you have to find ten minutes of this person's time, and you probably have to dot point it. Now, if I am going to communicate with a director, probably I won't get in his diary for a week, or general manager or whatever. So, a person getting the message at that layer thinks that I am covered, if someone above calls me, I'll know and I can say it is under control, we're managing it. You have got to adjust the content, and the delivery, and the medium. If you do not want to waste their time, and you want to make it efficient, what is the issue, what you are doing about it. If you need help, my request is I need the following, can you please assist? That person may not know anything about the project. You have got to assume that he knows nothing about it, so introduce it. I'm writing to you about this project, which is doing this. Don't assume, because it is in his division. He will know, because he probably has five other projects on his brain for the last few days." (Participant 18; senior manager; case 1; interview transcript: page 17)

"You've got to know who is the audience. Every document you're producing, every piece of work you are doing, who is it for? Is it giving what they need to do their job." (Participant 12; program and senior manager; cases 1 and 2; interview transcript: page 17)

All participants emphasised communication skills, essential for sending correct messages. Indeed, project managers were engaged in two-way communications. Listening skills were also important, not only verbally, but also other means of

communications like body language. Creating empathy with people, by indicating they are listened and understood, increased the credibility of the project managers. They also presented examples of how they provided better solutions to problems by listening to their teams and customers, and encouraged a solution that was effective both technically and business-wise in terms of processes and costs.

> *"He should be a good communicator, and a very good listener. In my personal experiences, I actually picked some of the ideas by listening in the team. People will pass the comments without thinking; most of the people do not notice it. But, those points are actually valid. If you pick them up and evaluate, they give very good results. I use that in my projects." (Participant 2; project manager; case 1; interview transcript: page 10)*

> *"For example, they tell you something, you go away, you think about it, things like that. Then you go back and ask other questions. And, they say 'hey, that's an insightful question'. Even you do like that, it builds your credibility. Or, you're able to talk back to them, and explain the things. That builds your credibility." (Participant 3; manager of project managers; case 1; interview transcript: page 15)*

5.3   Managerial skills

In all cases, as in any industry, project managers' main duty was to use the company resources (i.e. people and money) to deliver on time a new product that satisfied marketing requirements. They needed to develop project plans, execute and update them during the project's progress. Managerial skills were, therefore, mandatory for a project manager. They were vital to manage a project successfully by reaching a compromise between time, quality and cost constraints. There are well proven techniques and tools that can help project managers to produce better estimates and to track closer the project work. Lack of managerial skills prevented their use effectively; although they seemed to use those tools, behind the scenes it was rather an ad-hoc effort.

> *"You always work on sort of the three constraints of a project: time, scope and budget. They get impacted by any changes. So, something has got to give basically. We may have capacity within the project to resolve it. For example: budget may be available, or time may not be available. Depending on the priority in the project." (Participant 1; project manager; case 1; interview transcript: page 3)*

> *"Project management skills, i.e. developing plans, managing risks and issues, etc. are fundamental and basic stuff." (Participant 10; manager of project managers; case 1; interview transcript: page 9)*

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"Certainly a project manager needs to understand the basics of project management." (Participant 12; program and senior manager; cases 1 and 2; interview transcript: page 15)

"Project management: project schedule, plan. But, you need more. You need more than just ticking over activities." (Participant 14; manager of project managers, program manager and project manager; cases 1 and 2; interview transcript: page 17)

"A lot of the guys here, I do not think that their projects are running well. They are losing track. Or, they may not recognise it, because they do not know. They think they are doing their best, and they are. But, you know, with extra skills, they could do even better. You definitely need the project management skills. And, you choose your tools, the ones that suit and fit in your time frames, because you can only do that much." (Participant 19; project manager; case 1; interview transcript: page 16)

However, perfection and knowledge of every detail of these tools are not necessary; rather, the aim is their effective utilisation in managing projects. The plans were modified while a project progressed, assumptions and conditions changed, and the unknowns in the project tasks were better understood. With shortage of time, good managerial skills were required to evaluate progress and change plans quickly. Tools for producing plans were meaningless unless they were commanded with good managerial skills. Some participants made a very clear distinction between managing an NPD project, i.e. managerial skills, and knowledge in using project management tools, i.e. administration skills, which is addressed in the next section.

"I think that the skills to run MS [Microsoft] project and understand it, that sort of stuff is pretty low down the list. You do not even need MS project to do it. If you get a simple list of milestones, you hit those milestones, that's all what is required. You can do the same thing in spreadsheets, if you want to. They are not really using those tools in every way, they meant to be, and you do not need it. They can do quite complex things. We do not actually run at that level. Good looking schedule does not make a big difference to the project. It can give you a timeline, as the ball park, when your products are going to be ready, and that can help you track along the way. But it does not really help you to deliver the product." (Participant 13; project manager; case1; interview transcript: page 19)

"MS project, access, excel, whatever they are they are just tools. It is up to the individual project manager to apply them. Saying that, it would be good to have basic induction for new project managers." (Participant 21; project manager; cases 1 and 3; interview transcript: page 20)

Developing project plans for small projects was simpler as they consisted of only a few tasks. It was not always easy for large and complex projects, since they had multiple interrelated tasks, larger project teams, and many stakeholders. Updating project plans was beneficial to track progress and to proactively keep an eye on project issues. It was

a means of two-way communication with team members to convey project goals and to revise with feedback from the project team indicating what was missing. The project schedules associated with the plans summarised the critical tasks and milestones for reporting to senior managers. Especially with external parties involved in a project, the project plans were the official documents of their binding contractual agreements.

> *"I also use project plans to communicate goals to my team. This is the project, this is what I want to achieve, and typically either I present the plans, or people will tell you that the think should be done. At the end of the day, the final plan is a way of us agreeing on who should do what, when and how." (Participant 4; project manager; case 1; interview transcript: page 13)*

> *"Senior managers do not care about your schedule. They may want to know the key milestones, and when would be the business case gate approval. Your schedule helps you obviously work out the appropriate dates, and the time frame." (Participant 1; project manager; case 1; interview transcript: page 9)*

> *"They were working with the third party. They contracted them to do the first step only, which shows we had no concept what we are asking the vendor to do. We'd basically contracted them to what they do is to build a few modules, and make sure that modules work. We haven't planned to contract the vendor to document anything. The project was totally in shambles. There were no technical documents, the vendor was not contracted to provide any of those. If they handed over software, we would have no idea about what we bought. That comes down to scope, locking down your plans and agreements, which were not done." (Participant 16; project manager; case 1; project 47; interview transcript: page 4)*

Large and complex projects inherently contain more risks and unknowns. The most effective way to cope with them was to develop plans that contain contingency scenarios. Since the strategic direction was to deliver projects as fast as possible, project planning was the first step to evaluate the whole project end-to-end, and then manipulate tasks to be implemented concurrently to shorten the time-frame. As the speed in a project increased, so did the risks associated to deliver it in time. Planning enabled project managers to understand the risks, and what they could do to remedy them. Although project managers attempted to prevent mistakes from happening in the first place, it was impossible to predict them all. Thinking of risks beforehand during the planning process, constantly tracking the project progress and questioning what could go wrong helped to develop contingency plans in a very short time.

> *"Project managers should have experience to manipulate the proposed changes to sue the fast implementation. He should be able to use the resources effectively, to probe for short cuts, ways of doing things in phases, or rapid type implementation." (Participant 9; senior manager; case 1; interview transcript: page 7)*

"You want to know where the things are, you have to do your planning correctly. What it does to take a lot of risks out of your planning. When you get size and complexity. They increase the risks, whereas you know more about something, you reduce the risks. That's more a question of setting up a project plan." (Participant 3; manager of project managers; case 1; interview transcript: page 10)

The project sponsors, program and senior managers gained confidence in project managers and judged their performance with the project progress. They were well aware of the circumstances, and uncertainties that NPD operate in. To them, it was completely acceptable that project plans might not reflect everything: unforeseen technical limitations appear, requirements change, and delays happen. They were not interested in what was happening in detail; they looked at whether the project was progressing as planned, the interim milestones were being met, and any difficulties that could delay delivery time. They wanted to see if changes were handled with a good record of why they happened, and associated modifications in the plans to address them. With a good project plan, successful project managers drilled down to individual task level, extracted information, and modified plans quickly, when needed.

"Senior managers are interested in knowing what the milestones are; what the key issues are preventing you from achieving these milestones; key risks and issues that are preventing you from achieving those milestones. They are also interested in tracking your budget as well. They can see that spend is right." (Participant 4; project manager; case 1; interview transcript: page 12)

"Project manager had good theoretical skills, but it came down to actually managing the program, stuff just fell through the cracks: schedule slippages, and cost blow outs. Technically, he was perfectly capable, but he did not have the understanding to manage the changes in the program. As technical limitations spring up, then the project manager has to manage that change, but the scope of the program never changed." (Participant 11; product manager; case 1; project 35; interview transcript: page 2)

Although project plans are important, they did not suffice in project execution. Project managers did not have any authority to shift company resources in favour of their projects, when needed, to finish their projects in time. They were not in a position to exert direct power, and escalations were the only available mechanism that lets them use their positional powers. All of the participating project managers considered them a natural extension of their activities to address project issues. Because of time-to-market pressure, delays had to be prevented. The project stakeholders also wanted to know of problems beforehand, so they could take corrective action. There were a variety of reasons for escalations: resource conflicts, additional funds required, and critical tasks not completed in time. It was impossible to guess all future circumstances and ascertain

all risks. They followed the same pattern: first acknowledging the managers informally, and attempting to resolve it; then escalating formally, if a situation worsened. One of the participants summarised this process well: 'firstly be in control, at worst you should appear in control'. Well-timed escalations make project managers look like they are in control.

> *"They should have escalated that the scope was cloudy, and it needed to be clarified, while continuing the progress of the program. But then, while they are aware there were contentious deliverables, he should have escalated, instead trying to fix." (Participant 16; product manager; case 1; project 36; interview transcript: page 12)*

> *"If you think something is going to happen, even you do not know something is going to happen, it is always good to flag as a risk with your sponsors. You tell them that we will have with this resource, an engineer might be leaving, but we do not know when. Next week, you say it actually happened. That way, you get less hit. As a project manager, firstly you need to be in control, at worst you should appear in control. I think this is the difference between experienced and inexperienced project managers." (Participant 4; project manager; case 1; interview transcript: page 11)*

Project managers preferred escalations as the last resort due to their possible impacts. They were not necessarily reactive, when project managers could not handle them any more. They also needed to be proactive if a potential problem was on the horizon. They escalated such issues as early as possible, before it might derail the project. This indeed put the responsibility back on the project owners, i.e. senior managers and project sponsors, and made all stakeholders aware that their project was at risk.

> *"We identify the problem, we will say this problem impacts the whole delivery. Then I immediately create an awareness to the top manager. I'll send an e-mail across, just to make them aware. Whenever a problem is identified, I'll actually keep the management posted what is happening. So escalation will not come to them as a surprise, if things are not happened. When I get the impact assessment, I'll tell the top manager, see this is the impact, take the priority call." (Participant 2; project manager; case 1; interview transcript: page 3)*

> *"Any stakeholder, including project manager, who sees anything within the program, going off track, should escalate. That's not the responsibility of one person, so people should not say that it is not my job, I'll let this run off the rails. If they see something, at least they should flag it, and escalate." (Participant 16; product manager; case 1; interview transcript: page 13)*

> *"You have all your escalation procedures. One is not delivering to what was promised. Then, you have to go up in the chain and advise. Managers and senior managers would know as well. Because, they have to answer and pick up the phone." (Participant 3; manager of project managers; case 1; interview transcript: page 6)*

"I must admit that, I have changed my style. At the beginning, as I work in teams, I was very involved in the issues. I had hands on experience. I worked with them to solve the problem, and tried to be helpful. Now, if they already established a history of missing their targets, time and time again. I will escalate to the management immediately. If they miss one, two, you know. I'd say OK, we can absorb within project, put enough contingency and some fat. In some projects, you just do not have the luxury for waiting for something until it is not bearable any more. As soon as, it is not met, flag goes up, and the person is accountable immediately. It is the responsibility of the project manager to raise that flag." (Participant 21; project manager; cases 1 and 3; interview transcript: page 18)

Escalations still took some time for the stakeholder managers to understand the facts and conflicts, and then make decisions. Participating project managers indicated that they escalated indeed for themselves to show that they did their part, but could not reach a resolution. If they did not escalate and events went out of control, they might be considered responsible. Once they reached a threshold, which varied from one project manager to another, regardless of whether they could resolve the problem or not, they preferred to escalate it just to be safe. Senior managers did not consider escalations as indicators for the weaknesses of project managers. They also wanted to be seen to fulfil their part, and treated escalations as one of their daily routines. As well as timely escalations being important to address project issues in time, they helped project managers to be seen to be in control. Successful ones also provided alternatives, and made recommendations as to which path to take for a resolution. However, in reality, they were working with many risks and unknowns in large and complex projects, and using escalations to cope with them.

"I find mostly escalations do not work. Because, not I do not escalate. I escalate when I have to. You will escalate, what will happen is: an e-mail will go. that person will tell his or her story. You tell your story. When I escalate, I am trying to explain to management what the problem is. Half the time truth gets lost. Those times I have to escalate, there is no option. I do that much for me. Whether to actually fix the problem myself, rather than escalating." (Participant 8; project manager; case 1; interview transcript: page 5)

"Project managers should set the right expectations with management, and flag risks as early as possible to senior managers. They need to be seen as they are supporting for you, not working for them, in a way that working for you. You've got problems, you've got to let them know, so they can help you resolve a problem before it occurs." (Participant 4; project manager; case 1; interview transcript: page 11)

"Here is the issue, here is the impact on the business and customers. Here is what I am doing, and I will give you an update tomorrow. I know you are working on it, and I do not need to worry yet, and you are coming back, informing if the risk is gone away." (Participant 18; senior manager; case 1; interview transcript: page 16)

Company strategy assigns priorities to different projects, and senior managers, having the visibility over the projects, rank them. Project managers could still affect their decisions by proposing arguments on how the strategy might be impacted with a late product delivery. However, they might not be successful in getting their support. If a decision was made against their demands, they changed the plans with a new time line, when the resources would be available; their role was not to make such decisions.

> *"If your project is not getting the priority that needs, the first thing you can do is to engage your senior management, and make sure that they think this is the highest priority. And, the way to do is to highlight the impacts. It may well be that your project is not the highest priority, and then you do not have an option, but to say OK, well, I have to reset my own time frames. Because, the business criticality of this project third in the list." (Participant 10; manager of project managers; case 1; interview transcript: page 2)*

5.4 Administrative skills

A couple of stakeholders, low priority and less attention from senior managers had small projects managed much less tightly. Large and complex projects were fundamentally different; they are managed with more formal structures and role divisions, and well defined governance procedures. Telco companies comprise specialised groups assembled around technologies and functions. Administrative skills were required to handle the number of interfaces among the stakeholders, which proportionally increase the complexity. As project managers did not have any formal authority over anyone, they relied on administrative roles and policies to cross boundaries and implement process changes. They needed to know who does what and who are the decision makers. Project governance described roles and responsibilities to assist project managers find the right people. Escalation paths were also part of this governance.

> *"In the engineering and operational organisations, like in Telco, the numbers of technologies create siloism. Silos create a lot of work for the project managers in order to cross those boundaries. Especially with a new technology, people do not have the view who should do what. For a new product, where there are multiple facets, some people take care of this, some others take care of that." (Participant 4; project manager; case 1; interview transcript: page 15)*

> *"You need a more formal structure and a governance, sort of structure. Obviously you need a detailed project management plan that goes into roles and responsibilities of all the people involved in a project. You identify the stakeholders*

and governance structure in place. Also, you need an escalation path agreed. There's probably a vendor involved as well. You need a statement of work with that vendor that clearly defines their deliverables and milestones, as part of managing large projects." (Participant 1; project manager; case 1; page 6)

Time-to-market pressure in large and complex projects affected the way the projects were run. There were several projects competing for resources, and project team members were assigned to multiple projects with different priorities. They worked on the project tasks in the order given by functional line managers, which in turn came from senior management. Project managers did not have the administrative ownership of the resources, but their performances were still measured by delivering projects on time. When the resources were taken away from their projects, they could only escalate, with the arguments justifying the impacts and needs in their projects. All participants stated that escalations were their prime formal tool to resolve conflicts within and among projects. Consequently, escalations have become a culture in managing Telco NPD projects. Although they sometimes had undesirable political impacts on the team members and stakeholders, participants did not hesitate to escalate for the sake of project success.

"Sometimes you lose the personal relationship with certain project members in the long term. For me, it is important to establish a good relationship with these people. When you have short time, very high pressure, you do not have luxury of waiting. People at your back, you have to deliver." (Participant 21; project manager; cases 1 and 3; interview transcript: page 18)

"You've got to be able to get their co-operation mentally, that is, by being nice to them, getting them on board. You have got to be a body with them. Escalating to their managers really annoys them, and makes them feel very bad." (Participant 13; project manager; case 1; interview transcript: page 22)

The escalation path differed according to the organisational structure. For example, in Case 1 the first escalation points were their managers, and program managers, whereas in Case 2, it was platform owners. However, it did not make any difference to project managers regarding how and why escalations are made.

"Platform owner who owns the money, is the person is responsible for the project. Platform owners gets resources from functional managers and form a project team, and gets a project manager from their group, and tell him 'you are accountable for this project; if there is a problem, come to me'." (Participant 23; project manager; case 2; interview transcript: page 1)

An NPD that involved many stakeholders, even if its technologies were known, had the same process implications as a new technology project. Sometimes, structural changes

were also required, and escalations were unavoidable to overcome the resistance to implement them. To handle such complex matters, project managers needed a good understanding of the organisational settings in terms of both administration hierarchy, culture of various groups, and their processes. It was emphasised by participants that project managers should have experience in such environments to gain administrative skills, and ultimately to understand a Telco company.

> *"Especially, when the process change means there is going to be some organisational changes to support the new product, that's much harder. A project manager cannot do anything about it, other than escalating to senior managers." (Participant 18; senior manager; case 1; interview transcript: page 14)*

> *"A project manager must have Telco experience, and worked in various areas, in other words, process areas of Telco, the product development, the building of the network. That's probably a knowledge of the industry and the organisation." (Participant 14; project manager, manager of project managers; cases 1 and 2; interview transcript: page 16)*

In every case, the companies had NPD processes with some differences; a variation of stage-gated NPD processes was employed in all of them. Most of them used well known project management tools like Microsoft Windows Project or Excel, which are used in almost any industry today. All participants agreed that the tools are important to manage projects. They were also aware of other company specific management tools, even though they might not use them frequently. In some large and complex projects, there were supporting administrative team members who maintain such project tools and their data. There was evidence that some projects had the right tools to manage a project, like schedules, risk and issues registers, but these were insufficient to save them from failure. It again indicates that effective use of these tools to manage a project should be the main objective. Good administrative skills helped project managers use those tools efficiently, and enhanced their performance.

> *"We have systems available, but use less daily. We have [an internal project database] allows you to define milestones and get agreement with your stakeholders. Your milestones and costs are defined in that system, which are used to sort of track, used to define what risks and issues that need to be addressed, and what sort of mitigation is put in place. [Another internal financial tool] which helps you manage your budget. It comes from the financial and accounting teams. Because they have their big bucket of money, millions of dollars, they have got to work out how much it is going to get spent on a month by month basis. So it helps them how the money is managed." (Participant 1; project manager; case 1; interview transcript: page 9)*

> *"Project manager was not technically OK in understanding what the technology was delivering, not capable of communicating what business wanted either. But he*

had good theoretical project management skills. So, you know, schedule slippages, cost and technical blow outs, the whole work." (Participant 11; product manager; case 1; project 33; interview transcript: page 2)

Project managers used communications tools (e.g. e-mails), recorded meeting outcomes and produced documents by using documentation tools (e.g. Microsoft Windows Word, Excel). However, all these tools are accepted as standard in today's big organisations, and almost every employee uses them in their everyday activities. Considering the number of stakeholders in large and complex projects, and sometimes the distance between them, these tools were especially critical for project managers. All projects had to comply with company policies and rules to use electronic communications (e.g. what can or cannot be written, confidentiality) and documentation (e.g. format of a specific document, file structures). Additionally, their documents and e-mails needed to be clear and error-free to prevent misunderstanding. Since project managers acted as an information hub among many stakeholders, they needed to be more careful and sensitive than other employees about the content of their e-mails and written documents.

"You have got to make communication more meaningful, but also short and clear. Turn into a language that that person may not know anything about the project, then introduce it." (Participant 18; senior manager; case 1; interview transcript: page 17)

"Requirements should not be ambiguous, and suitable for a tender process. There is a common understanding of the engagement and involvement. In terms of all the stakeholders agreeing that the requirements fully represent a full set of requirements. They are compiled, proposed and presented in appropriate way." (Participant 9; senior manager; case 1; interview transcript: page 3)

The main benefits of the tools were to present project information in a compact and convenient format, and record the project history clearly: when, why and what were done in the past. With fast time-to-market goals, and dynamic business conditions, project managers were expected to produce reports for possible scope changes, and their financial and time impacts in a short time. Occasionally, project managers were asked to quantify how a project was performing, and to justify the needs to senior managers. No standard way was observed for using the project management, communications and documentation tools. Project managers customised the tools for their particular projects, according to how quickly they could retrieve information. They were aware of the benefits of standardisation, but participants from different stakeholders have all considered this variation positively, as long as they timely provide the desired outcome.

"Different standards and templates are used. But you also have to consider individuality, because some people are picture people, some people words, some others verbal. There are already some standards and templates for different types of reporting and presenting information. For example: there is a project one page report, everyone does that differently, but it provides a template." (Participant 14; manager of project managers and program manager; case 1; interview transcript: page 19)

"I think adapting your own styles is more positive than negative. Because, if you speed up the project, so you would not be so worried about handover from one person to next. That's one of the main problems. Because, cycles are so long, it is important that you do use very similar things, so somebody else can pick up and work instantly. But, in the case of people having their own unique styles, if it gets done quicker, then that's not a major issue." (Participant 15; product manager; case 1; interview transcript: page 12)

"You take the best out of it and adopt it. Maybe, the way I adopt is different from yours, some other has different. But, at the end, we are chained to end goal, delivery in time." (Participant 17; project manager; cases 1 and 2; interview transcript: page 21)

Mandatory procedures and processes integrated a project with the rest of the company to consolidate the information at a high level, thus measuring progress and alignment with the company strategy. Especially in large and complex projects, project managers were required to comply with company-wide policies, since their budget and legal aspects were closely scrutinised. On one hand, administrative processes ensured that the right projects were funded not to hit a road-block, but on the other hand, they were time consuming. For example: bureaucratic approval procedures tighten the time constraint in the NPD projects, which were readily under the pressure with challenging time-to-market goals.

"Some processes are cumbersome. The one I query the most is the approval process. Approval process adds time in decisions making, because of the delegations of sign off. It requires several briefings to get the approval. And, each one of those briefings and sessions take time. If you're going to go up approval, that can easily take three months, because it requires to go through stakeholders, then the next level stakeholders, then next level. When you look at the organisation structure, that can be up to five levels. So that process blows main governance for project management, makes extremely cumbersome. And, they were looking for a strategic positioning for this program, a further review, where it is fitting. So, it put about effectively 6 months delay." (Participant 14; program manager; cases 1; project 43; page 19)

The first and main goal in Telco NPD projects was to deliver new products in time, which consequently set the project managers' top agenda item while running their projects. Senior managers and project sponsors were aware of the NPD process implications from NPD projects, and usually let project managers bend the rules and

processes, wherever justifiable, to save time. Therefore, flexibility in applying the NPD processes was culturally accepted to deliver products in a shorter time. Although there were official project management processes that describe what to do in each project, and pre-requisites to move from one phase to another, project managers tailored and followed them differently in every project, and tried to reach a compromise between timely delivery of a new product and NPD processes. The processes that are not seen to have clear purpose were also questioned the most by the participants during the interviews.

> "[Company D] did not have any rigour at all. Each time you had to get approved, it seemed to be a different way to get the approval. There was a lot of politics, there was no rigour around spending money. I had no confidence on the guys at the top knew what they were doing. What I did notice here [company A], as soon as I joined, I had the confidence, they are people at the top, they are competent, they know what they are doing. They may not go about the best way, because of the culture, but clearly the guys know of what is going on. They have some control over what's happening. In [Company D], they seem not" (Participant 7; manager of project managers; case 1 and 4; interview transcript: page 10)

> "Certain deliverables are made and noted as mandatory. But, if you don't have the flexibility, and you do process for the sake of process, then you're really not working in a good business driven environment. You need to make sure that the process is there to facilitate end result, and process should be used to achieve that in the best way." (Participant 9; senior manager; case 1; interview transcript: page 8)

> "I try to do both. My first priority is delivery times, but I do not sacrifice the processes, because it will bite me. Because, the processes that I am following practical and useful. I do not do things that are not required. So, I minimise any process, if it is not practical for that project, for that environment, for those people." (Participant 20; program manager; cases 1 and 2; interview transcript: page 15)

> "That's according to the process. The reality is probably, my experience, half of the groups totally ignore the process. If they come up with something they need to do, although they need approval to proceed, for example they actually go and buy the equipment, install it, before even define the requirements." (Participant 23; project manager; case 2; interview transcript: page 4)

The participants all mentioned meetings, reports, etc., which are regular project management duties, but did not pay much attention to the administrative tasks that do little to contribute to project management success. As a consequence of flexibility in managing projects, they performed them in the order of urgency, and just at a minimum sufficient level.

> "I do not write meeting minutes, but try to note everything really really important. I don't write everything, but I write everything that's important. For instance, if a

person is saying he's leaving, I write it. If they made a decision, I write that. Not everything." (Participant 4; project manager; case 1; interview transcript: page 13)

Interestingly, participating project managers have not paid much attention to improving project management processes, as it was not set as one of the priorities, and therefore not one of their challenges. This left project managers with basic minimum processes to provide the maximum flexibility, and omitting anything that may prevent an NPD project's goals. One participant pointed out that it could be due to its lack of recognition. Project sponsors were frustrated with no apparent effort to omit redundancy and increase efficiency. Some participants acknowledged that NPD processes needed to be improved to eliminate the heavy dependency on individuals, to gain the effectiveness and efficiency of the best practices in Telco and other industries, and to retain the knowledge in the company. Indeed, this presents a mixed picture about project management processes: processes are claimed, on one hand, to have needless overhead and, on the other, to lack a consistent framework. It is then quite challenging for Telco companies to achieve the consistent project management processes, but also with flexibility and speed.

> *"There is no standard framework, and there is also no project management methodologies, like Prince2, PMBOK. I am not saying it has to be. So, what I am saying is this basic project management framework. That needs to be implemented, trying to standardising and consistently deliver programs. Every project manager in [Company A], should have fundamental understanding of basics of a project. I do not believe that everyone has that." (Participant 16; project manager; case 1; interview transcript: page 18)*

> *"I am not much of a process person. Processes are useful, because you're dealing with big organisations, large and complex projects, you cannot work as a cowboy. There has to be method in everything. Having said that, I do not think that processes, methods are an end itself, not an objective. The objective is to get quick fast outcome. To me, if a process is hindering a fast outcome, then the process should be thrown in the dust. Sometimes, unfortunately, the focus is on processes, not on outcomes. My view, people tend to hide behind them, and follow rigorous processes. They are people who are new, or people do not want to take any risk. When you are working at middle management level, you are working as a project manager, I think you should be able to use your wisdom, you should be able to use your experience, and say 'look, I do not need to follow this handbook, this is fast way to do it'. It is the tool, and you can tailor, modify, depending on your needs. " (Participant 8; project manager; case 1; interview transcript: page 9)*

> *"There is lack of recognition that these are the sort of processes that are required. I never looked at this here if necessary. I think, they were introduced in a certain way and stayed that way all the time." (Participant 19; project manager; case 1; interview transcript: page 17)*

6 Telco NPD project manager skill sets versus project phases

Although it is desirable to run a project with the same project manager from beginning to end, dynamic conditions may not allow that; occasionally the resources need to be re-allocated in an effective way. Under such circumstances, some criteria are needed to assign project managers to the projects at different phases of their life cycles. This section presents the findings about what skills were needed in which phases, so project managers with the right skills can be assigned. Each skill set is analysed to explain how they are contributing in a project phase: II, F&D, DIV and Closure.

6.1 Technical skills versus project phases

As part of their duties, marketing groups in a Telco company interact with customers, equipment manufacturers and competitors, and guide the company about which new products are needed. The participants from marketing had an idea of their rivals in the industry, and wanted at least to match them in their product offerings. However, in practice, it was not reasonable to consider every possibility in a product for the sake of competition; some of them apparently were infeasible, too expensive, or they had technical and operational limitations. To understand what can be done, and then to communicate with marketing, operational and engineering groups, and external vendors, project managers needed knowledge about the technologies upon which their projects were based. The good ones took such steps early in a project, without going down the track before engaging any resources, therefore saving cost and time. Technical skills were especially vital to finalising the project requirements during the II phase.

> *"Generally the product manager [marketing] work from their research what is available in the market. They are always trying to be one step ahead and deliver what they can. So, generally the technology is pretty much there, it is just a matter of getting a clear understanding of what they really want to achieve to make it successful from a product perspective." (Participant 1; project manager; case 1; interview transcript: page 4)*

> *"The key thing is the II phase, the scope. Once you defined it well, 50% of your job is done" (Participant 2; project manager; case 1; interview transcript: page 9)*

"I give my requirements, you interpret them into detailed specs. In that particular project, we gave the project manager our requirements, he did not add any value. Or not even, he wanted them ready in a format and technical details that can directly go to engineers. We would not need the project manager, if we wrote the specs." (Participant 15; product manager; case 1; project 36; interview transcript: page 14)

The project stakeholders from marketing, who are the internal customers, were not usually technical experts, and they were not able to describe some requirements from users' and development engineers' point of view. Then, it was the project manager's duty to have them clarified and explained in clear terms, agreed by both marketing and engineering groups, and documented in unambiguous terms. In addition to business requirements, there were sometimes hidden technical requirements necessary for the required functionality. Good project managers queried until they were sure that all the pieces fitted together coherently. Rather than accepting immediately, they dug deeper to disclose unwritten requirements from the stakeholders. The technical skills helped them ask the right questions, and determine different scenarios that encouraged people to think of a better description of the requirements. Senior managers also valued these skills in their project managers, because they could draw boundaries of a project's scope and give a clear direction to the project team. Failing to understand what was involved in a project, and communicating incomplete or incorrect information, caused a mismatch between what was expected and what was delivered from a project.

"Sometimes, marketers do not know what they want, it is a challenge. We rely on marketing people to learn what they want. They do not know necessarily everything, and cannot give us. They are relying on us to tell them what's possible; in a way to tell them what they want. It is reversed sometimes, where you'll say well I can do this, when they say I want that." (Participant 4; project manager; case 1; interview transcript: page 3)

"That project's scope is defined, but misunderstood. So, there is no alignment between marketing and engineering side of the expectations. And, hence the word 'assume': This spells a good example, it is because people kept assuming and not going back, and clearly verifying." (Participant 12; senior manager; cases 2; project 59; interview transcript: page 11)

"It was so complex, it needed several project managers inside the technical network space, to manage various components. What was missing in hindsight was a lack of a very strong project technical person to help making decisions, when they were being pulled and pushed by the stakeholders." (Participant 18; senior manager; case 1; project 38; interview transcript: page 4)

"A product could be delivered over [a communication channel] without encryption, which no customer wanted. They delivered an unencrypted service over a public network. They said 'that's what we are signing off, that's what you wanted.' It is not the product, we wanted. Anyone can intercept the communication. They replied

The alternative solutions were outlined, and then the feasible ones were tested in the F&D phase. Project managers had approved what were to be tested, so as not to waste company resources, because they had the end-to-end visibility of a project, and they knew the possible impacts more than others in the project team. An attractive technical solution proposed by engineers or external vendors did not necessarily imply a favourite option, as they were not aware of the constraints due to the organisational processes. Although the project manager had responsibility for the selected solution, their input in the F&D phase, was not very technical but consisted mostly of organisational process considerations. Therefore, their use of technical skills in this phase was more limited than in the II phase.

In the DIV phase, the agreed solution with the project stakeholders was implemented in the field. Although the requirements were gathered in II, and then an optimum solution was selected and tested in the F&D, the DIV phase usually had issues. The practical limitations that were not detected in the previous phases put a project on hold, and it required some changes in the design, which then impacted the product. An accelerated project that bypassed critical tasks ended up having technical issues needing to be fixed. New features were added to the product due to a recent market opportunity, or team members came with better ideas for the solution in later stages of a project. Some proposed changes offered cost and operational benefits, yet they also created complications. First, they were not thoroughly examined; second, they needed to be evaluated and implemented in a small window of opportunity. The technically capable project managers with a good understanding of the project tasks and their relations that form the final product changed the project plan, even at very late stages of a project, and came up with alternative ways to satisfy latest demands. A decision had to be made: include or forgo those last minute changes, and stick to the original solution for convenience, not taking any risks. Such changes were rarely encountered in projects that started with a clear scope. Therefore, technical skills were more important in the II

phase, but it was still desirable to keep an eye on the project work and to note any signals that something might go wrong.

> *"In DIV phase, funding was already approved, the scope had been defined, and roll out, establishment of program, time frames, and deliverables had been set. There are extensive scoping issues project and program managers missed, and propagated through to the DIV phase. I had to conduct a total review of the scope. Because, the vendor and internal within [company A], there was a lack of understanding exactly what was required. So, I had to do a review of the scope, and do matching between the requirements and the design solution, because the solution design did not address the requirements. Partially, because the project manager did not have sufficient technical skills, and missed the things." (Participant 14; program manager; case 1; project 43; interview transcript: page 3)*

> *"The design for interconnect was changed after DIV as well, adding some extra redundancy to the scope, which consequently added extra complexity. I believe, it would have been better, if they left it in the simple way it was initially. Design was defined before going into DIV, and then changed without consultation to use shared equipment for better redundancy." (Participant 7; manager of project managers; case 1; project 22; interview transcript: page 5)*

When a new product was accepted by operational groups at the end of the DIV phase, it was indeed the completion of its project. The support groups examined a product in detail before approving its acceptance; they were basically saying "we can own and support this product from now on". However, project managers were still engaged in this phase to support the product during its full transition to operations. Since the product was new, they were expected to help in answering initial queries from sales, operations and first customers. As project managers had an overall systemic view of a product, they were in a good position to understand what was happening in practice, and engage relevant groups to fix any gaps. Although they gave a hand, it was not their duty any more, but rather an operational matter for the support people. Consequently, some technical skills were useful in the Closure phase, but they were not as critical as in the II phase.

> *"In other words, they found other uses for the new product that they had not thought about. What was originally scoped was a set of conditions for a single connection, and the vendor supplied certain parameters for it. We received issues from the field, and investigated. Then, what happened was the sale of the product was extended to many connections. We actually tested for all the combinations of customer equipment, after the product was launched during Closure." (Participant 14; manager of project managers; case 1; project 44; interview transcript: page 14)*

> *"At a later stage after delivering the product, I observed that they are mostly man-made error during provisioning. We developed to indicate an error to engineers,*

when they enter incorrect data." (Participant 2; project manager; case 1; project 5; interview transcript: page 2)

6.2   Leadership skills versus project phases

Project phases did not have the same key stakeholders, but the need for leadership skills existed in each for different reasons. The first phase II was critical to determine what an NPD project would deliver. Defining a project's scope with clear boundaries always required informal and formal communications and getting stakeholders' agreement as the first step for a project's success. Two-way intense communications among the stakeholders, especially with project sponsors, happened until all agreed on the requirements.

> *"Defining and clarifying the scope is the key in that phase. The outcome in that phase is a clear set of requirements. You're doing clarifications in an iterative procedure. You are using e-mails, phone calls, etc. all sorts of communications, negotiation, giving and taking with all stakeholders." (Participant 4; project manager; case 1; interview transcript: page 9)*

> *"It involves some discussion both ways, and there is sort of an iterative process. We would have a general understanding of what they want. Then, we get a better understanding from the vendor what can be done, and it will hopefully open up holes, if they are unable to meet those requirements. Through an iterative process, we get a confirmation of the importance of certain requirements." (Participant 1; project manager; case 1; interview transcript: page 3)*

Good project managers weighed up what was good for the company overall, rather than accepting all the requirements even if they were feasible. Short term benefits or cannibalisation of another strategic product were not a concern of project sponsors, as they were after their own financial benefits. There were also several influences that heightened the sponsors' expectations, like vendors' untested claims of a new technology, or false promises made by some functional groups. With the involvement of politics, arguments could be harsh, and a situation could go out of control. Project managers needed to be strong to endure against such demands. Networking among the stakeholders was useful for understanding concerns beforehand, and to reach agreement on the project scope. It was indeed a benefit for the whole organisation to spell out as early as possible the areas where a product may fail in the market. Project managers encouraged all stakeholders and their team members to give bad news starting with the II phase, and point out the weaknesses in a new product before it reaches the market.

"Most of the problems happened in II phase, and later some in F&D. The capabilities of the technology that the vendor was claiming to marketing were not there. We did a number of rounds with them to clarify things, meeting after meetings. There were also some heated discussions among our product marketing and project management groups. We had a lot of problems with scope, and understanding business' requirements. We had problems with agreeing with what they wanted to do. Many things did not make much sense. It seemed to be driven by the product manager to get more revenue for his product portfolio. Not for the company, but for their product. They are trying to get more revenue out of a product that they saw was diminishing itself; that was sort of irrational driver. I think it affected some friendships. This was a particular example. I have learned very much from that for future projects." (Participant 7; manager of project managers; case 1; project 24; interview transcript: page 4)

"II phase, it is sure for investigation... Very seldom, you get people volunteering.[If] I do not ask you the question, you will never know and tell me the problems. As a person, I need to go out and ask the question. I need to go out and seek people, I need to go out and get access to people. That all takes time. I just cannot walk in, and start requesting this work." (Participant 12; program and senior manager; case 1 and 2; interview transcript: page 3)

When a requirement was not described in clear terms, project managers queried it until everyone had the same understanding, and then documented the agreement. They also considered technical and organisational capabilities and constraints while defining the requirement. Good marketing skills were valuable to get the stakeholders' buy-in.

"There are still no clear product definitions. So, I am working with the product manager through an understanding that we could have what can be delivered from engineering, and getting his agreement." (Participant 1; project manager; case 1; project 2; interview transcript: page 4)

Although there was some concept and idea generation before the II phase, it is the phase when the company starts projects formally, and allocates project management resources. To get the deserved priority and resources from the senior management, project managers needed to increase the visibility in the organisation. Senior managers were briefed about the recommendations, such as vendor and technology selections, to obtain their support up front. The communications had to be clear and persuasive.

"I have to socialise through the top of the organisation, come down with a priority. We had similar problems in [Company B], always. Because, everyone is busy with what they believe, and what they have to do. And, part of your job is to get things done." (Participant 12; senior manager; case 2; interview transcript: page 3)

A clear project scope was a pre-requisite to delivering a successful project. Good project managers did not let discussions on the requirements become protracted, since everyone's time is very valuable. They listened, understood the business and technical constraints, what could and could not be delivered in the required time frame, and came

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up with what was possible to deliver on time and within budget. As the last resort, they engaged the senior management proactively, and forced an agreement on the most feasible scope and time.

> *"The project requirements, not being locked down, and business wanting to push as much into it, thinking that they can get all of that in time and in the budget. It requires a strong project manager to be able to push back. And, that was not happening. That wasted several months of time. Whereas a more forceful project manager needs to be able to say 'no, you cannot have that, we cannot do in the timeframe. If you want that, it is going to cost more and more time'. Then, I needed to intervene at this point." (Participant 18; senior manager; case 1; project 38; interview transcript: page 5)*

After the II phase, defining the expected outcomes from an NPD project, the focus then shifted to how to satisfy them by developing alternative solutions. The project managers' pattern of communications with stakeholders turned internal to the project team, which might also include vendors. The engineering groups, who sometimes acted as consultants to project managers on technical matters during the II phase, became main players in the F&D phase. Several technical solutions were produced, and suitable ones were tested. Project managers encouraged business sensitivity among their project engineers, to produce the best solution that not only satisfied the technical requirements, but also was cost effective, easier and simpler to integrate with the business processes of operational groups. Technology limitations or operational impacts sometimes had imposed limitations on some of the requirements agreed in the II phase. Then, project managers went back to the project sponsors to discuss and obtain their agreement on modifications. Again, another cycle of intense communication happened to finalise that part of the project scope. Good marketing, communication and negotiation skills were again required to shorten this cycle, and to set the right expectations among the stakeholders. Its failure might result in a product that was totally different from what project sponsors wanted, and might increase their dissatisfaction. Project sponsors also expected project managers to accommodate changes in the scope during a project's progress. Successful project managers accepted these changes if they could be made without impacting on the project delivery time. Then, it became a selling and negotiation exercise to the project team members to justify more work.

> *"Well, as far as this program went, there was no communication with the sponsors, as to do what they would like. There was no open communication, regarding any of the technical discussions. And, no design document was provided. And, if it was provided, it was out of date and there was no updates for whatever [was] provided. We were not involved and not kept across it. So, by the time, we were given what*

was done, we said 'This is wrong, not what we asked for'". (Participant 15; product manager; case 1; project 36; interview transcript: page 8)

"Unfortunately, there is the communication issue. So, because the scope was not adequately tracked, and managed, and it was not communicated properly to the engineering teams." (Participant 16; product manager; case 1; project 36; interview transcript: page 10)

"My approach to this, if you allow too much scope creep, then you end up with no delivery. If you completely shut your eyes and ears to all reasonable requests, then you end with a useless product. It is a compromise. If the requirements imply a significant change in the design, or added lead times. We will have to assess that, on its own merit. Some things were allowed to go in, some things were too big, this will be done as a change to be done later. But, we always have the option, a choice of the project team, we have the authority to select which goes in." (Participant 21; project manager; case 3; interview transcript: page 13)

To avoid any further possible conflicts, communications were necessary to clarify what was both in and out of scope. A clear presentation was required to communicate with the stakeholders, and especially with the project sponsors. First, there were multiple projects running at the same time, and in a dynamic environment, people tended to confuse which project has what. If there was a grey area, good project managers proactively drew project boundaries clearly, and got written agreement so as not to cause any confusion later. There needed to be a clear explicit mutual understanding of the scope. Second, the data to be handled suddenly increased in the F&D phase with more details and inputs, and information had to be extracted and shown in a manner that was easily shared by different stakeholders. Rather than words, pictures and tables were the preferred way to convey a precise and concise message; presentation skills were very beneficial to summarise complex information to the recipients' level and needs.

"The way you describe things in pictures and tables is important to share complex information. I am [a] picture person, I need to admit. Power of whiteboard is unbelievable. I'll get on the white board very quickly, and start drawing something. And it might be as simple as drawing a circle. Obviously, a circle may mean anything. But, you are pointing, when you are referring to something, we point to this thing, and draw a line point A to point B, what's you're doing is a mental map for something to follow and share with other people. Then it is easier to reach an agreement about the boundaries: what is in, what is out." (Participant 12; senior and program manager; cases 1 and 2; interview transcript: page 8)

Once an optimum solution was selected in the F&D phase, it was deployed in the DIV phase. The interaction and communication among engineering, vendors and operational groups became closer and more frequent. If external vendors or contractors were doing the field work, negotiation skills to manage contracts were important.

"Whatever you do you cannot go faster than the work on the street. In that was, contractor management issues. We had contractors laying the cables, putting the devices on homes, doing the head end equipment, and so there was always continual negotiations, conflict resolution on prices, delivery, rate of work, completed work like that." (Participant 14; project manager; case 2; project 61; interview transcript: page 16)

Especially in NPD projects with new technologies, successful project managers had considered the benefits for their customers, and addressed any issue that might prevent a new product from being accepted in the market. In F&D, the focus was on the design, then in the DIV phase, it shifted to customers' perspective: what kind of problems they might have in employing the product, and what were their business drivers. However, due to time-to-market pressure, project managers did not focus much on customers' perspective in detail until the product was ready. Indeed, this had to be the first question in their mind, since the ultimate judgement if a product was successful come from them.

"We were looking at technical solution in F&D. When we moved to DIV phase, we started looking at customer end. OK, how the customer value this one. So, then our mind set completely changed, in the sense like the product in its current form may not meet customers' end-to-end requirements. Then all of a sudden, there were many marketing people started looking at the product." (Participant 17; project manager; case 1; project 38; interview transcript: page 9)

At the end of the DIV phase, project managers had to obtain operational groups' acceptance before the launch of a new product. It was frequently problematic, and there were a number of conditions to be met. Project managers usually did not have much time to satisfy all of them due to the tight delivery times, and then it became a challenge to get their approval. Good project managers were proactive in watching every signal and understanding major operational concerns. They addressed or negotiated them, and reached an agreement as early as possible, avoiding getting hit at the last minute and jeopardising the product delivery date.

"If you get to the stage of acceptance, and you felt you have met all these, but there usually happen last minute curly conditions appear during your acceptance meeting. Then you try to get some sort of conditional acceptance. That will still launch the product, but obviously recognising an issue, but firstly you get an agreement if there is an issue. You need to argue and get a consensus." (Participant 1; project manager; case 1; interview transcript: page 8)

"We need to negotiate and ensure that operations are in the position to support it. In the sense, we needed to introduce a confidence level on them. So, there are a lot of selling exercises. a lot of negotiations, and persuasions. We need to employ some sort of conflict resolution, and all these communication skills to the operations people." (Participant 17; project manager; case 1; project 38; interview transcript: page 8)

Once the operational acceptance was obtained, the new product was available to customers. Project managers' duty to deliver a product was mainly over. Minor conditions for operational acceptance might occur, and the project managers usually addressed them within the allowed time frames. Since the product was new to the market, there were initial queries coming from sales and first customers about the product features. Project managers answered some questions, but they were informative communication only, and the need for leadership skills was less.

> *"It was difficult for sales to convince the customer to use this tested product. So, marketing was an issue to be dealt with." (Participant 18; senior manager; case 1; project 52; interview transcript: page 7)*

> *"We need to educate the marketing how to sell the product, also a lot of customer education; the technology was new, they had issues with going to a shared telecommunication packet data based channel." (Participant 17; project manager; case 1; project 38; interview transcript: page 10)*

6.3   Managerial skills versus project phases

Effective plans could be produced only if what was required from a project had been defined. Clear requirements were a prerequisite for meaningful and useful plans, and it goes back to the initial stages of the project, when they were agreed in the II phase. Project managers did not blindly accept every requirement to be delivered in their projects without assessing, at least in rough terms, issues, risks, duration and costs. Successful ones thought of mitigation plans against the risks from day one. Project plans were not an apparent concern in the II phase, but they would be produced anyway in coming phases. With proactive thinking beforehand, and if possible with some details in advance, the project plans were simpler and easier to produce later. Consequently, having a basic level of management skills was helpful in the II phase.

> *"Also to that sort of phase [in II phase] is depending upon what the project is. You are quite often looking at the options, feasibility and various options. You do it to whatever level you need to do it." (Participant 3; manager of project managers; case 1; interview transcript: page 6)*

All NPD process gates required estimates with some accuracy, which became increasingly better towards the DIV phase as uncertainties were eliminated and unknowns were disclosed. From the beginning, including the II phase, project managers had to provide some cost and duration estimates to build a business case, whether the

revenues justify the cost and when the breakeven occurs. It did not need to be precise, but some indicative figures were required in the II phase.

> "We have some variation at each gate in the NPD processes. If required, we can actually increase variations that depend on the complexity of the project. If you are not sure, this project may take longer and shorter time, then you can convince the committee [NPD gate reviewing committee]. Say, I need more variations, because there are so many risks involved in this. Then, I'll put more variations there." (Participant 2; project manager; case 1; interview transcript: page 10)

The first expectation from the II phase was to agree on clear project requirements. In practice, project scope might vary in later phases, for example market conditions changed, budgets were cut, or technical team members wanted to use new technologies and added new features to the product in the F&D phase. Good project managers tracked and managed those changes until project delivery at the end of the DIV phase. Those changes were to be recorded, with sufficient detail to answer possible future questions. Lack of proper documentation and records resulted in misalignment among the stakeholders about what the project had to deliver.

> "The business conditions are so dynamic. It is difficult to cope with them. Can we be concrete enough? But, it is not 100%. There is another difficulty with those things: as the technology advances, towards the end of projects, there happen many changes. So, I think at the beginning of DIV stage, we should say there is no more scope changes." (Participant 11; product manager; case 1; interview transcript: page 9)

> "There were also some feature enhancements. So, then during II phase, we pulled those in. The life cycle issues were also asked to be included in the program. Then, it stayed in II stage so long. During that stage, we had a directive that we were going to be removing some of the stuff. Then later in F&D, we had a directive that it was coming back in. When they came back in, they left out some of the stuff that was originally in. So, by doing that, there was a misalignment. When the design document was produced in F&D, it was outdated, because requirements changed. The design document did not meet our understanding of requirements." (Participant 15; product manager; case 1; project 36; interview transcript: page 6)

Once the requirements were defined in the II phase, then the real product development work started in the F&D phase. Until this point, all studies were mostly on paper, with no significant resources involved. The companies started seriously investing in a project with the F&D gate approval. High level and draft project plans, which are reasonable in the II phase, were now unacceptable. Project managers had to produce detailed project plans and more precise estimates. The milestones were important to check that all stakeholders and the project team were fulfilling their commitments. As the resources were shared by multiple projects, the team members had similar time pressures from

their other projects. Successful project managers did not leave them alone until the last minute, when their contribution was needed, and checked their progress regularly. Consequently, good managerial skills were required in the F&D phase.

Performing the II and F&D phases properly eliminated all major risks, so the requirements for deploying the selected solution were known to a greater degree in the DIV phase. This phase was the implementation of a solution, and project managers tracked project progress against interim milestones. They watched any deviations closely. If an unexpected issue arose, such as lack of funds and scope variations, they addressed it immediately. Unless an agreement was obtained from the stakeholders, they did not let the relevant project work move forward until the conflict was resolved.

> *"There were lots of changes in F&D. They changed all the designs in II, so we compromised a stack of business requirements. The project manager just dragged the things until the requirements align with the solution. There were some issues, but after that, F&D went well. We de-scoped the requirements until solution could be met." (Participant 11; product manager; case 1; project 33; interview transcript: page 3)*

Time-to-market pressure sometimes forced overlapping project phases. Projects sometimes went forward with basic requirements from the II phase to save time, instead of waiting until all requirements were agreed. The detailed planning in the F&D phase also needed to take those uncertainties into account, and the project manager's task became more complicated. Good project managers resisted bypassing critical tasks, thus avoiding the high costs necessary to fix a product after it reached the market.

> *"In the particular product, which seems to be a typical characteristic, we didn't have any II phase. So, now we are trying to back fill some of the stuff that should have been done during initial investigation. Because you see that the business is trying to cut corners. We find that we cannot." (Participant 1; project manager; case 1; project 14; interview transcript: page 5)*

The DIV phase is the crunch time of a project. Project managers were asked to commit a delivery date and highly accurate cost estimates. Anything that could prevent reaching this date had to be addressed straight away. Looking at the pattern of escalation and occurrence frequency in the project phases, the DIV phase is far ahead of other phases. Good managerial skills were essential in this phase to execute project plans, and resolve matters that might prevent project progress. A new technology that required structural changes or changing the way operational groups work was not easy to resolve at project

manager level. The only way was to escalate it to be addressed at a higher managerial level. Senior management involvement was needed to overcome the resistance.

> *"We did a lot of escalations. There were fears in the managers, since they lose their groups. They wanted to keep the status quo. After that point, as a project manager, he does not have any power and control to change the organisational structure. A lot of problems in talking to the managers, and get their buy-ins. We escalated the issues to general managers, all the senior people involved. Although, we got the buy-in, but when they went out of the meeting room, things have changed again. There is still an issue, because organisation still has not changed, even sufficiently to meet the demands of this product." (Participant 17; project manager; case 1; project 38; interview transcript: page 15)*

> *"They developed a network management system from one to multi-user, but it required changes in the support groups. Processes were modified, but groups refused to accept. Senior managers were involved to implement the change." (Participant 5; manager of project managers; case 3; project 66; interview notes: page 4)*

The operational acceptance at the end of the DIV phase also signified the end of an NPD project. Consequently, project managers did not produce any plans beyond this point, and did not need any managerial skill in this phase.

6.4   Administrative skills versus project phases

The II phase focused on gathering and clarifying project requirements among different stakeholders. Good documentation not only helped during the project, but its impact extended beyond the project. Stakeholders could always go back later to documents, meeting minutes or e-mails to quickly clarify any questions or confusion about a product.

> *"We always knew what we were delivering on, because we had all the design documents clearly written. When there was a query about what was done, I could always go back to the design documents. Because we had the right stuff, it makes the product successful in the market." (Participant 15; product manager; case 1; project 12; interview transcript: page 12)*

> *"Why it was never realised, the documentation was incomplete from the beginning, about the functionality they are using on the current products. Because they were some of the early products. They were heavily customised, just for them, and not documented at all. That was the main reason for big delays." (Participant 20; program manager; case 2; project 64; interview transcript: page 9)*

> *"Although the technology was not new in [project 17], but at that time there was a big staff turn over, and no design and project documents were written. Therefore,*

each new project manager started almost with no past history of the project. The pressure from management to progress the project had worsened the case." *(Participant 5; manager of project managers; case 1; project 17; interview notes: page 3)*

Project managers might not have all the answers regarding whether a requirement was feasible or not. Then, they needed to find out who could provide an explanation of the relevant topic. Understanding organisation structure and knowing key people were beneficial to defining what was to be done, and to shorten the II phase. However, organisational political and cultural awareness were also needed in order to know how to approach them.

> *"II phase certainly for investigation. And, what get challenges in II phase, is getting people with sufficient knowledge to know, where to ask. One of the biggest problems that I constantly see, if you do not ask questions, you do not get an answer... That's why you need to be politically sensitive. It can be quite difficult to approach and to get the information you want." (Participant 12; program manager; case 1; interview transcript: page 3 and 4)*

Project managers also considered possible solutions, and made an early evaluation to eliminate the requirements that could not be satisfied in the II phase. By using project management tools, they generated high level project schedules and costs to compare different options that could meet the requirements. To understand process implications, some knowledge of the organisational boundaries and duties of different groups was also useful. Therefore, good administrative skills were beneficial in the II phase, but more important was to understand the content. Therefore, administrative skills were second to technical and leadership skills.

In the F&D phase, most of the project work was from engineering. Feasible solutions were tested and an optimum one was selected. The project plans were updated and more details were added, then the documents became more complicated than the one in the II phase. A tender process was used with external vendors, especially for NTI projects. It was important to have the same understanding with them, and a procedure had to be followed to ensure it happened.

> *"You have a tender process, then you have discussions with vendors, and you might have a preferred vendor, based on a set of requirements. They are going to talk through, and we are going to ask questions about your requirements, and understand it better. We're going to tell you how it might be built, design it, and you can tell us what you think, that's what you want. We had a lot of workshops in this particular program, to do that kind of thing. I'd expect the project manager makes sure they happened to the right level. They need to be able to see they have some*

appreciation of the requirements, of what level, what sorts of groupings, and split they are in, and then how in a conceptual and process way. That would be broken down into the next stages, be design or analysis, whatever is relevant for definition." (Participant 9; senior manager; case 1; interview transcript: page 3)

During the F&D phase, project requirements might change with changing business conditions and technical limitations. They had to be tracked and documented with sufficient detail until the end of the project. The regular team meetings also became critical for tracking project progress and for reviewing the project plans. Minutes were to be written, and actions and issues were to be visited each week until the projects were delivered. Lack of such records made it difficult for project managers and other stakeholders to remember the history of projects. Such an environment not only disappointed project stakeholders, but sometimes also destroyed coherence in the team. Although some participants considered administrative skills second to managerial skills, they were necessary to exhibit how well they were managing their projects. Even if a project manager was good at managing projects, a project could still become disorganised through lack of administrative work.

"We did not have meeting minutes, or the action registers, or anything updated, in a timely matter, and sometimes never sent. When we did the changes during the project, none of them was documented. Just poor project management. The project manager could have made a difference at the time, but had no control over the project. We did not have a proper project plan, and meeting minutes. What we agreed, and not agreed were not documented." (Participant 15; product manager; case 1; project 36; interview transcript: page 7)

Using project management tools for scheduling the tasks and financial procurement plans for cash flow, were essential in the F&D phase. Project managers had to follow certain policies and approval procedures for equipment purchases. As there were many stakeholders and interfaces, the documentation eventually increased. Good knowledge and practice in using those relevant tools helped project managers see the relations among tasks, adjust buffers in contingency plans, move resources around the tasks, and calculate expenditure over time. Additionally, they adapted a change and configuration management system, as the number of working files increased (e.g. technical documents, plan and schedule files, finance spreadsheets, etc.), otherwise they could lose track of changes and decisions in the project's history. For example, in another project, the same participant above noted a big difference from the proper documentation. A good level of administrative skills was valuable in the F&D phase.

"The project manager always kept a log of what was going on. Kept everyone on track. He knew about the project inside and out basically. So, he was able to drive to get all resolved, you know, key to delivery of a product." (Participant 15; product manager; case 1; project 45; interview transcript: page 3)

The DIV phase was used to deploy the selected solution in the F&D phase in the field, and to get approval from operational groups to support a new product after the market launch. Unexpected last minute problems usually happened in this phase, and they had to be addressed immediately. Consequently, most of the formal escalations were usually written or by e-mail. Some problems were big, requiring the whole project plan to be reconsidered. Again, project management tools helped to evaluate their impacts and produce alternative plans in a short time.

Project managers needed to locate operational groups and their key players to obtain their approvals. They also had a tool to track against new product acceptance conditions, which described administration of a product post market launch, such as producing training presentations, satisfying legal policies by law, procuring additional equipment and their technical support for a few years, documenting new product offerings and managing faults. The tool basically presented a list of the project artefacts, who owns them, and the authorities to approve their completion.

"You try to, sort of anticipate as much as you can as part of your final acceptance stage, and we have got tools to help to do that, for example product acceptance document [basically a checklist of standard acceptance conditions]" (Participant 1; project manager; case 1; interview transcript: page 8)

Time-to-market pressure forced the shortening or sometimes virtually elimination of some project phases. Then, it became more challenging to handle the various project tasks required in different phases at the same time. As a consequence, project and procurement plans required more frequent updates, documents had to be completed in shorter durations, acceptance conditions had to be satisfied simultaneously with the product development work, and communications were always intense. The administrative skills therefore were much more important for increasing efficiency.

The Closure phase was for product launch and involved mainly marketing activities. The operational acceptance to enter this phase implied that project managers had done their duty in delivering a new product and their role was over; therefore, administrative skills were not required. The administrative closure of projects was not considered difficult, if projects had been managed with good records in earlier phases.

7 Project manager skill sets versus competency standards

The aims of this study and the project manager competency standards are different. The scope of this research is Telco NPD project challenges and the project manager skill sets needed to overcome them successfully; it does not attempt to measure managers' knowledge or to judge project managers' competencies against the standards. However, an examination of the commonalities in such standards indicates how they cover Telco NPD projects.

Project Manager Competency Development Framework (PMCD second edition 2007 – unless stated below), and Global Alliance for Project Performance Standards (GAPPS) (2006) are selected as two specific and recent examples for analysis. The first addresses the greatest project management community, the 250,000-plus member Project Management Institute (PMI), and the second endorses many standards and qualification frameworks. This section probes the details of these project manager competency standards and examines the skill sets against them. Units of competencies in the standards contain criteria that can be associated with outcomes of project management activities. Mapping between the skill sets and the competency standards matches the activities encountered during the interviews with those listed under the standards. PMCD and GAPPS are sufficiently comprehensive to convey the concept, and the analysis may be extended to other competency standards.

The mapping tables are presented in Appendix F. Some elements are cited under several skill sets, as their criteria involve activities requiring multiple skill sets. The overlaps between the skill sets and the PMCD and GAPPS standards indicated how these standards address the required skill sets in Telco NPD projects.

It is obvious from the tables in Appendix F that both PMCD and GAPPS focus mainly on the managerial aspects of project management, which correspond to activities requiring managerial skills. The managerial aspects are convenient to quantify and measure, and outweigh other areas in the standards, reflecting the standards' aims to address what is common among all projects. However, they lack details of some managerial aspects specific to Telco NPD, for example, frequent escalations to meet tight project delivery times.

Neither PMCD nor GAPPS competency standards contain any criteria for assessing technical knowledge of project managers. PMCD implies it indirectly in a few performance and personal competencies' elements to determine a new product's characteristics; to track project risks, to view a project in a holistic way, and to understand and resolve project issues under 'Initiating a Project', 'Monitoring and Controlling a Project' and 'Closing a Project' performance competencies and under 'Cognitive Ability' and 'Effectiveness' personal competencies. However, PMCD considers technical skills an industry-specific application, and GAPPS does not attach technical aspects to project managers. They do not check whether these skills exist or their level for certification, instead leaving this to the organisation. The empirical evidence in Section 5.1 above indicates that Telco is one of these industries.

> *The PMCD Framework is based upon the principles and processes of PMBOK Guide – Third Edition. It describes the generic competencies needed in most projects, most organisations and most industries. In some industries, there may be technical skills that are particularly relevant to that industry or covered by specific domain, regulatory or legal requirements. For example, an organisation primarily involved in conducting information technology projects may require that its project managers possess a specified level of information technology competence, as well as competence in project management" (PMCD 2007:3)*

PMCD, in its 'Personal Competencies' section, covers most of the activities that require leadership skills defined in this research for an NPD context, as does GAPPS under a single unit 'Manage Stakeholder Relationships'. Although the project managers played some leadership role in projects, and undertook some activities to maintain a coherent team, such as good communications, conflict resolution and negotiation, they did not identify team and individual development as challenges in Telco NPD projects. Consequently, this research scope does not cover team and individual development included in the standards under 'Executing a Project' and 'Monitoring and Controlling of a Project', units of performance competencies, and under 'Leading' unit of personal competency in PMCD, and individual development needs in 'Manage Stakeholder Relationships' unit in GAPPS.

In Telco, an agile industry with short life cycle technologies and tough competition, the strategic direction from the senior management is to deliver new products faster. Consequently, participating project managers and other first degree project management stakeholders did not pay particular attention to team development. However, it should not be interpreted that they are not competent in this area; they were concerned more

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about project priorities and resultant challenges. Their performances were measured primarily against delivering products with acceptable quality in time, and time-to-market pressure did not allow them to focus on anything else. Additionally, all Telco cases have an organisational matrix structure, with the roles and responsibilities to manage a project team shared between project and functional line managers. Professional and personal development are mainly the functional line managers' responsibility.

PMCD acknowledges the importance of a variety of organisational factors: organisational structure, environment, culture and politics in 'Managing', 'Cognitive Ability' and 'Professionalism' personal competencies. GAPPS claims to have the minimum number of criteria, and therefore excludes clearly defined organisation-dependent factors. For example, in small companies, where everyone knows each other, administrative skills are of no concern.

Project managers used company process assets for managing their projects, but participants did not consider project management process improvement a challenging area, and therefore it did not fall within the scope of this research. However, process improvement is covered in the performance criteria under the 'Planning a Project', 'Monitoring and Controlling a Project', and 'Closing a Project' units in PMCD, and the 'Evaluate and Improve Project Performance' unit in GAPPS. Similar to team development above, the strategic choice to develop new products in a short time affected the project managers' priorities, without their paying particular attention to project management process improvement.

Vendors were managed through legal contracts and written agreements, and so project managers needed administrative skills to apply associated company policies and rules. Procurement departments also helped project managers, as equipment purchase and support agreements sometimes required specialised knowledge. Some NDP projects involved other external Telco service providers, and similar contractual arrangements were made. The participants did not specifically mention procurement as one of the challenges in their projects. They considered it a part of overall budgeting and cash flow management activities in Telco projects, as long as they had sufficient funds. Therefore, 'Planning a Project' and 'Executing a Project' performance competencies in PMCD,

and 'Manage Development of the Plan for the Project' in GAPPS, over-emphasise the procurement aspects for Telco NPD projects.

PMCD does not specifically name any tools, but in several instances, it emphasises that project managers should know and use the available communication, documentation and project management tools to perform managerial activities. The latest PMCD differs from its early version (PMCD 2002) and GAPPS, with dedicated criteria associated with selecting and using project management tools under 'Cognitive Ability' personal competency. GAPPS does not have such explicit criteria associated with tools. Tools and methods are too important to ignore, due to their importance in performing planning, timing and budgeting activities effectively and efficiently, which are especially critical in fast time-to-market projects. Therefore, the standards have inherently assumed that project managers are capable of using basic tools to perform those activities as part of their managerial skills, in the relevant units of competencies.

Names of the PMCD units of performance competencies resemble project phases: 'Initiating a Project' to II, 'Planning a Project' to F&D, 'Executing a Project' to DIV, 'Closing a Project' to Closure, and 'Monitoring and Controlling a Project' is the competency over-arching all of the phases. However, these are the process groups, and their activities associated with performance criteria drew a mixed picture; there is no one-to-one mapping correspondence between performance competencies and the project phases. Except for three elements – 'Manage project start-up', 'Manage transition between project phases' and 'Manage project closure' under 'Manage Project Transition' units of competency – GAPPS does not contain any specific reference to a project phase and, therefore, expects all units of competencies to be exhibited throughout the project, whenever required. The mapping between the skill sets and the units of competencies in the standards and the NPD project phases is not simple and straightforward.

PMCD mentions several elements on documentation and plans for almost every managerial activity. As indicated several times in the empirical data, time-to-market pressure means that Telco NPD projects occur in a very dynamic business environment. Indeed, requirements and plans are likely to change several times throughout the project. Consequently, the project managers minimised their efforts on non-value adding detailed documents and plans, and concentrated more on tracking and updating a

few key project management documents: requirements, schedules, costs, risks and issues. Therefore, GAPPS has fewer and simpler definitions of the units of competencies.

A similar mapping analysis was performed for the earlier version of PMCD (2002), and it was found to under-represent technical and administrative skills (Kosaroglu and Hunt 2007). Changes in the latest version of PMCD (2007) have closed the gap for the administrative skills, and provided more details on leadership skills. Although it still tests knowledge against PMBOK as the key part of the certification process, PMCD (2007) appears to be shifting from knowledge-based to performance-based assessment. Its elements of the units of competencies – on face value – seek hard evidence such as documentation or written feedback from stakeholders, as in GAPPS. Therefore, it can be connected to practical evidence, and is more convenient to operationalise. In practice, however, it is a different matter; checks of candidates' experience for the PMP certification are random (PMP Credential Handbook 2007), without examining any of the evidence stated in the performance and personal criteria, which are mostly associated with leadership and administrative skills.

In comparing PMCD and GAPPS, PMCD has a number of personal units of competencies associated with administrative skills, and indirectly implies technical skills in a few performance and personal competencies, whereas GAPPS has no units for either area. PMCD also covers managerial and leadership skill sets with more detail than GAPPS. However, they have different coverages: PMCD attempts to cover the maximum number of general areas in any project, whereas GAPPS aims to contain the minimum number of common areas.

RESULTS and DISCUSSION

1 Introduction

This research has investigated Telco NPD project managers. The study began with an extensive literature review about project manager skills, then closely related skills were grouped to form the skill sets. The product and industry characteristics were considered to deduce the required skill sets for Telco NPD projects. A new organising framework for skill sets was proposed and major outcomes were provided at the end of Chapter 2.

Chapter 3 detailed the research methodology and techniques. Since current knowledge did not extend beyond some theoretical assumptions, and the aim of this research was to gain deeper understanding and draw generalisable conclusions, a case study methodology comprising five cases was undertaken. Semi structured one-on-one interviews were found to be the most suitable method of data collection. Many participants were specifically selected from among project managers and first degree project management stakeholders, having long experience in Telco with more than one case. Participants could therefore make direct cross case comparisons, validate the findings from single cases and ultimately provide better generalisations from first hand experience. The iterative interviewing process was repeated until convergence was attained, in other words, until further interviews were producing no new data. The findings were reviewed with a number of project management experts to check the validity of the results.

Chapter 4 presented the findings and the triangulated evidence. This chapter now summarises these findings, compares and discusses them with the outcomes of the literature review. It employs the same structure as was used for literature review and data

analysis, so that the research results are easily traced back to the analysis and literature review chapters.

The next section presents the research questions and the relevant literature review outcomes. In Section 3, they are compared with the empirical results to determine whether the literature sufficiently describes today's Telco NPD projects. Challenges and the practices employed by Telco companies to overcome them are outlined in Section 4. Sections 5 and 6 summarise the results on skill sets and how they are beneficial in NPD project phases, and compares the results with the literature review outcomes. Finally, Section 7 compares the project manager competency standards, and emphasises their gaps compared with the skill sets. The discussion below contributes to the existing body of knowledge by verifying the theoretical propositions and reporting empirical results.

2   Research questions and literature review outcomes

The main research question was to determine what project managers need to successfully manage contemporary Telco NPD projects. Other associated questions were addressed as the research progressed. Initially, an extensive literature review was carried out to determine whether the literature contains answers to these questions. Theoretical propositions in the form of literature review outcomes were deduced, and were used to explain similarities and variations from the previous findings. This section briefly reviews the research questions presented in Chapter 1 and presents the associated outcomes from the literature review.

The first sub-problem was to find a common basis for evaluating the project managers. Project manager competency standards do not address specific circumstances of Telco NPD projects, and mainly focus on managerial aspects (Crawford and Pollack 2007; Whitty and Maylor 2007), which are necessary, but insufficient to cover all dimensions. Further exploration for the foundations of competency (Rifkin et al. 1999) showed that skills can form this common ground. There can be long lists of skills, and they may provide a biased view on some skills (Anderson 1992; Krahn 2005); an infrequently used skill can make a difference at a critical time. Then, a better organising scheme was sought for representing the skills in a simpler and more abstract manner. Selecting the rationale of how they contribute to project management success, and reviewing recent

literature on NPD projects and their managers (Hosking 1988; Thamhain 1989; Anderson 1992; Wateridge 1997; Thamhain 2004b; Mintzberg 2006) resulted in the following outcomes (presented in Chapter 2, Section 8 and repeated here):

Outcome 1: *There are four project manager skill sets: technical, leadership, managerial and administrative. Briefly, technical skills understand the technologies on which NPD projects are based; leadership skills influence stakeholders to act in favour of a project by will; managerial skills produce and execute project plans; and administrative skills use a company's organisational structures, culture, processes and tools to achieve a project's goals.*

Outcome 2: *An NPD project manager in Telco should have all four skill sets: technical, leadership, managerial and administrative skills.*

Outcome 4: *Technical skills of an NPD project manager in Telco are not required to be detail-oriented; however, they need to be at a high level and sufficient to understand involved technologies and project issues.*

Another research question was to look for projects that reveal information about the project manager skill sets. Considering Telco industry characteristics – deploying a proven technology in practice and integrating it with operations – the NPD literature basically described two types of projects: product line extensions and new technology projects, ranging between low technology and R&D projects. Below are the literature review outcomes with respect to this project classification (Henderson and Clark 1988; Wheelright and Clark 1992; Shenhar et al. 1995; Griffin and Page 1996b; Shenhar and Dvir 1996; Balachandra and Friar 1997; Shenhar 2001):

Outcome 3: *Technical skills of an NPD project manager in Telco are important if involved technology is new and not yet widely used.*

Outcome 6: *An NPD project manager in Telco uses leadership skills more for new technology projects that require handling more uncertainties, unknowns and risks, than for product line extension projects.*

Outcome 7: *Managerial skills of an NPD project manager in Telco are more dominant in product line extension projects.*

Outcome 9: *An NPD project manager should have better administrative skills for high technology projects that develop new base products and deploy new systems.*

The research scope was also extended to include the impacts of project phases, as commonly used in the Telco industry: Initial Investigation (II); Feasibility and Definition (F&D); Development, Implementation and Verification (DIV); and Closure. The review of the relevant literature and matching activities in each phase has resulted in the following outcomes (Pinto and Prescott 1998; Weinkauf and Hoegl 2002):

Outcome 5: *Technical skills are critical in the II, F&D and DIV phases.*

Outcome 8: *Managerial skills are more essential in the F&D and DIV phases than in the II phase.*

Outcome 10: *Administrative skills are more essential in the F&D and DIV phases than in the II phase.*

There is no outcome from the literature about how well the project manager competency standards cover Telco skill sets. This research is the first to closely examine the specific Telco industry and NPD project context, and therefore the literature is insufficient for producing any deductions in this area. The empirical evidence provided this mapping in the previous chapter.

The outcomes presented above are a number of check points. The picture may be incomplete, since no previous research study has been dedicated to Telco NPD projects and their project managers in today's hypercompetitive industry conditions. However, these outcomes serve as reference to the literature before making comparisons with the empirical findings. The rest of this chapter summarises these findings, delineates the differences in the field, and explains why and how these differences may occur.

3   New product development projects in Telco

Telco companies have some variations in how they form a matrix management structure, and the number of stages in their stage-gate NPD processes. The organisational structure determines the authority to whom project managers report and escalate project-related matters. The project sponsor, who makes the final decisions on them, may be from a marketing and technical group, as presented for two extreme cases in Section 2.1 of Chapter 4; however, the project managers' immediate environment and the way they manage the projects do not change. Therefore, they need to have the same skill sets to manage the projects successfully. The consistency of the findings on Telco NPD projects and their project manager skill sets, with many supporting examples of triangulated evidence across the Telco cases, occupying more than 90% of market share and employment, and participants throughout Chapter 4, especially its sections 3–6, indicate that one of the Telco companies examined in this research study can be considered as a representative or typical case for the majority of the Australian Telco industry.

The literature review resulted in two broad project categories: new products using high technology, and product line extensions (or incremental product modifications). These two groups of projects result from the bias towards product innovation and technology,

and associating them with newness of products and project sizes. Previous studies especially missed the process dimension to support a new service, i.e. a product, in Telco. This study has investigated the Telco NPD projects with different perspectives to ensure that the classification used provides real indicators for examining the project manager skill sets.

First, the NPD projects delivering consumer and business products were examined. They occupy opposite segments in the Telco market. The mass consumer market is based on volume and price. Increased competition has eroded profit margins, and a Telco company can make only a small profit from each customer to justify a business case for a new product. It is therefore vital to understand what users want. New technology products bring more risks, since they involve many unknowns about consumer response. To reduce the impact of these risks, Telco companies are forming joint ventures, and interestingly becoming their own business-to-business customers.

At the other end, the lucrative and smaller segment, is the business market. Unlike the one-fits-all consumer products, this market requires highly customised solutions that must work without disruption, since product failure causes financial losses for customers. Business customers usually come with clear descriptions of a new product, because the Telco services are a key component for running their businesses. They also sometimes fully or partially fund associated NPD projects to tailor a new product specifically for their needs. The challenge with the business products is the variety of systems and processes that are required to support a wider product range. A low-cost entry-level business product is supported similar to a consumer product with best effort (i.e. do your best; only a bit of consumer unrest, if things go wrong), but for a corporate niche, there are contractual terms for better service levels.

Despite subtle differences between consumer and business products, their NPD projects are not managed notably differently. They both utilise the same network infrastructure to reduce cost, and current technologies are converging on multi-purpose high speed packet data networks. Although business customers are more concerned with quality, and therefore will tolerate slightly longer delivery times to ensure a product's quality, both consumer and business Telco NPD projects have the same management challenges.

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Second, the NPD project types, as commonly referred to in Telco, were investigated for clear indicators of the project manager skill sets. These types are named according to how a Telco company responds to market demands. The deployment of new technology to handle increased capacity and to accommodate future new product features, is realised in New Technology Introduction (NTI) projects. These projects generally involve vendors through a tendering process and heavy regression tests to ensure no or minimum impact on the products. Since the operational groups are formed around technologies, knowledge must be transferred to the company, and the processes and organisational structure also need to be made congruent.

New Customer Product Development (NCPD) projects target a new product from the company not yet in the market. If the necessary technology is already acquired, then only process re-engineering is required. If that technology is mature and is already being used elsewhere, then defining the project scope and finding solutions to the practical problems is easier. If these projects require newer technologies, they also include NTI characteristics, and are more complex to manage. Such NCPD projects require flexibility, since their project teams need time to understand the technologies and progressively define a more realistic and acceptable product in the market.

Enhanced Product Development (EPD) projects do not produce new products; they enhance existing products with new features or add product line extensions. Their requirements are usually clearer, since the product has already completed its basic development cycle. However, the same constraints as in NTI and NCPD apply, due to the process and technology changes.

Small projects include minor product modifications, improving customer-facing aspects, process fixes to increase efficiency, and life cycle management. They generally go directly to implementation stage, since what needs to be done is already known. They have the lowest priority because they have least impact on revenue.

Bids are the most lucrative projects in the business market, since they require highly customised solutions that may not be satisfied with standard products. Sometimes standard products can be used in a solution, and only the processes are tailored to the customers' service level needs. The simplest of these are Small Product Customisations (SPC), requiring a one-off small change in a product. If new developments are needed,

bids are the same as NCPD, but they have more restricted time frames defined in contractual agreements. Bids are also beneficial by reducing the development costs of similar products.

There are similarities among the project types: an NTI project may have similar consequences to an NCPD one, if the technology changes affect several products. NCPD projects may include NTI components. Bids may initiate NCPD projects to meet the specific demands of business customers. Therefore, the project types commonly referred to in Telco do not always accurately indicate the challenges faced.

The obvious project groupings – the products and project types commonly referred to by the participants – do not clearly correlate with the project manager skill sets. The projects provided as examples throughout the research study were analysed for the indicators associated with the challenges. Investigating number of stakeholders, cost, revenue impact, duration, process implications, time-to-market and technology resulted in two project categories: small, and large and complex. In this context, the term 'small' used in the project classification corresponds to a broader category than just small projects and SPCs; the pilot study indicated that small projects do not provide much evidence for project manager skill sets. Consequently, the main research study focused especially on large and complex projects.

GAPPS (2006) recognises the differences in project types; some are inherently more difficult to manage. When the sample projects were rated with the CIFTER complexity factors on a scale from 7 to 28, small projects range between 7 and 10, and large and complex projects between 20 and 25 points. According to GAPPS, projects rated less than 12 CIFTER points cannot be used to assess competency, justifying the decision in this study to focus on large and complex projects.

Projects tend to cluster into two distinct categories according to the nature of the challenges they entail. Once a project crosses a certain threshold with respect to cost, revenue impacts and complexities in terms of processes and technologies, it attracts much more attention within the company, it becomes more visible and the urgency for its delivery increases. Above that threshold, the projects are accepted as large and complex. In contrast, small projects are treated with lower priority and receive no particular attention, as long as they are completed. Large and complex projects impact

many stakeholders and develop new products with new technology introductions to the market or incremental product modifications. Only new technologies mature enough and proven reliable are employed, but their projects still have unknowns and require changes – process changes or, at the extreme, organisational structural changes.

The literature tends to classify NPD projects by the degree of technology and product innovations (Henderson and Clark 1990; Wheelright and Clark 1992; Shenhar et al. 1996; Balachandra and Friar 1997). Not only new technology, but also incremental product modifications involving many stakeholders, may require similar changes. This finding contradicts the original assumption that Telco NPD projects consist of new technology and product line extensions. Projects that involve both new technologies and product line extensions can be large and complex projects, depending on the scale of the required process changes. Therefore, outcomes 3, 6, 7 and 9, which were deduced for the differences between new technology and products, and product line extensions, were re-evaluated in this study with new empirical findings for each skill set, as discussed later in this chapter.

4   Challenges in Telco NPD projects

When Telco services were provided by one state owned-company more than a decade ago, the NPD projects aimed only for technical excellence. There was no competition, and even though project management tools were used to track cost and duration, neither of these was a priority. With the toughening competition since deregulation, Telco companies now have a more systematic approach for NPD with dedicated groups and management structures. NPD projects now must meet strict financial and time constraints. This research identified major challenges of large and complex projects that prevent project managers successfully delivering a quality product on time and within budget. In some projects, these challenges may occur simultaneously, compounding their impacts.

Technology life cycles are getting shorter. When Telco companies seize a technology opportunity, they need to act quickly to gain its benefit. The first challenge with a new technology is to get an agreement on a project scope. Different expectations and

assumptions about a new technology with many unknowns can cause delays. If it is a brand new technology, the problems of early adopters also need to be addressed. If a project is delayed for some reason, its scope must be revised to match the latest technology changes. However, technology-related changes are not always unwanted. A new technology that provides better functionality can remove long-standing problems in a product and give the project a fresh start. In practice, the time required to perfect a product may be longer than the technology cycles. Therefore, rather than pursuing a strategy to offer all possible functions and fixes, technology should be considered as one of the variables that can define a product's roadmap.

All participants consistently noted that the integration of technologies with business processes is the biggest challenge they meet in Telco NPD projects; a new product is complete only when complementary support processes and systems are in place. Good business processes and systems can compensate for technical limitations, increase customer satisfaction and influence a new product's success. The number of project stakeholders can indicate the complexity of the process. The fewer the stakeholders, the less the complication among the interfaces, and the easier it is to manage. At the extreme, in addition to the processes, an organisational structural change is required to support a new product. Participants who had worked in more than one industry emphasised that the process aspects make Telco different from other industries. The literature also reports that projects that implement system and business process integration across many stakeholders have some similar characteristics. A similar example is Enterprise Resource Planning (ERP) implementation (GAPPS, 2006), which may take years. However, Telco still differs from such projects, because those projects are internal to a company, take longer, and they are not exposed to short term technology fluctuations.

Increased competition in Telco creates a constant race to be one step ahead. All participating project sponsors agreed that time-to-market is a key performance indicator of their NPD projects. They are concerned only that the quality of the product satisfies a minimum acceptable level, and are more interested in ensuring that the product reflects the latest customer demands. Consequently, if a project takes longer to realise than initially anticipated, more changes will likely be required. When combined with fast technology changes, a Telco NPD project has to target quick delivery.

When an NPD requires a new technology, more collaboration with the vendors that supply new technologies and equipment is beneficial. The NPD managers need to investigate the new technology and question the vendors closely, since any problems the new technology may have in the field are as yet unknown. Being the first with that technology in the market does indeed incur a cost, and a proper risk calculation has to be made. The chosen technology needs to be suitable for future growth by applying proper open standards, rather than proprietary ones that may create total dependency on a specific vendor.

As the number of vendors increases, project managers face greater complexity and a heavier workload. Telco companies sometimes prefer to have a turn-key solution by assigning a system integrator contractor as a single point of contact to other vendors. Doing this reduces the load on project managers and lets them focus more on the company's internal changes, but they should be aware of the agency costs. Another agent in the middle may push their own benefits and distort the messages to other vendors. Consequently, some control is lost and compromises may be necessary. To avoid the disadvantages of working with vendors, tender contracts are very important; if a vendor does not deliver, the project manager should be able to stop or change the contract with minimum loss. External parties are not limited to vendors. The nature of the regulated industry mandates Telco companies to share their infrastructures. However, they do it at a minimum level and keep attractive product features to themselves. Project managers should be aware of similar external risks brought by other Telco service providers.

Senior managers' visibility in NPD projects creates a sense of urgency to deliver products in time. They want to be seen doing their part and contributing to company strategy with new products. If they align with NPD project goals, their impact is positive, but if not, it harms the projects and the team members. With good intentions, they may consider other criteria, not relevant to NPD. For example, they may select vendors because of better financial deals or reciprocal business relations, rather than because of their technical capabilities. Due to their short-term financial focus, they may shift resources to other projects offering more revenue, after basic functionality in a product is completed, therefore leaving a half-delivered project. Senior managers of different stakeholder groups can put forward their own benefits, if conflicting requirements arise. Sometimes, their actions cannot be justified as leadership or group

behaviour. Their unwise decisions and resistance can be explained with the well-known agency theory (Eisenhardt 1989), where they push for their individual political agenda behind the scenes without considering the damage to either the project or the company, and fail to support project managers (Helm and Remington 2005).

Telco companies generally produce annual budgets allocated for NPD projects, and also assume that new products start generating revenues at a date based on the initial estimates. However, at that stage there are many unknowns and uncertainties, and project managers usually add buffers to cope with them. After a detailed technical analysis or during development, these buffers may not absorb the changes in the plans. For large variations, project managers have to go through several bureaucratic procedures and produce reports justifying the variations to senior managers who have the power to shift the resources. Eventually, rather than the project execution itself, the project managers focus on obtaining resources to minimise the impact and getting the project back on track. It is challenging to arrange additional funds in the middle of a financial year and, furthermore, the allocated resources may well have been assigned to other projects during this period. Obtaining bureaucratic approval for big amendments can take months.

The challenges in Telco NPD are associated with risks that project managers have to manage during a project's life cycle. The well-known risk management function of project management is also addressed separately as one of the nine knowledge areas in PMBOK (2004). The empirical findings support Jaafari's (2001) claim that an isolated view on risk management is inadequate. He suggests that "risk and uncertainties should not be seen as a discrete set of activities taking place at the time of conceptualisation. Rather, risk and uncertainty management permeates all decisions made during the currency of the project. In particular, management of risks and uncertainties should be seen as a continuous real time operation integrated with other project management operations" (Jaafari 2001:90), and a strategy-based decision making philosophy should be adopted. Large and complex Telco NPD projects entail technology, process, vendors, financial and managerial challenges and, in addition, projects managers need to cope with the chaos caused by time pressures. Although useful, simple risk management process (identification, analysis, response plan, monitor and control – PMBOK 2004) is far from explaining real life conditions, and instead describes a predictable linear pattern. In reality, these projects may start with incomplete scopes and requirements,

therefore unverified solution ideas, and undefined phases and releases. Developing response management plans for all possible risks is incompatible with fast time-to-market goals. The participants have emphasised that all their actions revolve around the strategy-based management, which is to produce a new product that customers can accept in a short time.

Jaafari (2001) has also defined risks that correspond to the Telco NPD project management challenges in this study: 'cost estimate risk' corresponds to 'project financial processes'; 'schedule risk' to 'competition: time-to-market'; 'organisational risk', 'integration risk' and 'operating risk' to 'business processes' and 'senior management involvement'; and 'technical risk' to 'technology'. This study does not consider other risks that are more related to a new product's acceptance in the market, such as promotion, market (volume and price) and financing, or external risks such as political and environmental risks. In Telco, the project managers' role is to deliver a quality product, as defined in the project scope, in time and cost; market and external risks are out of project managers' control. There is empirical evidence that they attempted to influence decision-making on the projects that have high-risk of market-acceptance, but they failed in some instances.

The interpretations of 'risk' and 'challenge', made by Jaafari (2001) and used in this study, need explanation. Risk is *chance of danger or loss* and challenge is to *do something difficult* (from Oxford dictionary). In simple terms, if something is challenging, it has associated risks, and these terms are frequently used interchangeably. However, challenge involves not only risks, but also uncertainties, unknowns, conditions and opportunities that increase the difficulty of managing something. Therefore, to avoid the implications of a limited sense of risk management, this study has used the term 'challenge' to convey the broader meaning.

Time-to-market is one of the important success factors in Telco NPD projects. Telco companies employ a number of practices to shorten NPD project cycles. They may not be new concepts, but they have implications for NPD projects and their managers. The most common approach is to deliver project outcomes in multiple releases, usually called phased delivery. The basic functionality is delivered first, but the project scope is not closed during the development. The scope extensions during a project execution create an ambiguity that project managers have to manage. Brun and Saetre (2007) have

identified the benefits of phased delivery: to retain a fallback option, to retain ideas, and to save cost and time. As the requirements solidify, closely related works are grouped together to form another release. Although it looks easy, in practice it can be complicated; a product roadmap has to be defined up-front in order to avoid incompatible patches in consecutive releases. Senior management has to commit to the full delivery of a product, since they tend to allocate resources to financially more attractive projects in the pipeline. The releases should be closely timed to avoid big technology changes, otherwise it cannot be counted as a release; it may rather turn into a whole NPD with a new technology.

A modular approach confines the development work of a product to clearly defined sections, which can be developed in parallel, thus speeding up the project (Miguel 2005). Modular production is already known (Baldwin and Clark 1999, Miguel 2005), and has gained popularity in recent years with the Lean concept in several industries (Walker 2002, Corbett 2007). Even though a product may not be successful in the market, the development work is not a waste, as its modules may be re-used in another product; Miguel (2005) calls this concept 'modularity in design'. However, defining modules is not always easy in Telco NPD: the interfaces in the legacy systems may be restricting; limiting customisation in business products. The product may inherit all the limitations of the modules on which it relies. Considerable effort beyond the original project scope may be needed to design a new modular product. This product may end up with many modules, thus eliminating the efficiency originally sought.

If products consist of fewer or standard modules, the process automation becomes cost effective and efficient, providing reliable and faster customer service. There is a demand in Telco for such applications, called Operations Support Systems (OSS) (Andreau et al. 2004). The consumer products have reached a high level of standardisation and the volume necessary to justify the costs of process automation. Whereas customisation is the norm in business products, achieving a good level of automation in this market segment appears likely to take some time.

To achieve fast time-to-market goals, project management must be flexible; time is too valuable to satisfy every process requirement. The processes are taken as guidelines, and compromises are made between satisfying the key processes and time-to-market goals. This finding concurs with the latest research studies in the NPD area, especially with

Lean NPD that targets elimination of non-value-adding work (Corbett 2007). Manufacturing is routine and repetitive and the source of waste can be identified with experimentation. On the other hand, each NPD has temporary conditions, and a task that can be considered a waste in one project may be critical in another. Schulze and Stormer advise project managers with technical knowledge and additional skills to encourage project team members to eliminate waste as "project managers do have a broader picture of processes reaching beyond single functions" (Schulze and Stormer 2007:10). Dalsace and Michaut-Denizeau (2007) differentiated trivial and random acceleration of projects, which tends to bypass project tasks, from process re-design for fast NPD, which they call process acceleration. They add that "process acceleration may trigger the incentives to improvise and experiment" (Dalsace and Michaut-Denizeau 2007:13). Similarly in the construction industry the time performance can be improved with "supportive environment for motivating a desire and a commitment to be flexible" (Walker 2002:43). As was also observed in this research, the recent trend of flexibility and freedom to apply project management processes requires skilful and strong project managers to decide the appropriate course of action. Consequently, Telco NPD project managers attract attention and need further investigation. This comes back to the 'so what' question which this research study is seeking to answer: what makes a Telco NPD project manager successful to delivering quality new products consistently in time and budget?

5   Project manager skill sets

This study is an example of how the research methodology selection can make a difference to develop theories that are convenient to apply in practice, even though similar type of research data is collected. The case study methodology employed here benefits previous literature, and uses methods and techniques to draw generalisable results; contrary to the other methodologies closer to the phenomenological extreme that require to enter the field without a priori knowledge, and sometimes, without a research question in mind (Glaser and Strauss 1967; Lincoln and Guba 1985). Cicmil (2006) has presented a process how such a phenomenological (or interpretative) research study generates new knowledge, where the starting point is the "theoretical traditions that are used to understand and explain the world of management practice with assumptions

about the concepts of reality, scientific knowledge, ethics and values" (Cicmil 2006:29); recalling assumptions of a research paradigm, rather than a well defined research question, or an approximate theoretical framework. Although she attempted to "shed some light on the process of determining the appropriate deployment of skills and knowledge by experienced practicing project managers in their local settings" (Cicmil 2006:30) by using hermeneutics methodological approach, she later concluded that "the associated set of skills identified in this study as useful and relevant to the practice of project management cannot be conventionally typologized under a number of discrete types of competencies that cumulatively could then be taken as making up a 'profile' of a successful project manager." (Cicmil 2006:36)

The fundamental difference is the ontological assumption between Cicmil (2006) and this study that is somewhere in the middle in the positivist – phenomenological approach continuum in Figure 3.1. Cicmil takes a different perspective to view projects: they are social settings to be recognised and coped with complex human interactions. It is clear that she has an ontological assumption more on the phenomenological approach that could be around "reality of a social discourse" in Figure 3.1. Her findings were based on practitioners' honest opinions from one-on-one interviews, which she called 'objectivity', and therefore, skewed towards the human (i.e. soft) aspects in projects. Her worldview about projects has propagated through the research design, and focused more on relations: alliances, negotiations, politics, communications, etc. that are covered mostly leadership skills here. Consequently, this research had a more balanced view that covers both soft and hard (i.e. plans, reports, tools, etc.) aspects of NPD projects.

The theoretical skill set framework from the literature review (Figure 2.15) was tested, and a very close fit with the empirical data was seen. The literature review Outcome 1, which proposes the organising framework with four project manager skill sets – technical, leadership, managerial and administrative skills – was therefore validated (Chapter 4, Section 5) for the Telco industry. It might be argued that managerial and administrative skill sets are similar, but there is strong evidence that they are clearly differentiated (Chapter 4, Section 5.3). Managerial skills are relevant to the project management concept (effectiveness), and administrative skills to understanding and using the organisational environment to make it happen (efficiency). Participants'

comments and examples of where and how the project managers exhibited each skill set (Chapter 4, sections 5.1−5.4) indicated that managers need all four skill sets to be successful in managing Telco NPD projects, which confirms Outcome 2 of the literature review.

Technical skills help project managers in two ways: first, to understand project work, its tasks and their relationships in forming a new product; second, to communicate with different stakeholders, especially with project engineers, senior managers and external parties. Such managers can explain technical matters in a language that suits the recipients' needs. However, these skills need not be oriented towards detail. The same conclusion was drawn from the literature in Outcome 4, but the empirical evidence provided further details. Some participants called these skills 'technical acumen' to describe the adaptability to different technologies in a project. Interestingly, the companies had intentionally selected most of their project managers with some technical background. Project managers with both managerial and technical perspectives can quickly resolve conflicts between the management and team. Therefore Outcome 3 of the literature review, which claims technical skills are important for only new technologies, was not observed. The evidence in Chapter 4, Section 5.1 shows that project managers need to understand technologies involved in a project, regardless of the technology's newness. Although they may have detailed technical knowledge in some areas, the relevant project work is better left to the technical team members. Otherwise project managers' focus may shift from managing projects into technical areas in which they should not be involved, and they could lose their objectivity, to the detriment of the project. They can definitely raise issues and concerns on technical matters, but it is not their responsibility to do the technical work.

Section 5.2 of Chapter 4 has shown that project managers utilised leadership skills to attain the project management goal of delivering a quality product on time and within budget. As leader of the project team, project managers are interested in their team members' concerns, conflicts and motives in getting the job done, but they feel no obligation to look after the members or help them advance in their professions. The leader−follower relationship that occurs between a functional manager and an employee does not hold for project managers, as described by Keegan and Hartog (2004). Project managers exhibit leadership skills when they communicate verbally and in writing with

the project stakeholders, vendors, and especially with senior managers, and when they negotiate a solution and obtain their buy-ins. They provide better solutions to problems by listening to their teams and other stakeholders, and encouraging a solution that is effective both technically and in a business sense in terms of processes and costs. Christenson and Walker (2004) observed the same activities of a project leader, who has communicated project vision and contributed to its success in a case study. Although Telco NPD project managers do not pay particular attention to team-building activities, they try to run a coherent team and resolve issues and conflicts within the project team. If they cannot reach a quick resolution, they engage functional and senior managers. Exhibiting leadership to attract followers, i.e. going beyond more than influencing stakeholders is not feasible in practice, for two reasons. First, Telco NPD projects are temporary endeavours with a limited and tight time-frame, and project managers have little opportunity for the activities other than the project work to establish long-term caring relationships. Their performance is mainly evaluated against delivering projects in time. Second, they are limited by the matrix organisational structure and, unlike functional managers, have no authority over anyone. One of the project managers intentionally ignored leadership totally, stating that theirs is not a leadership role at all. Although the literature has emphasised leadership skills more than others, their usage is found to be more limited in the sense of the classical leader–follower relationship. There was no evidence to support Outcome 6 from the literature review; leadership skills are needed not only for new technology projects, but for both new products and product line extensions, since both can be large and complex.

Managerial skills are mandatory skills for project managers. All participants stated (Chapter 4, Section 5.3) that it is project managers' ultimate responsibility to develop and execute project plans. Small projects that consist of a few tasks can be planned simply, unlike large and complex projects with multiple interrelated tasks, bigger project teams and many stakeholders. Therefore, Outcome 7 from the literature review, which proposes managerial skills are more important in product line extension projects, is not validated, since such Telco NPD projects can also be large and complex.

Project plans help project managers in many ways: they provide visibility into project details; allow close tracking and control; form a means of communication with the team members to convey project goals; and give a high level summary of critical tasks and

milestones for reporting to senior managers. The plans are updated in order to see their impacts on project goals as tasks are completed or delayed, and assumptions and conditions change. However, a project plan alone is not sufficient for project execution. Project managers do not have authority to shift resources in favour of their projects, or impose changes. They can only exercise their positional powers via escalations in the organisational hierarchy. The empirical evidence indicated that the participants use escalations often; it is considered a natural extension of their actions, and senior managers handle them as part of their regular daily duties. Escalations have to be justified with facts and quantified data. Project managers can affect senior managers' decisions by their arguments, and they can therefore influence company strategy in a limited way. They initially disclose an issue with a short informal communication, so it does not come as a surprise, then escalate it formally. One of the participants summarised this process well: "firstly be in control, at worst you should appear in control". Well-timed escalations make project managers look like they are in control. The literature mentions using positional powers, but does not indicate how escalations are critical for attaining challenging time-to-market goals. Escalations are the only formal tool that a Telco NPD project manager has.

Administrative skills are essential in Telco companies; as several participants emphasised in Chapter 4, Section 5.4, their organisations are formed of specialised groups around technologies and functions. As project managers do not have any authority, they rely on administrative roles and policies to cross these boundaries to implement process changes. They need to know who does what, and who the decision-makers are. Project governance describes roles and responsibilities to help project managers perform their duties. Project managers sometimes need to make use of the escalation paths defined in this governance to resolve project issues quickly. Time-to-market pressure makes escalations a part of project management culture. The project management tools also help in managing projects. Although the participants know the company-wide tools and use them whenever required, most use only the basic tools, like MS Project and spreadsheets. How these tools are used depends on a project manager's personal preferences for ways of recognising data and quickly producing summaries. The efficient use of these tools makes a significant difference in how managers exhibit their managerial skills. They also use other well known, widely used tools, like e-mails for communication and MS Word for documentation. The participants performed their

administrative tasks at a minimum level, avoided unnecessary tasks, and prioritised according to the level of urgency. Thus Outcome 9 from the literature review is partially validated: good administrative skills are needed not only for new technology projects, but also in any large and complex projects.

The skill sets interact during a project, rather than operating in isolation. The participants mentioned many such cases. For example, managerial skills (developing project plans) are incorporated with administrative skills (using project management tools) to produce and update project plans quickly. Or, for effective communication, technical skills (understanding a technical concept) are combined with leadership skills (writing or talking in simple terms to convey a topic). Their interaction creates a synergy and multiplies a project manager's effectiveness and efficiency.

6   Project manager skill sets vs project phases

Telco companies employ a stage-gate (or phase-gate) NPD process, which is well represented in the literature (Cooper et al. 2002). Most of the Telco cases, summarised in Chapter 4, Section 2.2, use four phases (Engwall et al. 2001): Initial Investigation (II), Feasibility and Definition (F&D), Development, Implementation and Validation (DIV) and Closure. The project phases used in Case 2, which had more phases, were mapped to these four phases during data analysis. Small projects generally go directly to the DIV phase, since what needs to be done is already known to a greater degree. The company still needs project managers who can do the project work and track it until completion. Therefore some administrative and basic managerial skills are adequate. In Chapter 4, Section 6 it was shown that large and complex projects need all skills to varying degrees in different phases. In Chapter 4, sections 6.1−6.4 presented the skill sets separately to analyse their comparative impacts in the project phases, due to the focus of the research study. In practice, it is more useful to know which skills are valuable in a phase, so resources can be properly allocated. Therefore, in the following discussion, the empirical findings for the skill sets are summarised for each phase, so closer attention can be paid to which particular skills are relatively important.

The chance of project management success is significantly increased by eliminating requirements that are not feasible in terms of technology, cost or time, and starting with a well-defined scope from the II phase. Communications are intense until an agreement is reached; it requires good listening, communication, writing, negotiation, conflict resolution and marketing skills. Project managers need to understand what is required, convey it precisely in both engineering and marketing terms, negotiate and resolve conflicts, obtain stakeholder buy-in, and then record the decision in plain language to prevent future confusion. Technical and leadership skills are the most essential skill sets in the II phase. These skills are useful for initiating discussions about possible solutions and their impacts on the plans and organisational groups, thus providing early warning of potential problems. Some managerial and administrative skills are also helpful, but having clear requirements upfront is more important than the plans at this stage. Outcome 5 from the literature review, proposing technical skills are important in all project phases except Closure, is partially valid; technical skills in the F&D and DIV phases are not as critical as in the II phase.

Interaction with functional engineering groups is more frequent during the F&D phase. In addition to other leadership skills, project managers encourage business sensitivity for a cost-effective and simple solution with least organisational impact. The technical limitations that may arise after a detailed analysis and testing are communicated back to marketing, and requirements are reviewed. Project plans are improved with more accurate estimates, since the company really starts using its resources with the F&D phase. The project schedule must now contain sufficient details and interim milestones to track project progress, and the financial plan is time-lined to manage cash flow better. Project management tools help project managers produce, update and store information efficiently. Increased documentation records designs and process changes, and explains a new product. Therefore outcomes 8 and 10 are validated: managerial and administrative skills are more essential in the F&D phase than the II phase. The technical skills that are essential in the II phase become less important, and they are needed only to check the quality of technical decisions. While the technical knowledge required in the F&D phase is much deeper, engineers in the project team already have this capability. This result differs from Outcome 5 from the literature review, which claims technical skills in II phase are equally important in the F&D phase. The

emphasis on business processes rather than technology is reflected in the empirical findings, with a decreased level of technical skills.

The challenge in the DIV phase is to satisfy product acceptance conditions, which ensure that operational systems and processes are updated, and sufficient knowledge is gained to support a new product (Nogeste and Walker 2006). Everything done so far in a project has had the goal of securing operational groups' buy-in, and in the end their approval. Project managers need to be careful; they should watch every signal, and understand and address concerns in order to eliminate the risk of last-minute problems that may delay project delivery. Deviations from project plans should be carefully examined, and anything that may affect the completion dates must be resolved immediately. Consequently, project managers' positional powers via escalation are used the most in this phase. It is impossible to predict everything. Project management tools help to identify risks early, and to update the plans and produce new ones, if required. As with the F&D phase, this phase requires good leadership, managerial and administrative skills. These findings validate outcomes 8 and 10 from the literature review: managerial skills and administrative are more important in the DIV than in the II phase. A lower level of technical skills suffices in the DIV phase than in the II phase, as there are technical expert team members to address technical issues. These skills are needed only to understand what is happening during roll out in the field. Thus Outcome 5, which states technical skills are needed equally in II and DIV phases, from the literature review is disproved.

The operational acceptance of a new product signifies that project managers have completed their task, and managed to deliver a new product that can be supported after its launch in the Closure phase. This phase has more marketing activities, project managers helping to answer initial queries coming from operations, sales and customers. It requires informative communications and some technical knowledge.

The required levels of skill sets in different project phases are presented pictorially in Figure 5.1. However, time-to-market pressure can force project managers to shorten project duration. An easy solution is to bypass project tasks or even a whole project phase, with the consequence that issues improperly addressed in earlier phases can appear later in the DIV phase. By reaching this phase, according to stage-gate NPD processes, projects are assumed to have passed through the preceding processes, and so,

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a delivery date can be committed. A product rushed to the market may have serious issues in the Closure phase. Often, real world conditions are not well identified in the II phase, or tests in the F&D phase remain incomplete. Project managers should resist cutting corners, and innovatively address critical tasks to be executed. This is very challenging with aggressive time-to-market goals. It requires considering the II, F&D and DIV phases at a high level. Project managers can adjust the phase durations or overlap them, and in addition they need to manage senior management's expectations. They may lengthen the F&D phase if there are many risks and unknowns, or start testing as early as possible in the II phase. Another solution is to arrange a project plan to accommodate a number of phases in product delivery. Such projects should be managed by project managers with excellent technical, leadership, managerial and administrative skill sets.

Figure 5.1. Skill sets versus project phases for large and complex projects. Bars with
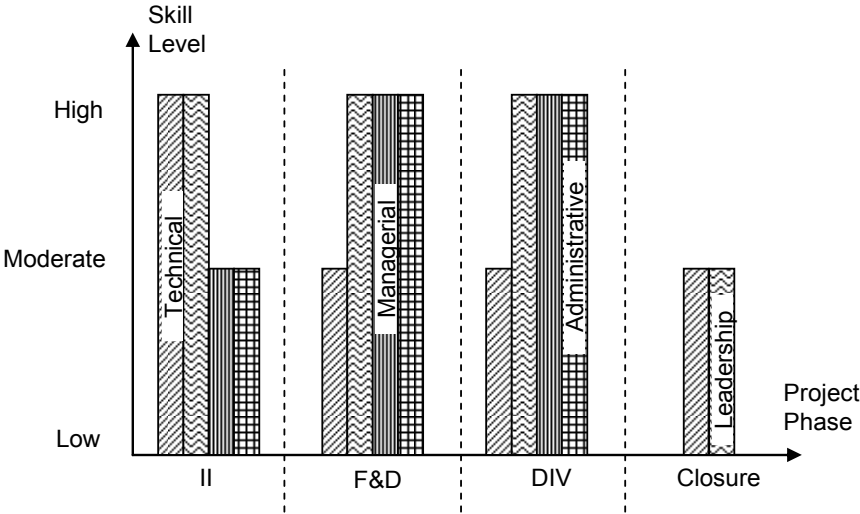
different patterns represent skill sets.

7 Project manager skill sets vs competency standards

Although this research's scope and project manager competency standards differ in purpose, their overlap gives a good indication if these standards cover the required skill sets in Telco NPD projects sufficiently well. Activities that are associated with the skill

sets and observed to overcome the Telco NPD project challenges in this study, were matched to those in PMCD (2007) and GAPPS (2006) project manager competency standards. Unless otherwise stated, in the following discussion PMCD refers to the latest version (2007). The PMCD and GAPPS are selected as two specific examples, but the concept may also be extended to other competency standards.

PMCD collects activities under performance competencies in process groups: Initiating, Planning, Executing and Closing, which resemble the project phases, and Monitoring and Controlling across all phases. However, when examined closely, the activities are not clearly delineated, with no one-to-one mapping between these competencies and the project phases. The only project phase mentioned by GAPPS is Manage Project Transitions competency, with all units of competencies being expected to be exhibited throughout the project, whenever required. Consequently, a generic mapping between the units of competencies in the standards and the NPD project phases is not simple and straightforward.

Most of the performance criteria in both PMCD and GAPPS address managerial skills. Although PMCD recognises technical skills, neither of the competency standards contains any criterion about the assessment of them. PMCD considers them as industry-specific. Therefore, Telco companies should amend their project management competency criteria accordingly. PMCD covers most of the activities that require leadership skills in the 'Personal Competencies' section, and GAPPS under a single unit of 'Manage Stakeholder Relationships'. The organisational factors reported in this research were identified to a limited extent in an early version of PMCD (2002) (Kosaroglu and Hunt 2007a), and to a greater degree with attached performance criteria in PMCD (2007). PMCD specifically has units of performance and personal competencies for organisational systems (tools, methods, techniques, etc.) and settings (culture, organisational structure, etc.). The participants did not emphasise procurement, as they are mostly concerned with its funding as part of budgeting and cash flow management. GAPPS does not have such clear organisational elements, since it claims to have the minimum number of criteria, and therefore excludes organisation-dependent factors.

Due to its scope, this study has not examined the areas that the participants did not find challenging to attain project management goals. Both PMCD and GAPPS standards

contain team and individual development, and process improvement, but the participants in this study did not mention much specific activities. In a recent study, Zwikael and Unger-Aviram (2007) found no significant influence of team development on project success, even in long, expensive and high-risk projects. They give several reasons: team development takes time and its effect may not be manifest by the end of a project; team members are allocated only partially to project teams, not full time; time is limited for team development; project managers lack the authority to reward team members for contributing to team development; projects are task-oriented, rather than having people-related goals; and team development is a generic Human Resources Management (HRM) activity, which may not fit a short-term project environment. Although Zwikael and Unger-Aviram (2007) acknowledge that PMBOK (2004) has a specific 'team development' process as part of its HRM knowledge area, they emphasise instead a productive working relationship with functional managers and engaging team members. It requires project managers to be become aware and regulating their own behaviours, then empathise and inducing desirable responses by using social skills, which Goleman (1995, 1998) named as Emotional Intelligence (EI). Higher EI in project managers helps to reinforce healthy human relations with stakeholders. To attain fast time-to-market goals, project managers focus on few key project management processes that allow maximum flexibility, improvise more (Dalcase and Michaut-Denizeau 2007) and eliminate waste (Schulze and Stormer 2007).

In Telco, the strategic direction is to deliver new products to seize short windows of opportunities. Senior managers prefer to use resources to develop new products as fast as possible, rather than diverting their energy in other areas. This strategic choice also affects the project managers' priorities, without particular attention on team development and process improvement activities. In a matrix structure, the functional managers, who lend the human resources to a project, assume prime responsibility for personal development. As it was noted in this study, project managers may need to pay more attention to speeding up projects without taking much risk, engaging and maintaining a coherent team, and co-operating with functional line managers to achieve these.

In summary, PMCD and GAPPS standards cover managerial skills quite well, and then leadership skills, with PMCD having more detail. PMCD recognises administrative skills sufficiently, but GAPPS does not. Although PMCD has indirect references, they

both under-represent technical skills. The activities associated with team and individual development and improvement in project management processes are not encountered as challenges in the Telco industry, because of the particular conditions and organisational constraints.

8   Conclusions

This research has provided a closer look at the Telco NPD projects and investigated their project managers' skill sets. This chapter has compared the empirical results with the literature and the selected project manager competency standards. As a result, this research has contributed to filling the knowledge gap on project managers in the hypercompetitive conditions of the Telco industry today. Possible gaps were highlighted in the existing competency standards. Consequently, the main research question is now better understood: a description of successful Telco NPD project managers, what kinds of skill sets they should possess, how they employ them and in which project phases.

CONCLUSIONS

1 Introduction

This research study has investigated the skills necessary for project managers to overcome the challenges and be successful in Telco NPD projects under today's dynamic and hypercompetitive industry conditions. The previous chapter presented the empirical results and compared these with literature review outcomes and recent publications. This chapter summarises and highlights the contributions of the research study, emphasises their practical uses, and explores possible future studies that can benefit from these research results.

2 Contributions

Increasing competition after the market deregulations and new technologies with shorter life spans are forcing Telco companies to produce new products in ever shorter and more challenging time-frames. The project manager is critical for NPD project management success. This study has addressed a knowledge gap in the literature by investigating contemporary Telco NPD projects and what skills sets project managers need in order to manage their projects successfully. The following summarises the contributions of this research.

First, many previous studies (Anderson 1992; Jiang et al. 1998; Dainty et al. 2003; Krahn 2005) lacked a holistic view that provides an abstract and compact representation of project manager skills. Some others either mentioned or implied skill sets, but fell short of clear descriptions (Hosking 1988; Wateridge 1997; Song et al. 1997c), or an empirical investigation in practical contexts (Thamhain 1989, 2004c). This study chose the rationale of how skills contribute to the NPD project management success –

basically delivering a quality product within time and budget – to form the skill sets, and then grouped them under the most logical exclusive sets, as shown in Figure 6.1. This organising framework with four skill sets, proposed theoretically after the literature review, has been validated by the empirical analysis.
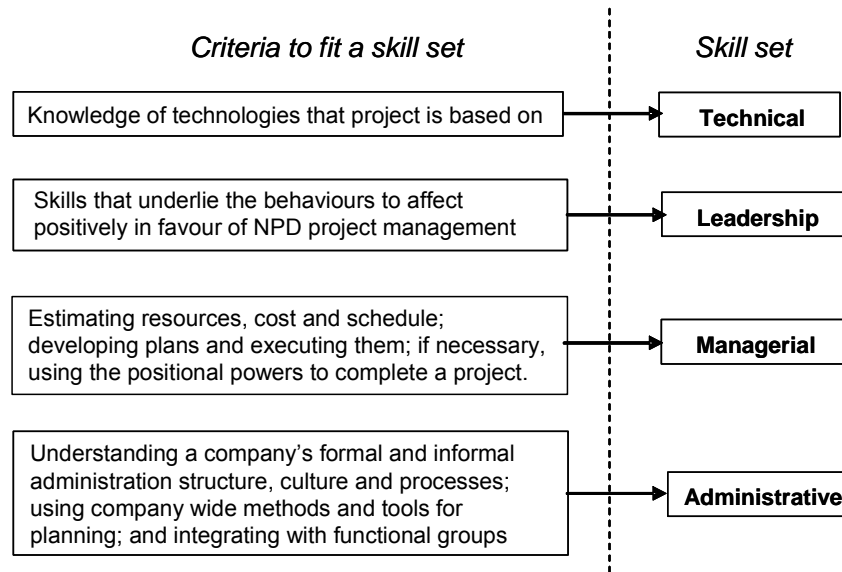
Figure 6.1. Project manager skill sets (repeated from Figure 2.15 in Chapter 2)

Second, the theoretical project categorisations based on project classifications from the literature were biased towards product innovation and technology (Henderson and Clark 1990; Wheelright and Clark 1992; Griffin and Page 1996; Balachandra and Friar 1997; Shenhar 2001), and lacking in other dimensions. The projects producing business or consumer products, and commonly referred to by the participants, provided an incomplete picture. This study classified the sample Telco NPD projects into two groups: large and complex, and small projects, with the indicators as shown in Table 6.1. Large and complex projects cross a certain threshold with respect to cost, revenue impacts and complexities in terms of processes and technologies. The pressure and urgency for their delivery increase, and consequently they have several challenges that project managers need to address. This research therefore focused on large and complex projects, since they reveal the maximum information about the project manager skill sets.

	PROJECT TYPE		
	Large and complex		**Small**
Stakeholders	Many		One or two
Cost	High		Low
Revenue impact	High		Low
Duration	Long		Short
Time-to-market	Fast		Flexible
Technology	New	Known	Known
Description	New technology introduction to the market	Incremental product modifications	Life cycle management
			Customer facing product improvements
			Process fixes

Dark grey: new product development that involve technology projects, grey: NPD with many stakeholders, light grey: small projects

Table 6.1. Classification of projects: large and complex versus small projects. (repeated from Table 4.2 in Chapter 4)

Third, although technology was seen as almost the most influential factor in the literature, in reality it is only one of the factors in Telco NPD projects. The integration of business processes with technology is the most dominant theme. They are combined with other challenges due to the involvement of senior managers, financial processes and, in some cases, external vendors and other Telco service providers. Although the process and time-to-market aspects were recognised in the literature, their importance and strength in shaping the Telco NPD projects and, ultimately, the project manager skill sets, were understated.

Fourth, Telco NPD project managers need all four skill sets shown in Figure 6.1, with varying degrees in different project phases, as shown in Figure 6.2. Technical skills do not need to be detail-oriented, but should be good enough to understand the technologies a project uses, regardless of the newness of an involved technology. Even if project managers have a strong technical background, they should refrain from getting too involved in the technical work and thus losing their objectivity and focus. Technical

skills are needed most in the early stages of a project, while the project scope is being defined.
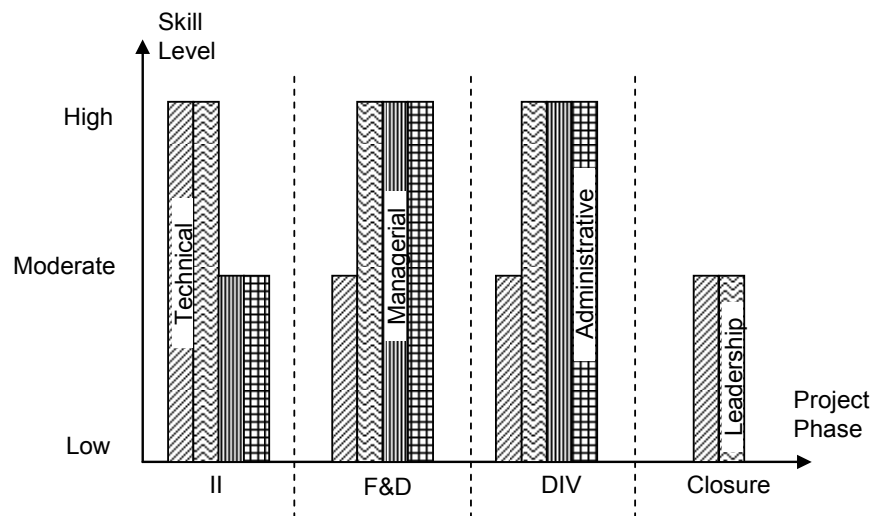
Figure 6.2. Skill sets versus project phases for large and complex projects. Bars with different patterns represent skill sets (repeated from Figure 5.1, in Chapter 5).

Managerial skills are covered extensively in the competency standards. They are the key skills for execution of a project plan until delivery of a new product. However, their emphasis in the project manager competency standards should not be misinterpreted; these are the foundation skills, but they are not sufficient.

Leadership skills are essential in every critical project phase from beginning to product delivery. Telco NPD project managers are not particularly concerned with team and individual development, since these do not have direct relevance to short-term NPD project goals. Additionally, matrix organisational structures pass prime responsibility for professional and personal development to functional line managers. Project managers care for their team members, but only in order to get the project work done.

Project managers need administrative skills in Telco, since they are usually big organisations that consist of several groups formed around technologies. Managers need to understand the policies, processes, structure and tools to manage projects and cross

boundaries between these groups, to execute project plans efficiently. Senior managers put the priority on completing projects on time, therefore project managers do not need to pay much attention to non-value adding activities.

Fifth, project manager competency standards may not cover all of the skill sets, and the outcomes of this research can complement these standards. As examples, PMCD (2007) and GAPPS (2006) project manager competency standards were mapped to the project manager skill sets by matching the activities in the standards and those observed in the empirical investigation to overcome project challenges. This concept can be extended relatively easily to other standards. Technical skills are not assessed in either of the standards. Managerial skills are covered quite well, but the importance of escalations is not evident. Many activities in both standards are also associated with leadership skills. Unlike PMCD, GAPPS does not refer to administrative skills explicitly, since it claims the minimum criteria for the competency. Telco NPD project managers do not pay particular attention to team and individual development or process improvement, which are included in both PMCD and GAPPS standards, since they do not appear challenging in the projects. This research excluded these aspects as it became apparent while analysing the project manager competency standards that they were not particularly pertinent to the research scope.

3   Managerial implications

This study provided a simple and compact representation of the skills of an NPD project manager with four skill set dimensions: technical, leadership, managerial and administrative. Telco industry requires all four sets, with varying degrees depending on the project phases. Considering time-to-market pressure, Telco NPD project managers need to have all these skill sets. Although it is desirable to run a project with the same project manager from beginning to end, occasionally resources need to be re-allocated in the most effective way. Project managers with associated skills can be assigned according to the phase of a project. For example, a project manager with good technical skills will perform better in a project in II phase, while one with managerial skills would be more suited to F&D and DIV phases. Since Closure phase does not require any managerial or administrative skills, a less experienced project manager can be assigned.

It is logical to assign the most skilful project managers to the most difficult projects. Since the project types commonly used in the industry may not clearly indicate their levels of difficulty, the better indicators in Table 6.1 need to be used. Project managers should pay closer attention to the major challenges shaping large and complex projects. The flexibility in applying processes for managing Telco NPD projects to achieve fast time-to-market goals again shows the need for skilful project managers.

The standard certifications are not sufficient when hiring and developing Telco NPD project managers. As examples, GAPPS (2006) and PMCD (2007) project manager competency standards have been shown to measure mostly managerial skills. Leadership skills are usually emphasised in job descriptions, but at the operational level in NPD projects, their usage is indeed limited to the project work. Technical skills are rarely mentioned, and administrative skills may not be sufficiently covered in the standards. Therefore, the coverages in the competency standards differ; all are acceptable for managerial skills, but this is not the case for other skill sets. Although the certifications prove that theoretical knowledge of project management exists, Telco companies need to be cautious as this theoretical knowledge may not be reliable for all dimensions. For example, standards claim to assess evidence, especially for leadership and administrative skills; however, in practice this may not go beyond checking the duration of a candidate's project management experience. The outcomes of this study can be considered complementary to the missing skill set dimensions in a generic project manager competency standard for Telco NPD projects.

4   Future research

The implications of technology, tough competition and business processes cause Telco to have its own specific characteristics that are worth examining. This study has addressed one component in NPD: its project managers. It had previously been considered that strong NPD processes are the key for successful NPD project management (Montoya-Weiss and Calantone 1994; Cooper 1998; Henard and Szymanski 2001), but some recent studies on Lean NPD (Corbett 2007; Schulze and Stormer 2007) and the empirical findings in this study show a different picture – the processes need to be tailored for each project's circumstances to eliminate waste and

perform faster product development. This is one reason for the need to have skilful project managers who can make sound decisions. The process implications, how they are tailored for different conditions, and the trends in the industry can be an area for further research.

Technological advances are impacting on almost all industries, and other industries may have market characteristics close to those of Telco. This study has presented a number of challenges of Telco NPD projects. The findings in this research can provide useful indicators in similar industries. Further research could analyse other industries, draw conclusions about project manager skill sets, and test or modify the skill set framework proposed here. For example, if the technology component is not as dominant as it is in Telco, project managers may need less emphasis on technical skills, and the project manager competency standards may therefore suffice for selecting project managers for NPD.

NPD projects may have different characteristics in different industries. CIFTER (GAPPS 2006), which is elaborated in Appendix E for the sample Telco NPD projects in this study, has noted that not all projects are equally difficult to manage, and has acknowledged that it may need tailoring for industry specifics, but it has not presented a scheme of how to do this. Future research could augment CIFTER and re-evaluate complexity rating with additional factors to take account of the Telco NPD environment and thus facilitate a better description for Telco NPD projects. For example, three new factors could be added: 'External parties (vendors) involvement', 'Technology newness' and 'Number of stakeholders impacted by the process changes'; the last may replace the seventh factor 'Number and variety of interfaces between the project and other organisational entities'. These would provide a better matching between the project types as commonly referred in the industry. NTI projects rate higher in technology newness and external parties involvement, whereas this may be lower for NCPD projects. But NCPD ranks high in the number of stakeholders as a direct indication for the process changes. Similarly, the third factor 'Magnitude of legal, social, or environmental implications from performing the project' might not be considered for Telco NPD projects, thus simplifying the complexity rating. Telco NPD projects are not in the same category as some other large scale projects – such as building a new nuclear power plant or a new highway – which directly affect people

and their immediate environment. Likewise, other industries may add different complexity factors, and amend the rating levels according to their conditions.

This research study has investigated the Australian Telco industry, which was deregulated more than a decade ago, one of the first countries in the world to do so. In addition to the old state-owned Telco company, other subsidiaries of global Telco groups are operating in a very competitive market, and new Telco companies are still seeking a niche segment in the market (Munch 2007). Therefore, the current state of the industry is likely to continue for the foreseeable future. The findings of this study also indicate what Telco NPD projects might be like in the countries that have only recently privatised their Telco market. Australian and other Telco companies may benefit from these research results to select and develop their NPD project managers with the appropriate skill sets to survive and prosper in a dynamic and competitive business environment.

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APPENDIX A: CASE STUDY DETAILS

PARTICIPANT	YEARS OF EXPERIENCE			EDUCATION / QUALIFICATION
	PROFFESSIONAL	TELCO	PROJECT MNGMT.	
Participant 1	26	26	12	B. Eng, Commerce deg.
Participant 2	22	9	9	B. Eng, MBA
Participant 3	26	24	12	Ph.D. in Eng.
Participant 4	12	12	5	B. Eng, MBA,
Participant 5	15	10	7	B.Sc. in Eng, Dip. in Law
Participant 6	27	27	17	B. Eng, MBA courses
Participant 7	18	18	5	B. Eng, MBA
Participant 8	20	6	5	M. in Econ. MBA
Participant 9	>30	7	25	Dip. in Proj. Mngmt.
Participant 10	11	7	5	B. Eng, MBA progress.
Participant 11	18	6	18	MBA progressing
Participant 12	30	20	30	B. Eng, Proj. Mngmt courses
Participant 13	29	20	7	B. Eng.
Participant 14	25	20	20	B. Eng, Proj. Mngmt. courses
Participant 15	15	10	5	M. in Tech. Mngmt.
Participant 16	10	10	5	B. Eng, MBA
Participant 17	20	15	9	B.Sc, M.Sc. in Eng.
Participant 18	30	25	15	B. Eng, Proj. Mngmt. courses
Participant 19	20	17	9	M.Sc. in Eng, Dip. in Proj. Mngmnt., AIPM certification
Participant 20	20	10	10	MBA, PMP and Prince2 certifications
Participant 21	17	13	5	B. Eng, Proj. Mngmt. courses
Participant 22	20	10	20	B. Eng, MBA
Participant 23	15	10	5	B. Eng.

Table A.1. Participants' profiles

CASE 1			
PARTICIPANT	**ROLE**	**PARTICIPANT**	**ROLE**
Participant 1	Project manager	Participant 2	Project manager
Participant 3	Mngr. of project managers	Participant 4	Project manager
Participant 5	Mngr. of project managers	Participant 6	Project manager
Participant 7	Mngr. of project managers	Participant 8	Project manager
Participant 9	Senior manager	Participant 10	Mngr. of project managers
Participant 11	Product manager[4]	Participant 12	Program manager
Participant 13	Project manager	Participant 14	Program manager, mngr. of project managers
Participant 15	Product manager	Participant 16	Product manager, project manager
Participant 17	Project manager	Participant 18	Senior manager
Participant 19	Project manager	Participant 21	Project manager
Participant 22	Program manager		
CASE 2			
PARTICIPANT	**ROLE**	**PARTICIPANT**	**ROLE**
Participant 1	Project manager	Participant 6	Project manager
Participant 12	Senior manager	Participant 14	Project manager
Participant 17	Project manager	Participant 20	Program manager
Participant 23	Project manager	*Participant 7[5]*	-----
Participant 19	----		
CASE 3			
PARTICIPANT	**ROLE**	**PARTICIPANT**	**ROLE**
Participant 5	Mngr. of project managers	Participant 21	Project manager
CASE 4			
PARTICIPANT	**ROLE**	**PARTICIPANT**	**ROLE**
Participant 22	Program manager		
CASE 5			
PARTICIPANT	**ROLE**	**PARTICIPANT**	**ROLE**
Participant 6	Project manager		

Table A.2. The cases and their contributing participants

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[4] Project sponsors represent the marketing groups, and they are usually titled as product marketing manager. Company B is an exception, where an engineering (or engineering senior) manager acts as the sponsor.

[5] The participants indicated in italics have also worked in the company associated with a case. They did not hold project management positions in projects, but exposed to project related work, and they could compare different cases.

PROJECT	COST/BUDGET (x$1000)	NO OF STAKEHOLDERS	DURATION (months)	CITED BY PARTICIPANT(S)	CASE
Project 1	700	9	12	1, 3	Case 1
Project 2	1200	11	18	1	Case 1
Project 3	700	9	12	1	Case 1
Project 4	700	10	9	1	Case 1
Project 5	70	3	2	2	Case 1
Project 6	1500	4	3	2, 3	Case 1
Project 7	100	4	2	2	Case 1
Project 8	700	9	9	2, 21	Case 1
Project 9	1200	12	18	3	Case 1
Project 10	600	9	9	3	Case 1
Project 11	1000	10	12	3	Case 1
Project 12	1500	12	18	3, 15, 20	Case 1
Project 13	700	9	12	3	Case 1
Project 14	2000	11	18	4	Case 1
Project 15	20000	11	18	4	Case 1
Project 16	200	6	8	4	Case 1
Project 17	15000	12	24	5	Case 1
Project 18	5000	10	18	5	Case 1
Project 19	2200	11	24	6	Case 1
Project 20	1200	9	8	6	Case 1
Project 21	1300	12	9	7	Case 1
Project 22	1000	12	30	7	Case 1
Project 23	1200	11	18	7	Case 1
Project 24	1100	11	18	7	Case 1
Project 25	3000	10	18	8, 20	Case 1
Project 26	2800	12	18	8	Case 1
Project 27	40000	15	48	9, 12	Case 1
Project 28	2000	15	18	9	Case 1
Project 29	4000	12	18	9	Case 1
Project 30	200	4	6	9	Case 1
Project 31	1700	10	18	10, 11	Case 1
Project 32	1000	10	12	10	Case 1
Project 33	2500	10	18	11	Case 1
Project 34	10000	15	24	11	Case 1
Project 35	5000	12	30	11	Case 1
Project 36	2000	10	24	12, 15, 16	Case 1
Project 37	1000	10	(terminated)	13	Case 1
Project 38	12000	20	36	13, 14, 17, 18	Case 1

Table A.3. The distribution of projects, their characteristics and citing participants among the cases

Appendix A (continued)

Project 39	1500	11	12 (terminated)	5, 13	Case 1
Project 40	1000	10	12	13	Case 1
Project 41	2000	12	18	13	Case 1
Project 42	1000	10	12	13	Case 1
Project 43	5000	20	48	14	Case 1
Project 44	3000	10	18	14, 18, 19	Case 1
Project 45	1500	10	12	15	Case 1
Project 46	1200	10	18	15	Case 1
Project 47	10000	20	48	1, 16, 22	Case 1
Project 48	1000	10	12	16	Case 1
Project 49	500	8	6	17	Case 1
Project 50	1300	8	12	17	Case 1
Project 51	8000	17	18	17	Case 1
Project 52	4000	10	12	18	Case 1
Project 53	5000	10	12	18	Case 1
Project 54	5000	10	12	19	Case 1
Project 55	2000	12	18	19	Case 1
Project 56	5000	12	36	19	Case 1
Project 57	>100000	20	36	22	Case 1
Project 58	3500	10	12	6	Case 2
Project 59	4000	10	18	12	Case 2
Project 60	2000	12	18	12	Case 2
Project 61	100000	20	48	14	Case 2
Project 62	3000	12	18	17	Case 2
Project 63	40000	20	18	20	Case 2
Project 64	10000	20	48	20	Case 2
Project 65	2000	12	9	23	Case 2
Project 66	500	5	3	5	Case 3
Project 67	20000	18	18	21	Case 3
Project 68	1000	3	18	21	Case 3
Project 69	2500	10	36	21	Case 3
Project 70	300	7	4	21	Case 3
Project 71	5200	11	12	6	Case 4
Project 72	1500	15	9	22	Case 5

(terminated): project was terminated, once understood that it is not feasible or not a good business case any more

Table A.3 (continued)

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APPENDIX B: INTERVIEW INVITATION AND CONSENT FORM

INTERVIEW INVITATION

Subject: Research interview
Location: …………. (or another room you may prefer)

Start: Date / Time
End: Date / Time

Recurrence: (none)

Meeting Status: Meeting organizer

Required Attendees: Mustafa Kosaroglu; …………….

Hi …………,

Thank you very much for accepting to contribute to my research study, titled as "Project Manager Skill Sets in Telecommunications Industry New Product Development Projects". I mainly look for the different project types and skills that helped telecom new product project managers to overcome project related challenges. The questions are of the following form, or similar:

1. Interviewee profile: years of industrial experience, project management experience, qualifications, telecom experience, etc.

2. What are generally involved in the projects you have encountered?

3. Think about a number (2 or more) different projects that have provided challenges. What were their critical dimensions and attributes? (start date, end date, budget, type, team size, customers, sponsor, project manager, finished on-time, on-budget, on scope, outcome/benefits realisation? etc.)

4. Describe the particular challenges that arose in each project: In which phases of the projects did they happen? How did project manager contributed to overcome them? What would you expect him/her do differently?

5. How do you think project managers may benefit from the formal project management processes and tools in your organisation?

Confidentiality is assured as part of the research study, and clearly mentioned in the consent form attached below. Any company, groups, or individual specific data and information is not presented in any research outcome.

You need to sign the attached consent form.

<<consent_letter_interview.doc>>

Thanks,

Mustafa Kosaroglu

Consent form for the interview – Investigator's copy

Name of Project: Project Manager Skill Sets in the Telecommunications Industry

You are invited to participate in a study of skills of new product development project managers in the telecommunications industry. The purpose of the study is to investigate required skills that they need to have in today's changing business environment in the industry.

The study is being conducted by Mustafa Kosaroglu to meet the requirements for the degree of Doctorate of Business Administration under the supervision of Robert Alan Hunt, Macquarie Graduate School of Management. They are reachable with the phone numbers 0422 342 401 for Mustafa Kosaroglu and 9850 9627 for Robert Hunt.

If you decide to participate, you will be asked to participate in an interview which is expected to last between 1 and 2 hours. The participation is voluntary. If you permit, the interview will be recorded on an audio recorder. The interview scripts will be provided to you later, you can omit or add sections for a final form. Then, all individual participant references on the transcripts will be removed.

Any information or personal details gathered in the course of the study are confidential. No individual will be identified at any stage of data processing and publication of the results. Only the researcher Mustafa Kosaroglu will have access to the data you provided.

You are free to withdraw from further participation in the research at any time without having to give a reason and without consequence.

The researcher is pleased to share his research artifacts with you. The researcher will send them (e.g. conference or other publications, or summary sections of the thesis) to the e-mail address that you are requested to indicate below.

I, *(participant's name)* _____ have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

I would like to receive the research artifacts: YES ☐ e-mail: _____
                                                    NO ☐

Participant's Name:
(block letters)

Participant's Signature: _____   Date:

Investigator's Name:
(block letters)

Investigator's Signature: _____   Date:

The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research). If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Ethics Review Committee through its Secretary (telephone 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(INVESTIGATOR'S COPY)

Consent form for the interview – Participant's copy

Name of Project: Project Manager Skill Sets in the Telecommunications Industry

You are invited to participate in a study of skills of new product development project managers in the telecommunications industry. The purpose of the study is to investigate required skills that they need to have in today's changing business environment in the industry.

The study is being conducted by Mustafa Kosaroglu to meet the requirements for the degree of Doctorate of Business Administration under the supervision of Robert Alan Hunt, Macquarie Graduate School of Management. They are reachable with the phone numbers 0422 342 401 for Mustafa Kosaroglu and 9850 9627 for Robert Hunt.

If you decide to participate, you will be asked to participate an interview which is expected to last between 1 and 2 hours. The participation is voluntary. If you permit, the interview will be recorded on an audio recorder. The interview scripts will be provided to you later, you can omit or add sections for a final form. Then, all individual participant references on the transcripts will be removed.

Any information or personal details gathered in the course of the study are confidential. No individual will be identified at any stage of data processing and publication of the results. Only the researcher Mustafa Kosaroglu will have access to the data you provided.

You are free to withdraw from further participation in the research at any time without having to give a reason and without consequence.

The researcher is pleased to share his research artifacts with you. The researcher will send them (e.g. conference or other publications, or summary sections of the thesis) to the e-mail address that you are requested to indicate below.

I, *(participant's name)*   have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

I would like to receive the research artifacts: YES ☐ e-mail: _____
                                                    NO ☐

Participant's Name:
(block letters)

Participant's Signature: _____ Date:

Investigator's Name:
(block letters)

Investigator's Signature: _____ Date:

The ethical aspects of this study have been approved by the Macquarie University Ethics Review Committee (Human Research). If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Ethics Review Committee through its Secretary (telephone 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT'S COPY)

APPENDIX C: INTERVIEW PROTOCOL

Preparation (before the interview): Contact a participant candidate by phone or e-mail. Mention what kinds of questions they are expected to answer

Introduction:
- Introducing the researcher.
- Explaining the research subject and what is aimed with this interview.
- Ask the participant if he/she has any questions about the research.

Obtain the consent form:
- Emphasise the participant that confidentiality is assured.
- Get the consent form. If not signed yet, the researcher and the participant sign the consent forms and exchange their copies.

Participant's attributes:
- No of years of industrial experience.
- No of years of experience in the telecommunications industry.
- Current and other roles held in the past.
- Qualifications and certifications
- Education
- Any project management experience. If so, how many years

Naming sample projects:
- Identify a number (two or more) of projects that had challenges.
- What are their attributes *(Note the following for each project)*
  - Project name? *(Participant may not name, if he/she does not want)*
  - What type of product it developed?
  - What was his/her role in the project?
  - Team size?
  - Who were the stakeholders?
  - Start and end dates; project duration?
  - Did it finish in time and budget?
  - Did it satisfy the original scope?
  - Did it meet the expectations in the market?

Examining sample project:
- Go through each project sample project one by one, and explore its challenges with open ended questions. There are no specific defined questions in this part; depending on the participant's responses, they are chosen to reveal the maximum information for a project. The typical initial questions can be as follows, but not limited to them.
  - Describe the particular challenges that arose in each project.
  - In which phases of the project did they happen?
  - Why did this happen? Anything missed in the plans?
  - How did you (or the project manager) overcome them?
  - *If participant is a project manager:* What would you do differently?
  - *If not a project manager:* What would you expect project manager do differently?
  - *Follow up questions: Why do you think….? How did it impact….? etc…*

Examining organisational settings / differences:
- What kind of project management tools were used? Did they suffice?
- Are there any company wide project management processes and tools?
- Can you describe the processes and tools at a high level?
- How do you use them?
- How do you define the new product development projects? Can you give examples? How do you differentiate them?

- — *If participant worked in more than one company:* Can you see any differences between the companies you worked for? If so, what are they? Do you describe how it impacted project management?
- — *Follow up questions: Why do you think….? How did it change…? etc.*
- — How do you think the projects can be managed better?

Generalisations over the projects and project managers:
- — Consider the projects you gave as examples: Can you tell what are common among them?
- — Do they have similar challenges? Can you explain what they are?
- — *If participant is a project manager:* Have you addressed them the same way, or changed depending on the circumstances? Explain.
- — *If participant is not a project manager:* How do you think the project manager addressed them? In other projects, do you think project managers do similar things? Explain
- — *If participant worked in more than company:* Do you think that the companies you worked for have the similar challenges? If so, do you think that project managers do the same to address them?
- — Can you describe what makes a project manager successful in new product development projects?
- — What are the skills should the project manager have? Explain.
- — *Follow up questions: why do you think they differ…? How do you think they should…? etc.*

Seeking additional information / feedback:
- — Do you think the researcher has covered the new product development projects and their managers?
- — What else do you think that needs to be covered in this interview?
- — Do have any further comments?

Closure:
- — The participant will receive his/her interview transcripts to make any changes: if correct information is given; add or modify to produce the exact meaning; or remove if it is confidential.
- — The participant can contact the researcher, if he feels to add something that was not mentioned during the interview.
- — The participant will receive the outcomes in summary at the end of the research.
- — Thanking the participant for his contribution to the research.

APPENDIX D:

DATA ANALYSIS, PROCESSING and REPORTING: AN EXAMPLE

The material presented in Chapter 4 is the result of a data analysis, processing and report development that were revised and refined for seven months from April 2007. Chapter 3 explains the methods and techniques employed to produce generalisations in case study with multiple cases. Space limitations permitted only selected evidence to be presented, such as the most striking or pertinent interview excerpts or notes that would convey a generalisable result objectively and also coherently with the narrative (Yin 2003a). Chapter 4, which presents only a summary of closely related data and selected quotes from different participants across cases, does not fully exhibit all steps undertaken during development of the final report. This Appendix selects one of the research outcomes, and briefly shows the steps the researcher took to produce the analysis report.

The example used here is leadership in NPD projects (presented in Section 5.2, Chapter 4). Briefly, Telco NPD projects have no leader−follower relationship between a project manager and team members; the project managers are interested in getting the work done, not in developing a caring relationship to help the members to develop professionally and personally beyond the scope of the project.

STEP 1: Analysing raw research data. As an example, the following excerpt is taken from page 24 of the interview transcript of participant 17. The researcher (i.e. investigator) is proposing opposing arguments to obtain clear unambiguous statements from the participant. The reference numbers for the mapping matrix, the next step, are indicated in bold in parentheses.

> *Participant: Project manager can be a leader, but he does not want, assume a leadership role.* *(134)*
>
> *Investigator: Yes, but the thing is with the leadership roles, you do not have authority [over] anyone?*
>
> *Participant: That's why I am saying that. It is a...When you try to take all the leadership role, it is becoming like a line manager... (135)*

Investigator: You are becoming a line manager...

Participant: But, line manager is different compared to the project manager role, in the sense, they are in charge of day-to-day function, where you are looking at...delivering a piece. **(136)**

Investigator: Yes, in terms of the leadership. With the leadership, there is a leader follower relation. But, as a project manager, your duty is to get the job done?

Participant: That's it. And, basically, even to the negotiation and persuasion, you do not have the upper level, in the sense you are basically trying to get their acceptance and willingness to work for you. That creates more [of a] problem. **(137)**

Investigator: Very good point.

Participant: You need to be basically, not other leadership, you cannot only say work to be done, but you need to be a good listener, at the same time, you need to play in such a way, you get maximum concession out of it.

Investigator: Can I say that you need to be a good influencer?

Participant: You could be a good influencer, yes, yes. **(138)**

STEP 2: Filling mapping matrix with references to the original data. The short summary of the phrases and comments that help the researcher to interpret a participant's statements better, and their reference numbers back to original data in the interview transcripts, are recorded in the mapping matrix. The section for the excerpt in step 1 above is presented in Table D.1.

SKILL SET	SKILL	PROJECT CHARACTERISTICS	PHASE	SUMMARY OF THE PHRASE	COMMENT (WHY/HOW)	REFERENCE NO
Leadership	Influencing			Project manager's leadership is different. They do not assume a leader position.	He does not think project manager role as a leadership position. Explaining why from 135 to 138 below.	134
Leadership	Influencing			If leader role is assumed, it is more like a line manager role; different leadership		135
Leadership	Influencing			Project managers focus is to deliver a product, perform its day-to-day activities to reach this goal.		136
Leadership	Influencing, negotiation, persuasion			No formal authority over anyone. You try to get their willingness to work with you.		137
Leadership	Influencing			Proj manager can be a good influencer only		138

Table D.1.   Section of the sample mapping matrix for the selected research outcome from participant 17

STEP 3: Aggregate all research outcomes and check if the findings are consistent across participants and cases, i.e. triangulation of the data. All relevant data and reference numbers from different participants' mapping matrices are aggregated. Table D.2 below shows all evidence that supports the research outcome. The sample mapping matrix for participant 17 in step 3 is indicated with shaded cells.

PARTICIPANT	SKILL SET	SKILL	PROJECT CHARACTERISTICS	PHASE	SUMMARY OF THE PHRASE	COMMENT (WHY/HOW)	REFERENCE NO
1	Leadership	Influencing			Project manager is not a line (functional) manager	A clear differentiation between project manager and line managers. They clearly separate the environments; projects are short term, temporary settings.	75
2	Leadership	Direction setting			Project manager drives the projects.		82
3	Leadership	Direction setting			A credible project manager is the one who fulfils his promises and delivers projects in time.		68
4	Leadership				Project manager's prime role is to get the job done.		78
5	Leadership	Communications	Large and complex		Framing a requirement, so that it is clear and easy to explain	He communicates one of the leadership skills, so they can do their job better; ultimately delivering a project faster	49
8	Leadership	Influencing			He wishes to work with anyone and make them part of a team. But sometimes it does not work.		37
8	Leadership	Influencing, Communications, Direction setting			It is better to say 'it is not working'. Your energy should focus on delivery, not on people.	He is always after getting the work done.	38
9	Leadership	Direction setting			Project managers should target delivering on time.		46
10	Leadership	Influencing	Large and complex	DIV	Project manager focused on schedule and budgets and could not deliver in time, rather than influencing stakeholders to get work done.		32
11	Leadership	Influencing, Direction setting			Project manager has to ensure that a task is done on time.		63
12	Leadership	Marketing			Project manager should sell the project to get the support and deliver a quick result.		77
13	Leadership	Listening			Understand people's environment and feel sympathy to get results from them		85

Table D.2. (a) First section of aggregated mapping matrix for the evidence that leadership skills are needed to get the work done

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Appendix D (continued)

PARTICIPANT	SKILL SET	SKILL	PROJECT CHARACTERISTICS	PHASE	SUMMARY OF THE PHRASE	COMMENT (WHY/HOW)	REFERENCE NO
13	Leadership	Influencing			Try to make their jobs easier, then they will work for your goals.	Influence to get results.	86
14	Leadership	Direction setting			Project manager comes with a single focus: the project to deliver a new product in time.		90
14	Leadership	Influencing			Like mentoring people to get results.		91
15	Leadership	Influencing, people management			Project managers should have good leadership skills, but they are not as important as the whole project. Influence people to contribute to a project's vision.		45
16	Leadership	Influencing, Direction setting			Project managers should be leaders, provide direction and influence stakeholders to get results.		101
17	Leadership	Influencing			Project manager's leadership is different. They do not assume a leader position.	He does not think project manager role as a leadership position. Explaining why from 135 to 138 below.	134
17	Leadership	Influencing			If leader role is assumed, it is more like a line manager role; different leadership		135
17	Leadership	Influencing			Project manager's focus is to deliver a product, perform its day-to-day activities to reach this goal.		136
17	Leadership	Influencing, negotiation, persuasion			No formal authority over anyone. You try to get their willingness to work with you.		137
17	Leadership	Influencing			Proj manager can be a good influencer only		138

Table D.2. (b) Second section of aggregated mapping matrix for the evidence that leadership skills are needed to get the work done

Appendix D (continued)

PARTICIPANT	SKILL SET	SKILL	PROJECT CHARACTERISTICS	PHASE	SUMMARY OF THE PHRASE	COMMENT (WHY/HOW)	REFERENCE NO
18	Leadership	Influencing			Project manager should have push backed, then asked what impacts the delivery date, and why it cannot be delivered on time.		16
19	Leadership	Influencing, Direction setting			Leadership only to get the work done		91
19	Leadership	Influencing, negotiation, persuasion			Provide direction in a consultative way. Time is valuable: discuss enough and make a decision to progress.		93
20	Leadership	Networking			Project managers need to build relationships to influence people and get results; they do not have direct authority.	The ultimate goal is the project work, not a leader-follower relationship.	67
20	Leadership	Influencing			Getting results without having formal authority over anyone.		68
20	Leadership	Influencing			Make the people important and valued, part of something interesting to get results. It is win/win.		69
20	Leadership	Direction setting			He tried to work with influencing, but later fired team members, since they did not deliver results.		70
21	Leadership	Direction setting	Large and complex	II, F&D	Project manager was given responsibility to deliver a critical consumer product in time.		47
22	Leadership	Influencing			Leadership skills are essential to lead a group of people and to get results.		68
22	Leadership	Influencing, Direction setting			Influencing people is quite important. First manage people, then manage tasks.		69

Table D.2. (c) Third section of aggregated mapping matrix for the evidence that leadership skills are needed to get the work done

STEP 4: Drafting analysis report. The initial draft of the analysis chapter, Chapter 4, incorporating all the evidence for the empirical findings referred in the aggregated mapping matrix, was over 250 pages. Useful excerpts that could be used in the analysis report were directly taken from interview transcripts, after omitting the researcher's statements. The reference numbers from the mapping matrix were also removed. Initially, there was little narrative; just short sentences describing what the evidence was about.

The following presents the first draft version of the part in Section 5.2 in Chapter 4. The first excerpt below is the one produced from step 1 above about project leaders' aim with leadership skills is to get the project work done:

(Start of the first draft of the sample part in the analysis chapter)

Leadership is generally associated with teams, in our case NPD project teams. All participants mentioned the people management aspects, but with a purpose of getting the project work done.

> *"Project manager can be a leader, but he does not want, assume a leadership role. That's why I am saying that. It is a...When you try to take all the leadership role, it is becoming like a line manager.. But, [the] line manager is different [from] the project manager role, in the sense, they are in charge of day-to-day function, where you are looking at...delivering a piece. That's it. And, basically, even to the negotiation and persuasion, you do not have the upper level, in the sense, you are basically the trying to get their acceptance, and willingness to work for you. That creates more [of a] problem. You need to be basically, not other leadership, you cannot only say [there's] work to be done, but you need to be a good listener; at the same time, you need to play [it] in such a way, you get maximum concession out of it. You could be a good influencer, yes, yes." (Participant 17; page 24)*

> *"When you work with people, they have their issues [they are] trying to deal with. They may have conflict of work they are trying to deal with. They may have personal issues that may be affecting your project. You need to be able to talk to each person and counsel each person. You know, one-on-one situation. You just need to be honest and trying to talk with these people, ultimately you need to get the job done." (Participant 1; page 10)*

> *"Typically, the people on the team, they may have worked with each other personally before. But they know they worked with the person, their group. And, they have expectations, and you need to understand those to make sure that our role achieves our goals." (Participant 4; page 14)*

"Understanding what their issues are, framing a requirement in such a way that they can more easily understand it, stuff like that. A lot of communication skills you need" (Participant 6; page12)

"You should also look, what [it] is they do and the environment they are working and have some sympathy for the difficulties they have. You should also take into account that in getting it through, if you can do in a way that makes their jobs easier, they are going to like you for it. And, they are going to be cooperative. At the end of the day, you are responsible for the delivery." (Participant 13; page 22)

"The question is not about, should it be project and program managers? It is recognised as a necessity, full stop. And the reason is because in most of the businesses a person has [a] multitude of functions, and gets drawn into doing many of those, and it is fleeting. Project manager comes with a focus on one. That's what it is all about. If people only had one thing to do, then they would deliver it. When they have time pressures doing [a] multitude [of] things, conflicts, they do not know how to assign and do things. That's why [the] program manager or project manager is there. They focus. Here is the next thing I want from you. Here is your deliverable. They provide…almost like a mentoring [for] all those people. So, all those people did what they need to do, on time, and to the quality and the cost. Directing as a leader of those people, getting direction, how they go for it. That's why. It is sort of a leader to make sure everyone is focused and delivering what is needed." (Participant 14; page 20)

"Here we are, it is that way. I mean, I do not know if...I mean, you have to be that way, even you are just a program manager or whatever. In a way, you need to push the direction of 'this is where the project is going', and to achieve the milestones and whatever. And sometimes when you see that they are not sure about this and that, you need to ask for a decision, or something, you do have to lead in a certain direction, you cannot...but you have to...Leadership as a direction setting, but in a consultative way. You have to discuss a bit more and [get] more opinions. And then, make an informed decision. But, you have to be strong, if required: OK, we talked enough, now let's get something going. People need a direction." (Participant 19; page 20)

"That's the only thing project manager is given as...not given authority. The rest is left [to] the project manager. That's the skill of the project manager for building relationships, understand[ing] how to communicate with other parties, and build the...Having the right skills to get the job done. Because you need some influencing skills. To become a leader without formal authority, that's the key thing. It is usually built by listening to people, making them feel important. You have relationship, you can take them to coffee, ask them to help you. They consider they are part of something. Try to market the project itself, how valuable this is, and therefore they are part of something interesting. This will be big, and good for their career. So, you know, looking from the win/win, you can do as a leader. I fired a business analyst in [company A]. I fired two project managers, and several people who do not perform. There is [a] certain process. I take the person, have a discussion, talk to his line manager. If nothing happens, that's it you know. The interest is the project, it rules.

When the priority comes, [the] project comes first. Even I have to remove myself. Or, if I realise that the project will not realise the benefits, or it is flawed. On the [project review board] group, recommendation will be [made], for this to be re-considered, or kill the project, because of this politics. OK, we can kill, and we have killed one of the projects." (Participant 20; page 17)

"If you do not have leadership, you cannot lead. You have got to lead a group of people to get somewhere. You really need to. You cannot be only a task manager, you also need to be a people manager. It depends on which level. The influence can be quite important, you have to." (Participant 22; page13)

Project sponsors similarly expect the project managers to have good people and communication skills to relate to their team members. They see leadership to get the project team around the project manager with the purpose of delivering results, and value it close to managerial skills.

"I expect to have good leadership skills, and a project manager within it is important, but not as important if they are not managing the whole project. But it is still important that they have those skills, because they are...they have to be able to get their technical team, to work with them, to deliver stuff, and to have good open communications, so that you get the best results possible. And, if you do not have those skills, if you do not have those communication skills, those people skills, you are not going to be a very good leader. Or your team, technical team, are not really going to be giving you what you need. You need to influence the people to contribute the project's vision." (Participant 15; page 10)

"They should be a leader, [for] the fact that they are accountable to drive the delivery of the program, or body of work. Their role is to guide a project from start to finish. And so, from the leadership perspective, they have to provide direction, where core team members are not clear about an activity, or the work. And, they are suffering from resource constraints, whatever they [do] to assist in resolving those, or flagging there are constraints, or delay in delivery. So, from that perspective, project manager is a leadership role, because they are the driving force between success and failure." (Participant 16; page 19)

(End of the first draft of the sample part in the analysis chapter)

STEP 5: Revising and refining the analysis report. With this step, the researcher had reviewed and refined the analysis chapter iteratively many times, by combining closely related parts, separating long explanations that have different subjects into more meaningful shorter segments, and changing the headings and sections so the reporting structure was consistent with other parts of dissertation. Long excerpts were shortened until they contain the key vital messages without altering the original statements of the participants. Excerpts containing repetitive content were eliminated, keeping those that

best conveyed the intended message and maintained a good flow to the narrative. However, this operation sometimes left phrases or sentences disrupted or disjointed. The researcher intervened only to keep the evidence intact, and produce coherent transitions between sentences, not changing the content or level of the emphasis. At the end of several revisions, the resulting analysis chapter (or report) was concise and precise, but also contains sufficient evidence to indicate triangulation of data from participants and across cases. Finally, the participants' roles, cases and project references, if any, were added between the parentheses at the end of an excerpt.

For the selected outcome in this Appendix, the two perspectives – one from project managers, their managers and program managers, and another from project sponsors – were combined into a single part. Only five of the excerpts, shortened by removing repetition, have been provided as evidence at the beginning of Section 5.2 in the analysis chapter as below:

(Start of the final version of the sample part in the analysis chapter)

Leadership is generally associated with teams. Project managers wanted to know their team members' concerns, conflicts and motives; however, they were more interested in getting the job done. Other project stakeholders expected project managers to set the direction for the project, and to influence the team members to co-operate. The conventional leader–follower relationship, which is more associated with helping individuals to excel personally and professionally, does not hold for project managers. Project managers did not have any intention to look after the team members, or help them progress in their professions. In many instances, a different kind leadership role has been emphasised.

> *"Project manager can be a leader, but he does not assume a leadership role. Line manager is different [from] the project manager role, in the sense, they are in charge of day-to-day function. Whereas you are looking at delivering a piece. Basically, even with negotiation and persuasion, you are trying to get their acceptance, and willingness to work with for you. You could be a good influencer." (Participant 17; project manager; case 1; interview transcript: page 24)*

> *"They should be a leader, in the fact that they are accountable to drive the delivery of a project. Their role is to guide a project from start to finish. They have to provide direction, where project stakeholders are not clear about the work. So, from that perspective, project manager is a leadership role, because they are the driving force between success and*

failure." (Participant 16; product and project manager; case 1; interview transcript: page 19)

"If you do not have leadership, you cannot lead. You have got to lead a group of people to get somewhere. You cannot be only a task manager, you also need to be a people manager. The influence is quite important." (Participant 22; program manager; cases 1 and 4; interview transcript: page 13)

"His [project manager's] main goal is to get the job done. The interest is the project, it rules. When the priority comes, project comes first." (Participant 20; program manager; cases 1 and 2; interview transcript: page 17)

"In a way, you need to push the direction where the project is going, and to achieve the milestones. Sometimes when you see that they are not sure about this and that, you need to ask for a decision; you do have to lead in a certain direction. Leadership as a direction setting, but in a consultative way. You have to discuss a bit more and more opinions, and then, make an informed decision. But, you have to be strong if required: OK, we talked enough, now let's get something going." (Participant 19; project manager; case 1; interview transcript: page 20)

(End of the final version of the sample part in the analysis chapter)

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APPENDIX E: CIFTER EVALUATION OF SAMPLE TELCO NPD PROJECTS

Cifter Complexity Factor	Participant 1				Participant 2				Participant 3							Participant 4		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**11**	**12**	**13**	**14**	**7**	**15**	**16**
Stability of the overall project context	3	3	3	3	1	3	2	3	3	3	3	3	3	3	1	3	4	1
Number of distinct disciplines, methods, or approaches involved in performing the project	3	3	3	3	1	3	1	3	3	3	4	3	3	3	1	3	4	1
Magnitude of legal, social, or environmental implications from performing the project	2	2	2	2	1	2	1	2	2	2	2	2	2	2	1	2	2	1
Overall expected financial impact (positive or negative) on the project's stakeholders	4	3	3	3	1	4	1	4	4	4	4	4	4	4	2	3	4	2
Strategic importance of the project to the organisation or organisations involved	4	4	4	4	1	4	2	3	4	4	4	4	4	4	3	3	4	1
Stakeholder cohesion regarding the characteristics of the product of the project	3	3	3	3	1	3	1	3	4	3	4	3	3	3	1	3	3	1
Number and variety of interfaces between the project and other organisational entities	3	3	4	3	1	4	1	3	3	3	4	3	3	4	1	3	3	1
CIFTER TOTAL	22	21	22	21	7	23	9	21	23	22	25	22	22	23	10	20	24	8

Notes:
1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

Cifter Complexity Factor	Participant 5			Participant 6				Participant 7				Particip. 8		Participant 9		
	17	18	66	58	72	19	20	21	22	23	24	25	26	27	28	29
Stability of the overall project context	4	3	2	3	3	3	3	2	4	3	4	4	3	4	3	4
Number of distinct disciplines, methods, or approaches involved in performing the project	3	3	1	2	4	4	3	3	3	3	3	4	3	4	3	3
Magnitude of legal, social, or environmental implications from performing the project	2	2	1	2	2	2	2	2	2	2	2	3	2	1	2	2
Overall expected financial impact (positive or negative) on the project's stakeholders	4	3	2	4	3	4	3	4	4	4	3	3	3	3	4	3
Strategic importance of the project to the organisation or organisations involved	4	3	1	3	4	4	3	4	4	3	3	4	3	4	4	3
Stakeholder cohesion regarding the characteristics of the product of the project	3	3	1	3	2	3	3	2	3	3	4	3	3	3	3	3
Number and variety of interfaces between the project and other organisational entities	3	3	2	3	2	3	3	3	3	2	3	4	3	4	3	3
CIFTER TOTAL	23	20	10	20	20	23	20	20	23	20	22	25	20	23	22	21

Notes: 1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

Cifter Complexity Factor	Participant 10			Participant 11				Participant 12				Participant 13					
	30	31	32	31	33	34	35	27	59	60	36	37	38	39	40	41	42
Stability of the overall project context	1	4	3	4	4	4	4	4	3	2	4	3	4	3	3	3	4
Number of distinct disciplines, methods, or approaches involved in performing the project	2	3	3	3	3	4	3	4	3	3	3	3	4	3	3	3	3
Magnitude of legal, social, or environmental implications from performing the project	1	1	2	1	3	1	2	1	4	2	2	2	2	2	2	2	2
Overall expected financial impact (positive or negative) on the project's stakeholders	1	3	3	3	4	3	3	3	4	4	3	3	3	4	3	4	3
Strategic importance of the project to the organisation or organisations involved	2	4	3	4	4	4	3	4	4	3	3	4	4	2	3	4	4
Stakeholder cohesion regarding the characteristics of the product of the project	1	3	3	3	3	3	3	3	2	3	3	3	4	3	3	3	3
Number and variety of interfaces between the project and other organisational entities	1	3	3	3	3	3	3	4	2	3	3	3	4	3	3	3	3
CIFTER TOTAL	9	21	20	21	24	22	21	23	22	20	21	21	25	20	20	22	22

Notes: 1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

Appending E (continued)

Cifter Complexity Factor	Participant 14				Participant 15				Participant 16				Participant 17			
	38	43	61	44	12	36	45	46	36	47	48	49	38	62	50	51
Stability of the overall project context	3	4	2	3	3	4	3	3	4	4	2	1	4	3	4	3
Number of distinct disciplines, methods, or approaches involved in performing the project	4	3	3	3	3	3	3	3	3	4	1	1	4	3	3	3
Magnitude of legal, social, or environmental implications from performing the project	2	2	3	2	2	2	2	1	2	2	1	1	2	1	2	2
Overall expected financial impact (positive or negative) on the project's stakeholders	4	3	4	3	4	3	3	3	3	4	2	1	3	3	4	3
Strategic importance of the project to the organisation or organisations involved	4	4	4	3	4	3	3	3	3	3	1	1	4	4	4	3
Stakeholder cohesion regarding the characteristics of the product of the project	4	4	3	3	3	3	3	4	3	4	1	1	4	3	3	3
Number and variety of interfaces between the project and other organisational entities	4	3	3	3	3	3	3	3	3	4	1	1	4	3	4	3
CIFTER TOTAL	25	23	22	20	22	21	20	20	21	25	9	7	25	20	24	20

Notes: 1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

Cifter Complexity Factor	Participant 18				Participant 19				Participant 20				Participant 21				
	38	44	52	53	44	54	55	56	12	25	63	64	8	67	68	69	70
Stability of the overall project context	4	3	4	2	3	3	3	4	3	4	3	3	3	3	3	3	1
Number of distinct disciplines, methods, or approaches involved in performing the project	4	3	3	4	3	3	3	3	3	4	3	3	3	4	2	3	2
Magnitude of legal, social, or environmental implications from performing the project	2	2	3	2	2	4	2	1	2	3	3	2	2	2	4	2	1
Overall expected financial impact (positive or negative) on the project's stakeholders	4	3	4	3	3	2	3	3	4	3	3	4	4	4	2	3	2
Strategic importance of the project to the organisation or organisations involved	4	3	4	2	3	3	4	3	4	4	3	4	3	4	3	4	1
Stakeholder cohesion regarding the characteristics of the product of the project	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	2	1
Number and variety of interfaces between the project and other organisational entities	4	3	3	3	3	3	3	3	3	4	3	3	3	2	3	3	1
CIFTER TOTAL	25	20	24	19	20	22	21	20	22	25	21	22	21	22	20	20	9

Notes: 1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

Cifter Complexity Factor	Participant 22			Par. 23
	57	71	47	1
Stability of the overall project context	4	3	4	3
Number of distinct disciplines, methods, or approaches involved in performing the project	4	3	4	3
Magnitude of legal, social, or environmental implications from performing the project	3	2	2	2
Overall expected financial impact (positive or negative) on the project's stakeholders	4	4	4	3
Strategic importance of the project to the organisation or organisations involved	4	4	3	3
Stakeholder cohesion regarding the characteristics of the product of the project	3	3	4	3

Cifter Complexity Factor	Participant 22			Par. 23
	57	71	47	1
Number and variety of interfaces between the project and other organisational entities	3	3	4	3
CIFTER TOTAL	25	22	25	20

Notes: 1) Projects are referenced in the same order they appear in Table A.3 in Appendix A.

2) Projects mentioned by different participants are indicated with shaded project no cell.

APPENDIX F:
MAPPING TABLES BETWEEN TELCO NPD PROJECT
MANAGER SKILL SETS, and PMCD and GAPPS
COMPETENCY STANDARDS

For a simple and compact presentation of many elements under units of competencies, the following representation in Table F.1 is adapted below from Tables F.2 to F.8. PMCD (2007) also has two kinds of competencies: performance and personal competencies. The personal units of competencies are indicated accordingly with italics. GAPPS does not have such personal competencies concepts.

SKILL SET – A	
Unit of Competence # 1 (performance)	
Unit of Competence # 1, Element # 1	Unit # 1, Element # 1, Performance criterion 1
	Unit # 1, Element # 1, Performance criterion 2
Unit of Competence # 1, Element # 3	Unit # 1, Element # 2, Performance criterion 1
Unit of Competence # 2 *(personal)*	
Unit of Competence # 2, Element # 1	*Unit # 2, Element # 1, Performance criterion 1*
Unit of Competence # 2, Element # 2	*Unit # 2, Element # 1, Performance criterion 1*
	Unit # 2, Element # 2, Performance criterion 2

Table F.1.   Presentation of units of competencies and elements with performance criteria with activities that require a skill set. PMCD has two kinds of competencies: performance and personal, indicated in parenthesis and italics, respectively

TECHNICAL SKILLS	
Initiating a Project (performance)	
Project aligned with organisational objectives and customer needs	Determines product or service characteristics
Preliminary scope statement reflects stakeholder needs and expectations	Understands the preliminary scope of the project
High-level risks, assumptions and constraints are understood	Establishes the project's high-level assumptions and constraints
Monitoring and Controlling a Project (performance)	
Risk is monitored and controlled	Recognises when unknown risks occur
Closing a Project (performance)	
Project outcomes accepted	Transitions all deliverables to operations
Cognitive Ability *(personal)*	
Takes a holistic view of project	*Understands project stakeholders needs, interests and influence for project success*
Effectively resolves issues and solves problems	*Simplifies complexities for a complete and accurate analysis*
	Aggregates multiple related issues to understand the complete picture
	Observes discrepancies trends, and interrelationships in project data
Effectiveness *(personal)*	
Resolve project problems	*Validates that proposed solutions resolve the problem and are within the project boundaries*

Table F.2. Technical skills versus PMCD units of competencies, their elements and performance criteria

LEADERSHIP SKILLS	
Initiating a Project (performance)	
Project aligned with organisational objectives and customer needs	Achieves agreement on project alignment with project sponsor
	Establishes key stakeholders' needs and expectations
Preliminary scope statement reflects stakeholder needs and expectations	Frames high-level project scope ensuring alignment with organisation and customer needs and expectations.
Stakeholders identified and their needs are understood	Conduct stakeholder analysis to gain buy-in and identify needs for the project
	Identifies high-level communication requirements
Planning a Project (performance)	
Project scope agreed	Obtains agreement for the scope defined by the WBS
Project schedule approved	Obtains approval for the project schedule
	Communicates project schedule with stakeholders
Cost budget approved	Gains approval for the planned project budget
	Communicates project budget to stakeholders
Project team identified with roles and responsibilities agreed	Reaches agreement with the organisation for access to suitable resources
Risk response plan approved	Gains agreement from key stakeholders for the project risk response plan.
Integrated change control process defined	Communicates with with stakeholders on change control process
Procurement plan approved	Obtains plan approval
Project plan approved	Communicates approved plan to key stakeholdes
Executing a Project (performance)	
Project stakeholders' expectations management	Reviews stakeholders' expectations throughout the project to ensure they are being met within the project scope.
	Interacts with stakeholders to ensure support for the project
Monitoring and Controlling a Project (performance)	
Project tracked and status communicated to stakeholders	Communicates status to stakeholders
Project change is managed	Communicates changes to project stakeholders
Closing a Project (performance)	
Project outcomes accepted	Obtained final acceptance
	Transitions all deliverables to operations

Table F.3. Leadership skills versus PMCD units of competencies, their elements and performance criteria

Communicating (personal)	
Actively listens, understands and responds to stakeholders	*Actively listens*
	Understand explicit and implicit content of communication
	Responds to and acts upon expectations, concerns and issues
Maintains lines of communications	*Engage stakeholders proactively*
	Disseminates information effectively
	Maintains formal and informal communication
Ensures quality of information	*Provides accurate and factual information*
	Seeks validation of information
Tailors communication to audience	*Provides relevant information*
	Uses suitable communication method for the audience
	Aligns communication with environment and setting
Leading (personal)	
Creates a team environment that promotes high performance	*Expresses positive expectations of team*
	Encourages teamwork consistently
	Demands and models high performance
Builds and maintains effective relationship	*Confines relationships to work-related matters appropriate to the project and local culture*
	Builds trust and confidence with stakeholders
	Creates an environment that encourages openness, respect and consideration of stakeholders
Motivates and mentors project team members	*Establishes and communicates to the team the project vision, mission statement, and strategic value*
	Rewards performance according to organisation guidelines
Takes accountability for delivering the project	*Demonstrates ownership of, accountability for, and commitment to the project.*
	Aligns personal activities and priorities toward increasing likelihood of achieving project goals.
	Supports and promotes team's actions and decisions
Uses influencing skill when required	*Applies appropriate influencing technique to each stakeholder*
	Uses experts and third parties to persuade others
Managing (personal)	
Builds and maintains the project team	*Ensures expectations and responsibilities are clear to team members and they understand their importance to the project*
	Maintains a positive attitude and effective relationships among team members.
Plans and manages for project success in an organised manner	*Works with others to clearly identify project scope, roles, expectations and tasks specifications*
	Organises project information, emphasising appropriate levels of details

Table F.3 (continued)

Managing (personal)	
Resolves conflict involving project team and stakeholders	*Recognises conflicts*
	Resolves conflicts
Cognitive Ability (personal)	
Takes a holistic view of project	*Understands project stakeholders needs, interests and influence for project success*
	Uses emotional intelligence to understand and explain others' past actions and current attitudes, and anticipate future behaviour
Effectively resolves issues and solves problems	*Simplifies complexities for a complete and accurate analysis*
	Aggregates multiple related issues to understand the complete picture
Seeks opportunities to improve project outcome	*Looks for opportunities to improve project value or execution*
	Seizes relevant opportunities as they emerge
	Consolidates opportunities and passes them to the organisation
Effectiveness (personal)	
Resolve project problems	*Employs appropriate problem solving techniques*
	Validates that proposed solutions resolve the problem and are within the project boundaries
	Chooses solutions that maximize project benefit and minimise negative impacts
Maintains project stakeholder involvement, motivation and support	*Uses stakeholder communication to maintain stakeholder motivation*
	Constantly seeks opportunities to communicate project status and directions to meet the needs and expectations of stakeholders
	Includes experts in meetings and discussions to influence and obtain stakeholder support
	Uses objectivity for consensus building
Changes at the required pace to meet project needs	*Adapts to changes in the project environment to minimise adverse project impacts*
	Demonstrates flexibility towards changes that benefit the project
	Takes positive actions to capitalise on opportunities or to resolve present problems
	Enables a change-friendly environment by fostering continuous learning
	Act as a change agent (Note: for project work only)
Uses assertiveness when necessary	*Takes initiative when required, assuming calculated risks to expedite project delivery*
	Prevents inconclusive discussion, makes a discussion, and takes appropriate action
	Shows persistence and consistency in actions.

Table F.3 (continued)

Professionalism (personal)		
Demonstrates commitment to the project	*Understands and actively supports the project's and organisation's mission and goals*	
	Cooperates with all stakeholders to achieve project objectives	
	Makes sacrifices where necessary to move the project forward	
Operates with integrity	*Seeks to avoid and discloses any possible conflict of interests to all stakeholders*	
	Maintains and respects confidentiality to sensitive information	
Handles personal ad team adversity in suitable manner	*Maintains self-control in all situations and responds calmly*	
	Admits shortcomings and explicitly accepts responsibility for failures	
	Learns from mistakes to improve future performance	
Manages a diverse workforce	*Develops elements of trust and respect within the project environment*	
	Ensures team's adherence to cultural issues, legal requirements and ethical values	
	Respects personal, ethnic and cultural differences	
	Creates an environment of confidence and respect for individual differences	
Resolves individual and organisational issues with objectivity	*Balances individual interest with organisational interest*	

Table F.3 (continued)

MANAGERIAL SKILLS	
Initiating a Project (performance)	
Project aligned with organisational objectives and customer needs	Understands the project alignment
Preliminary scope statement reflects stakeholder needs and expectations	Selects and uses a suitable project management methodology and process
	Frames high-level project scope ensuring alignment with organisation and customer needs and expectations
High-level risks, assumptions and constraints are understood	Establishes the project's high-level assumptions and constraints
	Identifies, qualifies and quantifies the project's high-level risks
Stakeholders identified and their needs are understood	Identifies project stakeholders
Project charter approved	Develops a high-level project strategy
	Establishes the project's key milestones and deliverables
	Develops summary budget
	Supports the charter preparation
Planning a Project (performance)	
Project scope agreed	Defines project deliverables using a work breakdown structure (WBS)
	Implements scope management
Project schedule approved	Defines activities and dependencies to deliver approved scope
	Estimates time for completion of each activity
	Identifies internal and external dependencies
	Schedules project activities against resource commitments
Cost budget approved	Estimates costs for each activity
	Estimates all other project costs
	Develops the project budget
	Develops cost management plan
Project team identified with roles and responsibilities agreed	Identifies specific resources
	Defines roles and responsibilities
	Plans resource ramp up and team building (Note: no evidence for team building)
Communication activities agreed	Builds a project communication plan
	Selects suitable tools and methods to communicate with identified stakeholders
	Selects activities to address the communication plan

Table F.4. Managerial skills versus PMCD units of competencies, their elements and performance criteria

Planning a Project (performance)	
Quality Management process established	Establishes quality standards to be used within the project that aligns with organisational quality policies
	Defines processes to be used to deliver the project deliverables
	Develops a project quality management plan.
Risk response plan approved	Develops project risk management plan
	Identifies and quantifies majjor risks
	Leads / delegates the effort to find response strategies for each identified risk.
	Estimates risk contingency costs
	Assigns risks responsibility
Integrated change control process defined	Leads/delegates the effort to establish a change control process
	Involves stakeholders in generating change control plan
	Ensures the use of a change control processes and procedures
Procurement plan approved	Analyses material requirements
	Plans purchases and acquisitions
	Plans external labor procurement
	Plans contract administration
Project plan approved	Integrates the planning activities into a complete project management plan
	Establishes project baselines
	Conducts kick-off meeting
Executing a Project (performance)	
Project scope achieved	Verifies task completion as defined in the project plan
	Closes identified performance gaps
	Executes risk management
	Manages phase transitions
Human resources managed	Acquires human resources per staff management plan
	Builds project team
Quality managed against plan	Executes quality assurance activities
	Ensures compliance with quality standards and processes
Material resources managed	Requests seller information
	Selects suitable sellers
	Executes procurement tasks against schedule commitment
	Acquires internally supplied resources

Table F.4 (continued)

Monitoring and Controlling a Project (performance)	
Project tracked and status communicated to stakeholders	Executes the process for capturing project information
	Ensures action plans are put in place to address any variations to plan
Project change is managed	Identifies changes to baseline project plans
	Identifies the impact of the changes to the project plan
	Follows the change management process to manage and record changes
	Execute configuration management process
Quality is controlled and monitored	Records acceptance of completed deliverables
	Monitors deviation from project baselines
	Recommends corrective and preventive actions
Risk is monitored and controlled	Updates risk response plan
	Recognises when unknown risks occur
	Establishes workarounds for previously unknown risks
	Recognises new risk
	Review risk response strategies
Project team managed	Holds regular team meetings
	Provides feedback on team and individual team performance
Contracts administred	Ensures seller contracts are effectively managed
Closing a Project (performance)	
Project outcomes accepted	Obtains final acceptance
	Meets all contractual requirements, when required
Project resources released	Executes the organisational processes for releasing project resources
	Provides performance feedback to project team members
	Provides feedback to the organisation regarding team members' performance
Stakeholder perceptions measured and analysed	Survey project stakeholders
	Analyses results of feedback
Cognitive Ability *(personal)*	
Effectively resolves issues and solves problems	*Applies lessons learned to resolve current project issues*
	Aggregates multiple related issues to understand the complete picture
	Observes discrepancies trends, and interrelationships in project data
Uses appropriate project management tools and techniques	*Understands PM tools and techniques*
	Selects appropriate tools and/or techniques
	Applies selected tools and/or techniques to project management
Seeks opportunities to improve project outcome	*Provides a framework to address opportunities and concerns*

Table F.4 (continued)

Effectiveness *(personal)*	
Uses assertiveness when necessary	*Makes timely decisions based on facts while managing ambiguity*
Professionalism *(personal)*	
Resolves individual and organisational issues with objectivity	*Assigns team members in an unbiased way to appropriate tasks*

Table F.4 (continued)

ADMINISTRATIVE SKILLS	
Initiating a Project (performance)	
Project charter approved	Uses governance process to obtain sponsor approval and commitment
Planning a Project (performance)	
Communication activities agreed	Selects suitable tools and methods to communicate with identified stakeholders
Risk response plan approved	Documents risk response plan
Project plan approved	Reviews organisational process assets
	Reviews enterprise environmental factors
	Integrates the planning activities into a complete project management plan
	Seeks approval by key stakeholders
Executing a Project (performance)	
Project scope achieved	Manages phase transitions
Human resources managed	Builds project team
Monitoring and Controlling a Project (performance)	
Quality is monitored and controlled	Facilitates audits
Risk is monitored and controlled	Facilitates audits
Contracts administred	Facilitates audits
Closing a Project (performance)	
Project resources released	Executes the organisational processes for releasing project resources
Project formally closed	Executes closure activities for the project
	Closes all financial activities associated with project
	Notifies stakeholders formally of project closure
	Closes all project contracts
Communicating (personal)	
Ensures quality of information	*Uses appropriate information sources*
Leading (personal)	
Builds and maintains effective relationships	*Confines relationships to work-related matters appropriate to the project and local culture*
Managing (personal)	
Plans and manages for project success in an organised manner	*Applies organisation or industry standards and generally accepted practices to the project*
	Tailors generally accepted practices for successful completion of the project
Resolves conflict involving project team or stakeholders	*Ensures that the team and stakeholders are fully aware of team rules.*

Table F.5.   Administrative skills versus PMCD units of competencies, their elements and performance criteria

Cognitive Ability (personal)		
Takes a holistic view of project	*Understands how project actions impact other areas of the project, other projects and organisational environment*	
	Understands both the formal and informal structure of organisation	
	Understands organisational politics	
Effectively resolves issues and solves problems	*Applies complex concepts or tools, when needed*	
	Observes discrepancies trends, and interrelationships in project data	
Uses appropriate project management tools and techniques	*Understands PM tools and techniques*	
	Selects appropriate tools and/or techniques	
	Applies selected tools and/or techniques to project management	
Seeks opportunities to improve project outcome	*Provides a framework to address opportunities and concerns*	
Professionalism *(personal)*		
Operates with integrity	*Adheres to all legal requirements*	
	Works within a recognised ethical standards	
	Respects the intellectual property of others	
Manages a diverse workforce	*Ensures team's adherence to cultural issues, legal requirements and ethical values*	
Resolves individual and organisational issues with objectivity	*Respects the organisational framework for running projects*	

Table F.5 (continued)

MANAGERIAL SKILLS	
Manage Stakeholder Relationships	
Ensure that stakeholder interests are identified and addressed	Relevant stakeholders are determined
	Stakeholder interests are investigated and documented
	Stakeholder interests are considered when making
	Actions to address differing interests are implemented
Promote effective individual and team performance	Individual project roles are defined, documented, communicated, assigned and agreed to
	Individual and team performance is monitored and feedback provided
Manage stakeholder communications	Communication method, content and timing is agreed to by relevant stakeholders
	Information is communicated as planned, variances are identified and addressed.
Facilitate external stakeholder participation	External stakeholder participation is planned, documented and communicated
	External stakeholder participation is supported as planned, and variances are addresed.
Manage Development of the Plan for the Project	
Define the work of the project	A shared understanding of desired project outcomes is agreed to with relevant stakeholders
	Processes and procedures to support the management of the project are identified, documented, and communicated to relevant stakeholders
	Work items required to accomplish the product of the project are determined
	The work-items and completion criteria are agreed to by relevant stakeholders
	Assumptions, constraints and exclusions are identified and documented
Ensure the plan for the project reflects relevant legal requirements	Relevant legal requirements are identified, documented and communicated to relevant stakeholders
	Potential for conflicts caused by legal requirements are identified and addressed in the plan for the project
Document risks and risk responses for the project	Risks are identified in consultation with relevant stakeholders
	Risk analysis techniques are used to evaluate risks and then prioritise them for further analysis and response planning
	Responses to risks are identified and agreed to by relevant stakeholders
Confirm project success	Measurable project success criteria are identified and documented
	Project success criteria are agreed to by relevant stakeholders

Table F.6. Managerial skills versus GAPPS units of competencies, their elements and performance criteria

Manage Development of the Plan for the Project	
Develop and integrate project baselines	Resource requirements are determined
	Schedule is developed based on resource requirements, resource availability, and required sequence of work items
	Budget is developed based on resource requirements
	Conflicts and inconsistencies in the plan for the project are addressed
	The plan for the project is approved by authorised stakeholders and communicated to relevant stakeholders
Manage Project Progress	
Monitor, evaluate and control project performance	Performance of the project is measured, recorded, evaluated and reported against the project baselines
	Processes and procedures ae monitored and variances addressed
	Completed work-items are reviewed to ensure that agreed completion criteria were met
	Corrective action is taken as needed in support of meeting project success criteria
Monitor risks to the project	Identified risks are monitored
	Changes to the external environment observed for impact to the project
	Applicable legal requirements are monitored for breaches and conflicts
	Actions are taken as needed
Manage Product Acceptance	
Ensure that the product of the project is identified	Desired characteristics of the product of the project are identified in consultation with relevant stakeholders
	Characteristics of the project are documented and agreed to by relevant stakeholders
Ensures that changes to the product of the project are monitored and controlled	Variances from agreed product characteristics are identified and addressed.
	Requests for changes to the product of the project are documented, evaluated, and addressed in accordance with the change control processes for the project
	Approved product changes are implemented.
Secure acceptance of the product of the project	The product of the project is evaluated against the latest agreed characteristics and variances addressed where necessary
	The product of the project is transferred to identified stakeholders and accepted

Table F.6 (continued)

Manage Project Transitions	
Manage project start-up	Authorisation to expend resources is obtained from the appropriate stakeholders
	Start-up activities are planned and conducted
Manage transition between project phases	Acceptance of the outputs of a prior phase is obtained from the relevant stakeholders
	Authorisation to begin work on a subsequent phase is obtained from the stakeholders
	Transition activities are planned and conducted
Manage project closure	Closure activities are planned and conducted
	Project records are finalised, signed off and stored in compliance with processes and procedures
Evaluate and Improve Project Performance	
Develop a plan for project evaluation	Purpose, focus and criteria of evaluation are determined

Table F.6 (continued)

LEADERSHIP SKILLS	
Manage Stakeholder Relationships	
Ensure that stakeholder interests are identified and addressed	Stakeholder interests are considered when making project decisions
Promote effective individual and team performance	Interpersonal skills are applied to encourage individuals and teams to perform effectively.
	Individual and team behavioral expectations are established.
Manage stakeholder communications	Communication needs of stakeholders are identified and documented
	Information is communicated as planned, and variances are identified and addressed
Facilitate external stakeholder participation	External stakeholder participation is planned, documented and communicated.
Manage Development of the Plan for the Project	
Define the work of the project	The work-items and completion criteria are agreed to by relevant stakeholders
Document risks and risk responses for the project	Responses to risks are identified and agreed to by relevant stakeholders
Confirm project success criteria	Project success criteria are agreed to by relevant stakeholders
Develop and integrate project baselines	The plan for the project is approved by authorised stakeholders and communicated to relevant stakeholders
Manage Project Progress	
Reflect on practice	Feedback on personal performance is sought from relevant stakeholders and addressed.
Manage Product Acceptance	
Ensure that the product of the project is defined	Characteristics of the product of the project are documented and agreed to by relevant stakeholders
Secure acceptance of the product of the project	The product of the project is transferred to identified stakeholders and accepted
Manage transition between project phases	Acceptance of the outputs of a prior phase is obtained from the relevant stakeholders

Table F.7. Leadership skills versus GAPPS units of competencies, their elements and performance criteria

Planning a Project (performance)	
Quality Management process established	Establishes quality metrics for deliverables, processes and project management performance
Executing a Project (performance)	
Human resources managed	Develops project team members
Monitoring and Controlling a Project (performance)	
Quality is monitored and controlled	Collects project and product metrics
Project team managed	Conducts team building activities
	Monitors team satisfaction
Contracts administered	Collects seller performance metrics
	Ensures sellers are part of the project team cultures
Closing a Project (performance)	
Project formally closed	Documents and publishes project learning
	Updates organisational process assets
Leading (personal)	
Creates a team environment that promotes high performance	*Promotes team learning and advocates professional and personal development*
Motivates and mentors project team members	*Establishes mentoring relationships for team members' development*
Managing (personal)	
Builds and maintains the project team	*Identifies, evaluates and selects internal and external talent*
Plans and manages for project success in an organised manner	*Insists on compliance with processes, procedures and policies*
Cognitive Ability (personal)	
Effectively resolves issues and solves problems	*Applies lessons learned to resolve current project issues*

Table F.8.   PMCD units of competencies, their elements and performance criteria that are not in the research scope

Manage Stakeholder Relationships	
Promote effective individual and team performance	Individual development needs and opportunities are recognised and addressed
Manage Development of the Plan for the Project	
Define the work of the project	Relevant knowledge is gained from prior projects is incorporated into the plan for the project where feasible
Manage Project Progress	
Reflect on practice	Lessons learned are identified and documented
Evaluate and Improve Project Performance	
Develop a plan for project evaluation	Relevant evaluation techniques are determined
Evaluate the project in accordance with plan	Performance data is collected and analysed in accordance with the evaluation plan
	Evaluation process engages relevant stakeholders
Capture and apply learning	Knowledge sharing and skill transfer is encouraged among relevant stakeholders
	Results of evaluations are documented and made available for organisational learning
	Potential improvements are identified, documented and communicated to relevant stakeholders
	Improvements agreed for this project are applied.

Table F.9. GAPPS units of competencies, their elements and performance criteria that are not in the research scope