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PROJECT MANAGEMENT MATURITY VERSUS PROJECT SUCCESS IN SOUTH AFRICAN COMPANIES

A research report submitted

by

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ABSTRACT

In a fiercely competitive and changing environment most companies employ project management as a strategic tool to respond to the changing business environment and to outperform their competitors, yet the project management maturity level and the Project Success rates for the particular company is not always known. The main objective of this research was to determine whether a higher project management maturity level would go hand in hand with a higher project performance level.

To assist in the project management maturity assessment of organisations in South Africa, a shortened version of Harold Kerzner's project management maturity model was used in the empirical research. Regression analysis was used to determine the correlation between the maturity level and actual project performance of the surveyed organisations. Non-empirical research into the fields of Project Management Benchmarking, Project Management Maturity and Project Success were used to motivate the findings of the empirical research.

Whilst conducting the empirical research, assessment and analysis, it was identified that most organisations operate at different project management maturity levels and that there is a relatively strong correlation between the maturity level and Project Success. The analysis of the data indicated that a significant opportunity exists to improve project management maturity within South African organisations and a number of recommendations were made in that regard.

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DECLARATION

I declare that this research report is my own, unaided work. It is submitted in partial fulfilment of the requirements of the degree of Master of Business Administration for the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university.

…… Date: ……

Andre Deon Roux

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- Throughout the study program, I was supported by excellent lecturers of the Gordon Institute of Business Science, in particular by Dr. Peter Tobin who was my supervisor for my research,
- My superior Don Turvey gave me the opportunity to study many hours during work time and to complement my project management experience with a solid theoretical background. I take advantage of this additional knowledge in my daily work and I am preparing for the "Project Management Professional" certification offered by the Project Management Institute,
- Empirically verifying my research hypothesis proved to be more difficult than I would have expected. Approximately 150 individuals were requested to participate in the Survey and I would like to express my gratitude to all those who have contributed data to this study but whom I cannot name here for confidentiality reasons. The sample of companies of all sizes and from many industries that they represent is the foundation for the validity of my research results,
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LIST OF ABBREVIATIONS

ACI	Absolute Cost Index
ASI	Absolute Schedule Index
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
CPI	Cost Performance Index
IT	Information Technology
KM	Knowledge Management
KPI	Key Performance Indicator
OPM3	Organisational Project Management Maturity Model
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMMM	Project Management Maturity Model
$(PM)^2$	Project Management Process Maturity Model
PWC	Price Waterhouse Coopers
SEI	Software Engineering Institute
SPI	Schedule Performance Index
TQM	Total Quality Management

1. INTRODUCTION TO THE RESEARCH REPORT

1.1. Introduction

Few people would agree that an operation was a success if the patient died during or immediately after the procedure. We would all agree that this was a failure (Oni, 2007). Yet in the Project Management (PM) world, many people claim exactly that – they argue that their project was a success, despite its failure to meet the business objectives.

In light of the above statement and from a PM viewpoint, the question that this research project attempts to answer is: Is their a correlation between PM Maturity and Project Success? This chapter presents the Background to the Research Problem, Research Report Structure, Research Motivation, Research Problem and conclude with a summary.

1.2. Research Background

Corporate organisations are facing enormous competitive pressures today and new markets are hard to penetrate. Apart from the competition, technology is rapidly evolving, organisations are segmented and experts are decentralised. Many companies are forming strategic alliances, through merges and acquisitions, to share their knowledge and resources to produce and provide high quality products or services. In today's time-based business environment,

the project-driven organisational form appears to be attractive (Kwak and Ibbs, 1995).

According to Cooke-Davies and Arzymanow (2003) modern PM has its roots in the Second World War, and developed in a limited number of engineering based industries during the 1950's until the 1970's. As from the 1990's, the demand for project managers has mushroomed, as project management has increased dramatically in a broad range of industries.

Despite the broad usage of PM tools and practices across different industries, organisations are often confused, uncertain, and have difficulties locating their current application of PM (Kwak and Ibbs, 2002). Although most companies employ PM as a strategic tool to respond to this changing environment and to outperform their competitors, the PM Maturity level and the Project Success rates for the particular company is not always known.

Since 1994, when the first edition of the Standish Group's CHAOS report was published, the Standish Group has conducted a survey every two years to determine the success rate of Information Technology (IT) projects in the USA (Standish Group, 1994). In the CHAOS report, the Standish Group also reflects the most common reasons for failures, challenges and success in IT projects. While the CHAOS report represents the state of IT projects in the USA, there are no South African statistics of this kind. The purpose of this research project was to determine the correlation between PM Maturity and Project Success in South Africa and the results from the CHAOS report will be referred to.

In times where technological developments create new opportunities at an ever faster pace and start-up companies threaten established corporate giants using new business models, rapid change is the motto of the day. Few business leaders would disagree that projects are the vehicle for implementing change and therefore PM is more important than ever. Environmental forces - competitive, economic, technological, political, legal, demographic, cultural and ecosystem, create challenges and opportunities for organisations. They must therefore continuously adapt to the environment if they are to survive and prosper. Apart from the above it was also stated in a report from Price Waterhouse Coopers (PWC), that top management is thus confronted with the critical task of analysing and improving the ability of an organisation to survive and grow in this complex and changing world (Pricewaterhousecoopers, 2004).

In a global survey conducted by PWC it was found that the successful organisation employs PM as a strategic tool to respond to this changing environment and to outperform those that do not adapt. An organisation that excels at PM becomes an agile organisation that knows how to deal with and drive change (Pricewaterhousecoopers, 2004).

The above statement is just an example giving an impression of the importance that is attached to PM in today's business world. But if PM is considered that important, why do so many projects fail in one way or the other. In the 2006 CHAOS report, the Standish Group reveals that only 35% of software projects started in 2006 can be categorised as successful, meaning they were

completed on time, on budget and met user requirements. Although this is a marked improvement from the first groundbreaking report in 1994, that labelled only 16.2% of projects as successful, it's still a fairly low success rate (Rubinstein, 2007).

1.3. Report Structure

This research project report consists of seven chapters. Chapter 1 gives an introduction to the general topic and research goals of the study. It briefly describes the Research Background, Research Report Structure, Research Motivation and Research Problem. Chapter 2 is a review of the literature related to PM Benchmarking, PM Maturity and Project Success and Failure. Various maturity assessment models are analysed to assist in defining the research methodology. The Research Hypothesis is described in Chapter 3 followed by the Research Methodology in Chapter 4. It is explained in detail why this particular approach has been chosen and which specific properties were identified by asking particular questions.

The results of the PM process maturity assessment and actual project performance is presented in Chapter 5. In Chapter 6 the results are analysed and major findings discussed in terms of the hypothesis. Further to this chapter the correlation of the level of PM process maturity with organisational project performance was identified and quantified. In Chapter 7, conclusions are drawn from the research. The chapter highlights the key findings of the research, pulling the results together into a cohesive set of findings, including

recommendations to stakeholders based directly on the findings and proposes recommendations for future research.

1.4. Research Motivation

Proper use of PM practices can improve overall organisational effectiveness, in today's uncertain and rapidly changing business environment. However, management has had trouble convincing top managers that PM investment, results in financial and organisational benefits. Corporate executives request and demand a better understanding of the relationship between PM sophistication and its influence on the company's PM performance. Therefore, as Kwak and Ibbs (2000) argue, project managers who are trying to implement PM practices and processes in their organisations have to show the benefits and payback from PM investment quantitatively.

Until now, very few methodologies or well defined processes were available that impartially measures and implements PM practices both in the organisation and against different industries. This has been a challenge for organisations that want to adapt PM as a major business practice. In addition, there has been a lack of appropriate criteria for measuring PM Maturity. Kwak and Ibbs (2000) define PM Maturity as a level of sophistication that indicates organisation's current PM practices, processes and its performance.

Each industry and even companies within the same industry have different levels of PM sophistication. Some of the reasons are: the adaptation timing of

PM, market situation, and top management's commitment. Generally, implementation of PM practices and processes in organisations is hard to justify economically. Rationalising the benefits of PM processes and the cost of executing PM is hard to do in precise terms.

The research report describes a PM Maturity analysis methodology that was used to measure PM Maturity and Project Success. By determining whether a higher maturity level would go hand in hand with a higher project performance level, management teams will be able to position themselves 'ahead of the wave' of change and this will enable managers to promote PM applications.

1.5. Research Problem

Business leaders may be aware of the importance of PM and therefore, they invest in the development of PM skills and other PM tools. To improve PM performance and the PM capabilities of the organisation has financial implications, but business leaders are not always sure how much they should invest. They also don't always know how much is necessary to reach the level of PM capability, adequate for their business requirements (Schiltz, 2003).

PM professionals have the big challenge of drawing their senior executives' attention to the importance of investing into PM and the benefit of raising the PM Maturity level to organisation. Further to this, it is very difficult to do a PM Maturity assessment in an organisation where senior executives are not yet convinced, that it is worth investing into PM. Although most senior executives

has recognised, over the last few decades, that PM is an efficient tool to handle novel or complex activities, the correlation between Project Success rates and PM Maturity is not always known (Pricewaterhousecoopers, 2004).

The process of bringing new projects on stream and into the market imposes demands on established organisations and necessitates different management techniques from those required to maintain day-to-day operations. These undertakings would call for more and faster decision making techniques than possible in a normal operation and making the right choices will be critical to company success (Munns and Bjeirmi, 1996). Yet not all companies know if their PM processes are adequate.

Hillson (2003) states that many businesses recognise PM as a core competence and seek to deliver benefits to the business through effective management of projects, but companies cannot always benchmark itself with best practice or its competitors because they don't know their PM Maturity level.

1.6. Summary

In the report from PWC, it was mentioned that organisations should be aware that when talking about Strategic Planning, Investment Appraisal, Capital Budgeting, New Product Development Organisational Change, Mergers and Acquisitions, Outsourcing, etc., they are in fact talking about initiatives that translate into, and are executed through, projects. Top and Senior Management should therefore understand that PM is a key strategic tool to drive these

initiatives and to reap their business benefits. Those organisations that understand the vital importance of excelling at PM and act upon it will undoubtedly outperform the competition. The main objective of the research was to determine the PM Maturity and Project Success levels of organisations and to determine the correlation between them.

2. LITERATURE REVIEW

This section presents an introduction to the literature review and three main topics: PM Benchmarking, PM Maturity and Project Success and Failure.

2.1. Introduction

In many fields, such as those measuring achievements in sport, the arts and entertainment, industry and commerce, the measure of good or best performance is now often described as 'world-class' according to Tobin (2004). Benchmarking and Maturity are two of the key topics that measure world class performance and will either lead to success or failure (Tobin, 2004).

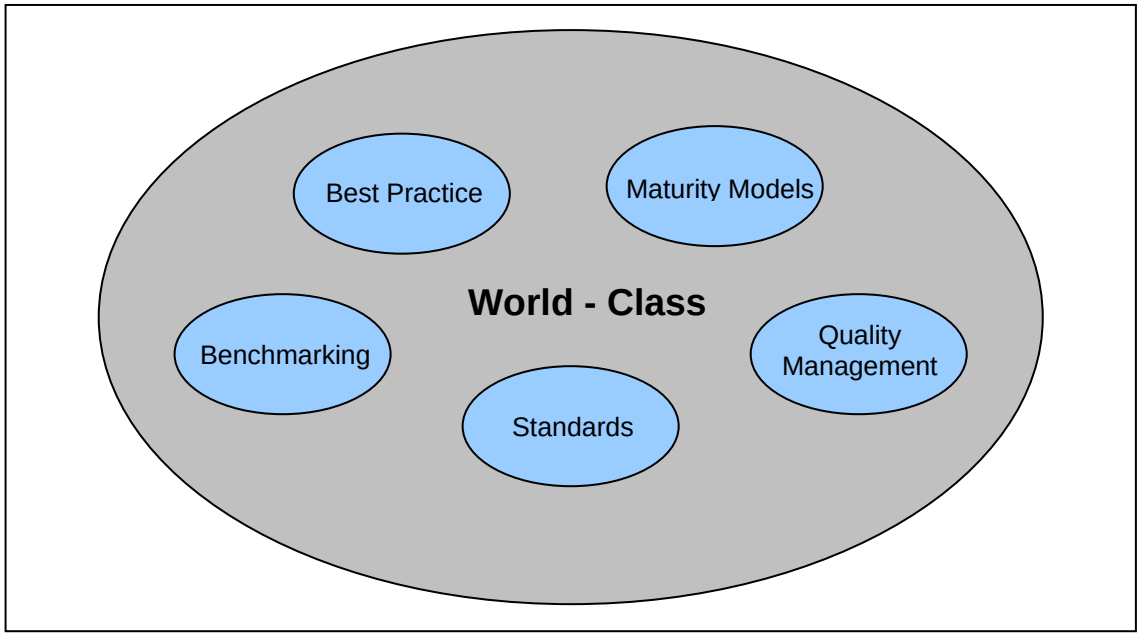
Tobin (2004) proposed a framework for the assessment and measurement of world-class performance. It is suggested that the elements included in the framework be used individually or in combination to measure, improve and sustain world-class performance. Although the framework is specifically with reference to Knowledge Management (KM), it is a useful framework to apply to the business environment and more specifically PM.

Figure 1, indicates the several topics of what might potentially be deemed as measures of world-class performance, including Best Practice, Benchmarking, Quality Management, Standards and Capability Maturity. These individual elements have been identified as perhaps the most significant contributors to a

model that might be used to measure and manage world-class performance (Tobin, 2004).

According to Tobin (2004) there is no single measure or model which can be used to determine world-class performance, but over time various elements of the proposed framework may be used both individually and in combination to improve and sustain the performance of organisations.

Figure 1: Proposed World-Class Performance Framework (Tobin, 2004)



2.2. Project Management Benchmarking

Munns and Bjeirmi (1996, p.81) define a project to be:" the achievement of a specific objective, which involves a series of activities and tasks which consume resources". It has to be completed within a set specification and having definite start and end dates. Munns and Bjeirmi (1996, p.81) argue that PM can be

defined as: “The process of controlling the achievement of the project objectives”.

The Guide to the Project Management Body of Knowledge (PMBOK) defines PM as the application of knowledge, skills, tools, and techniques, to project activities to meet the project requirements (Project Management Institute, 2004). The focus of PM therefore, is distinct from that of the project because it is short term, until delivery of the project for use. In contrast the project itself is long term, based on the whole life rather than just the development cycle.

According to Kwak and Ibbs (1995), benchmarking is a continuous discovery process that opens the organisation to new and sometimes radical ideas that can play a pivotal role in improving effectiveness. It is a method to increase the competitiveness of a firm, through getting information about the best practices and comparing top performing companies. Benchmarking has been widely applied to evaluate current practices and performance in almost all industries.

Griffith (2006) states that benchmarking is just as applicable to PM as it are to other endeavours. PM has always applied the Goal Setting Theory. Almost every project establishes cost and schedule targets. In addition, projects set other goals such as quality, customer satisfaction, safety, and operational performance.

The second element of benchmarking, learning from others is also applicable to projects. PM training courses and certification programmes indicate that

improvements can be gained by learning from others and that practitioners are open to learning by means other than direct experience (Griffith, 2006).

In order for an organisation to be able to determine whether its PM processes are adequate, agreed measures are required to enable it to compare its management of projects with best practice or against its competitors. Hillson (2003) states that the purpose of a benchmarking exercise is to assess current capabilities, diagnose strengths and weaknesses, and identify gaps where improvement is required.

However, according to Griffith (2006), benchmarking PM is difficult to implement in practice due to the following factors:

- Deciding what to measure is not always clear,
- Obtaining reliable competitor data is also difficult,
- Identifying the right learnings can also be challenging,
- Maintaining a benchmarking process requires discipline and resources.

Despite these barriers, PM benchmarking is well underway. A search of the PMI web site (Project Management Institute, 2007) returns 103 articles related to PM benchmarking. Practitioners, consultants, and academics recognise the power of benchmarking and its potential to improve project performance.

Kerzner (2004) argues that process improvement is necessary to maintain a competitive advantage and that benchmarking must be performed on a continuous basis. The company must decide whom to benchmark against and

what to benchmark. To determine the PM process maturity of an organisation you need to benchmark its performance in terms of the implementation of the PM processes.

2.3. Project Management Maturity Models

Apart from benchmarking Tobin (2004) also indicates in his World-Class Performance Framework the importance of maturity models. The most common approach to PM benchmarking is through Project Management Maturity Models (PMMM's). Maturity models are frameworks for helping organisations improve their processes and systems (Sonnekus and Labuschagne, 2004).

Several different maturity models have been introduced to the PM community (Pennypacker and Grant, 2003). These models attempt to measure an organisation's level of PM Maturity through a rating system based on the extent that different practices, processes, and skills are in place (Griffith, 2006).

Back in the mid to late 1980s the software industry explored formal ways to better measure and manages the quality and reliability of the processes used for software development. The industry saw value in applying the concepts of Total Quality Management (TQM) and continuous improvement to their development processes (Kerzner, 2004). This prompted the Software Engineering Institute's (SEI) development (in 1990) of the Capability Maturity Model (CMM). The tool provided the industry with a structured and objective

means for measuring a software organisation's development processes and for comparing these measures against optimum practices. The CMM helped software developers identify specific improvements that would allow them to become more competitive in a highly competitive industry (Kerzner, 2004).

To utilise the CMM in other industries, the tools have been implemented with PM measures and standards (e.g. The PMBOK Guide) to serve as the foundation for many of the PMMM's on the market. In Appendix A, a comparison of seven different PMMM's is shown, excluding the Organisational Project Management Maturity Model (OPM3) and Kerzner's model, which is described below.

According to Crawford (2006), a good model for the measurement of PM Maturity creates a strategic plan for moving PM forward in an organisation. Most maturity models make reference to five levels, and are all quite similar in nature, ranging from 1 (Ad-hoc stage) to 5 (Sustained stage) as illustrated in Table 1.

Level 1 indicates that processes are disorganised or even chaotic, while Level 5 indicates that an organisation uses feedback from the established processes to continually improve and redefine them. On Level 1 the success of a project is determined to a large extent by individuals, whilst at Level 5 the organisation can adapt to changes in personnel and still expect the same levels of success.

Table 1: Key Project Management Processes (Kwak and Ibbs, 2000)

Maturity Level	Key Project Management Processes
Level 5 (Sustained Stage)	• PM processes are continuously improved, • PM processes are fully understood, • PM data are optimised and sustained.
Level 4 (Integrated Stage)	• Multiple PM (program management), • PM data and processes are integrated, • PM processes data are quantitatively analysed, measured and stored.
Level 3 (Managed Stage)	• Formal project planning and control system is managed , • Formal PM data are managed.
Level 2 (Defined Stage)	• Informal PM processes are defined, • Informal PM problems are identified, • Informal PM data are collected.
Level 1 (Ad-hoc Stage)	• No PM processes or practices are consistently available, • No PM data are consistently collected and analysed.

As described by Kwak and Ibbs (2000) the Berkeley Project Management Process Maturity Model $(PM)^2$ is a fully integrated maturity model to measure, locate, and compare an organisation's current PM level.

Maturity models identify project, or organisational strengths and weaknesses and benchmarking information. In addition, most focus on incremental improvements based on quality improvement practices. The five levels enable repeatability in terms of assessments and enable a measurement of progress over time. Most companies are at a level 1 or 2 (Kwak and Ibbs, 2000).

However, some have criticised the maturity models from a practical point of view (Cabanis, 1998; Dinsmore, 1998):

- Models are inflexible when a model is required for managing change and while maintaining quality specifications,
- Maturity models are useful for problem identification and highlighting areas of concern, but are not geared to solve the issues. Normally the organisation must set up action plans to solve the problem,
- The five maturity levels do not offer enough granularity to measure progress over time,
- The models are not ideal in a rapid changing environment, where organisations must adopt new technologies, practices or new policies,
- Models focus on the work processes and some ignore the organisational aspects.

In two other articles, PMMM's were critised for lacking empirical support for determining which competencies contribute most to Project Success (Jugdev and Thomas, 2002, and Skulmoski, 2001).

Apart from the criticism a recent survey conducted by eighty-one PM practitioners from the Center for Business Practices, the research arm of the consulting and training organisation, PM Solutions revealed that, improving an organisation's level of PM Maturity, results in significant performance benefits, especially in customer satisfaction. Although organisations are, in general, fairly low in PM Maturity, the higher the level of maturity, the better the performance of the organisation in all areas measured (Center of Business Practices, 2006).

Results from a similar survey conducted in 2001 were compared with the 2006 results to see whether or not there has been improvement over time in PM Maturity industry-wide and, if so, how much. These conclusions are among the results of the survey:

- Improving PM Maturity level results in significant performance benefits, (30% of organisations showed more than 25% improvement),
- The higher the PM Maturity level, the better the performance, in all areas measured,
- Almost 90% of organisations are at Level 1 or 2 PM Maturity level. This has also been stated by Kwak and Ibbs (2000),
- Overall PM Maturity grew by 26% from 2001 to 2006, and the biggest improvements were in risk management, followed by procurement and cost management.

The benefits of a structured assessment of PM Maturity lie in setting direction, prioritising actions, and beginning cultural change rather than in understanding

the current level at which an organisation is performing. Crawford (2006) states that the emphasis is on "structure." It is important that the assessment itself be repeatable, provide consistent measurements and results, and provide for some degree of benchmarking with other organisations.

Crawford (2006) further argues that maturity assessments may be here to stay in this complex PM world in which we live, not too distant or different from the software development world and SEI's maturity models.

2.3.1. Organisational Project Management Maturity Model

In a major project, the Project Management Institute (PMI) has developed the OPM3. The OPM3 seeks to describe and assess an organisation's ability to enact strategy through selection and delivery of multiple projects. Kerzner (2004) describes that the model provides a hierarchical structure with a number of best practices, each comprising of multiple capabilities, with each capability leading to outcomes which can be assessed by Key Performance Indicators (KPI’s) and metrics.

According to Hillson (2003) the OPM3 is a very comprehensive assessment and framework, though the complexity of its broad scope addressing best practices, capabilities, outcomes, KPIs and metrics at three organisational levels (projects, programmes and portfolios) through four levels of maturity (standardise, measure, control, continuously improve) may discourage some potential users.

The standout difference between OPM3 and other leading PMMM's is that it is not another five-step model. Instead, Rose (2004) argues, the OPM3 takes a more comprehensive approach comprising three elements: knowledge, assessment, and improvement. Overall, OPM3 bridges the gap between organisational strategy and successful projects.

According to Rao (2005) the OPM3 was developed as a result of a need to have a standard that embraces PM to meet objectives of an organisation as compared to a single project and is therefore more useful to assess PM Maturity wherein projects are considered not only at project level but also at program and portfolio level.

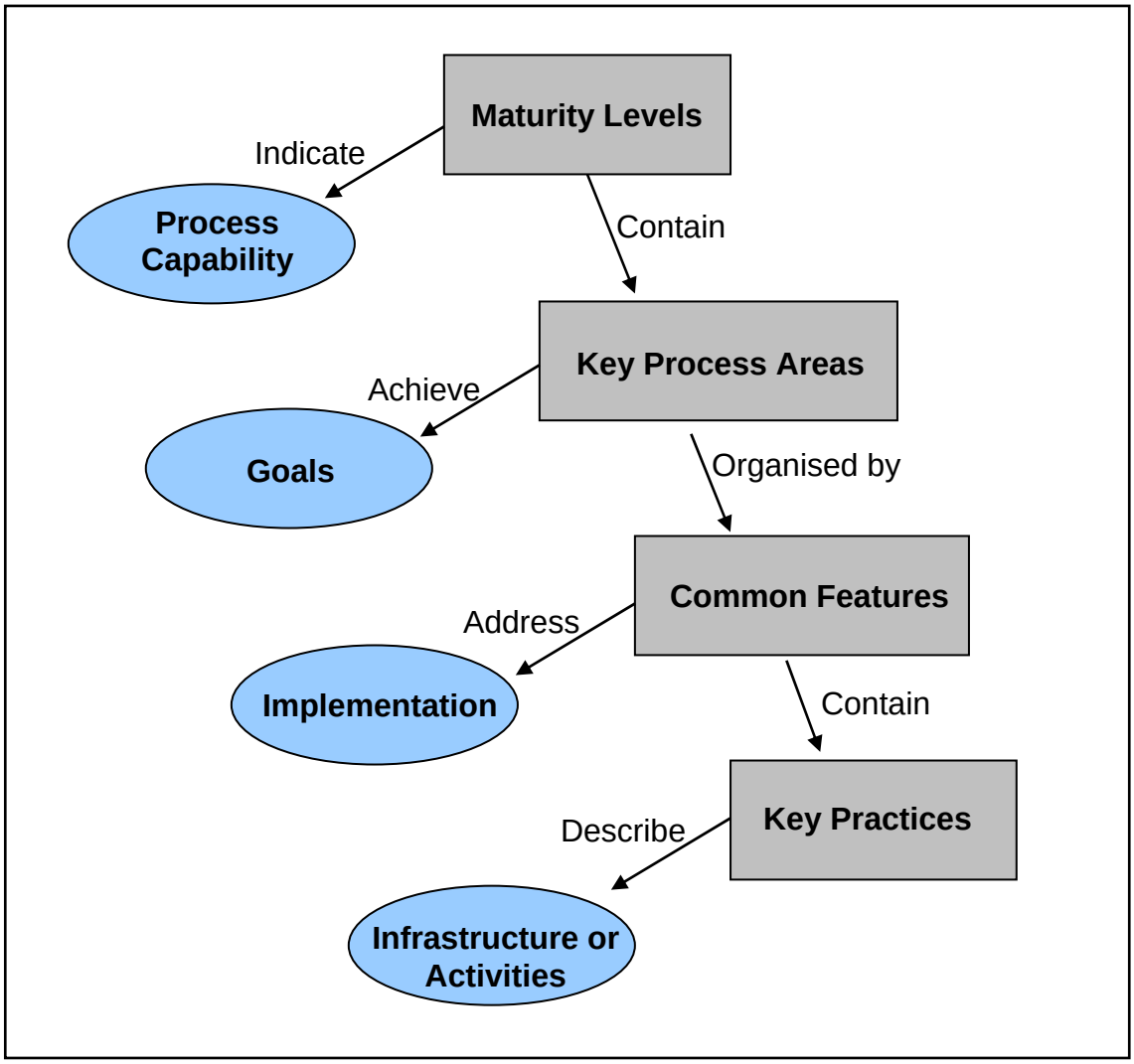
2.3.2. SEI's Capability Maturity Model

The CMM (Paulk, Weber, Garcia, Chrissis, & Bush, 1993) of SEI is a framework that describes the key elements of an effective software development process (Paulk et al., 1993). The very thorough description of the framework makes it a strong theoretical starting point for developing process maturity models in other areas such as PM. A step-by-step process for deriving key practices which can be translated into much more focused questions are described.

This process starts with maturity levels for which process capabilities are described. By describing these capabilities, key process areas are identified, together with the goals that are attained using these process areas. In the next step, common features characterising the successful implementation of these

process areas are determined. Finally, key practices that indicate the successful implementation of the common features are described (Paulk et al., 1993). This derivation process is depicted in Figure 2. In the final step, it is then relatively straightforward to formulate questions that have to be asked in order to determine the presence of key practices. The CMM defines five levels of process maturity that are very similar to those of the $(PM)^2$ model. The maturity levels are described in Appendix B.

Figure 2: The Structure of the CMM (Paulk et al., 1993)



The CMM has been retired and not been updated since 1997 and CMM has been superseded by CMMI (Capability Maturity Model Integration).

CMMI is the successor of the CMM. The CMM was developed from 1987 until 1997. In 2002, CMMI Version 1.1 was released. Version 1.2 followed in August 2006. The goal of the CMMI project is to improve the usability of maturity models by integrating many different models into one framework.

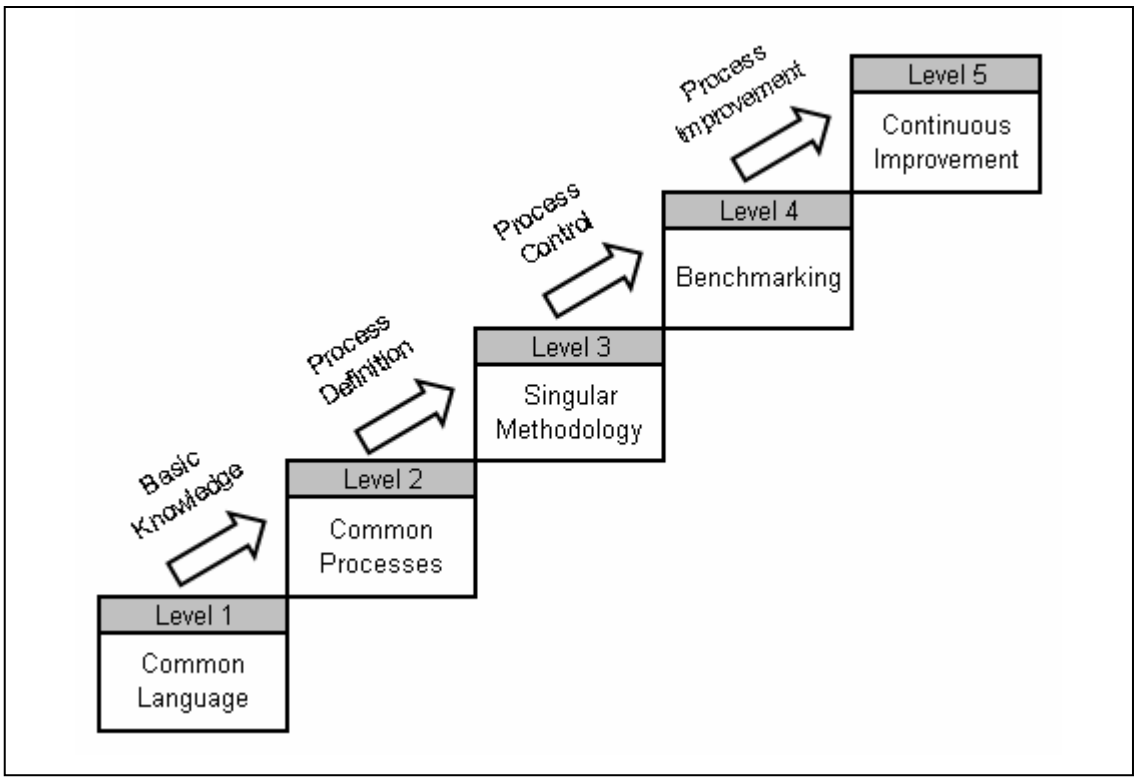
CMMI is a process improvement approach that provides organisations with the essential elements of effective processes. It can be used to guide process improvement across a project, a division, or an entire organisation. CMMI helps integrate traditionally separate organisational functions, set process improvement goals and priorities, provide guidance for quality processes, and provide a point of reference for appraising current processes (Kerzner, 2004).

2.3.3. Kerzner's Project Management Maturity Model

Kerzner (2004) see PM as a core competency that many companies must develop in order to remain competitive in the market. In Kerzner's (2004) view, PMMM's are an important strategic tool for senior management that allows an organisation to benchmark its capabilities in respect of PM with its competitors. As such, a PM Maturity assessment model is a tool for establishing PM excellence, which is considered a condition for success.

Like $(PM)^2$ and CMM, Kerzner's maturity model defines five levels using which an organisation is ranked from lacking PM processes to continuous improvement. These five levels are shown in Figure 3 and are described in Appendix C (Kerzner, 2004).

Figure 3: Kerzner's Maturity Levels (Kerzner, 2004)



Kerzner's model is based on the life cycle phases for PM Maturity shown in Table 2. Virtually every company that achieves some level of maturity goes through these phases. The culture of the organisation and the nature of the business will dictate the amount of time spent in each of the phases.

Table 2: Five Phases of the Project Management Life Cycle (Kerzner, 2004)

Embryonic	Executive Management Acceptance	Line Management Acceptance	Growth	Maturity
Recognise need	Get visible executive support.	Get line management support.	Recognise use of life cycle phases.	Develop a management cost / schedule control system.
Recognise benefits	Achieve executive understanding of PM.	Achieve line management commitment.	Develop a PM methodology.	Integrate cost and schedule control.
Recognise applications	Establish project sponsorship at executive levels.	Provide line management education.	Make the commitment to planning.	Develop an educational program to enhance PM skills.
Recognise what must be done	Become willing to change way of doing business.	Become willing to release employees for PM training.	Minimise creeping scope, select a project tracking system.	

2.3.4. Summary of Project Management Maturity Models

All companies desire to achieve maturity and excellence in PM. Unfortunately, not all companies recognise that the time frame can be shortened by performing strategic planning for PM (Kerzner, 2004). The simple use of PM, even for an extended period of time, does not lead to excellence. According to Kerzner (2004, p193) "… it can result in repetitive mistakes and, what's worse, learning from your own mistakes rather than from the mistakes of others". The

foundation for achieving excellence in PM can best be described as the PMMM, which is comprised of five levels, as shown in Figure 3. Each of the five levels represents a different degree of maturity in PM (Kerzner, 2004).

Until in the 1990's, the concept of "maturity" was seldom used to describe the state of an organisation's effectiveness at performing certain tasks. Beyond 2000, we find this maturity concept being used increasingly to map out logical ways to improve an organisation's services. Several trends point to this (Crawford, 2006):

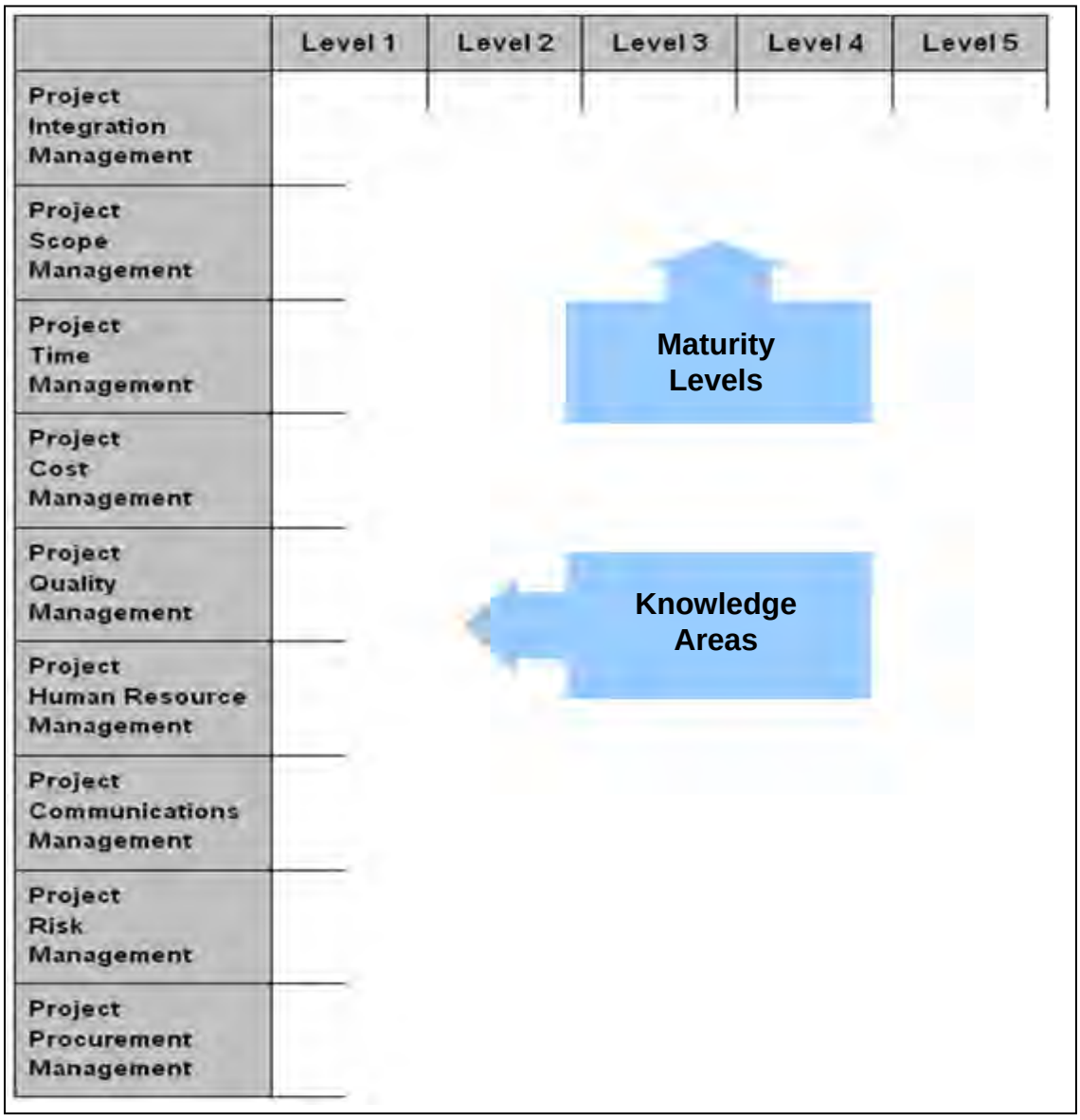
- More organisations are adopting SEI's latest addition to the CMM family of models the CMMI,
- More and more support is being shown for the development of PMI's OPM3 model,
- PMMM's are referred to as the new 'silver bullet' that project managers have sought for so long,
- In support of this trend, there are at least 30 models on the market that are currently being used by organisations to assess the maturity of their PM processes.

2.4. Project Success or Failure

Projects are run in organisational environments where various factors can influence the different stages that incorporates the PMBOK and the project life cycle (Figure 4), especially the implementation thereof, either favourable or

unfavourably. The organisational factors that influence the project environment can be external and or internal to the project environment.

Figure 4: PMBOK with Project Life Cycle Process (Crawford, 2006)



When a project fails it is not only because of poor project planning, a weak business case or lack of top management involvement and support, but also because of poor execution (Matta and Ashkenas, 2003). According to a study

conducted by Pinto and Kharbanda (1996), the factors that contribute to project failure is shown in Table 3.

Table 3: Factors Contributing to Project Failure (Pinto and Kharbanda, 1996)

No.	Factors
1	Ignoring the influence of the project environment
2	Pushing a new technology to the market too quickly
3	Not bothering about building in fallback options or contingencies
4	When problems occur, blaming the person most visible
5	Letting new ideas starve to death from inertia
6	Not bothering about conducting feasibility studies
7	Never admitting that a project, or part of it, is a failure
8	Over-managing project managers and their teams
9	Never conducting post - failure reviews
10	Ignoring project trade-offs between time, cost and quality
11	Allowing political expediency and infighting to dictate project decisions
12	Running a project with a weak project leader

All the mentioned factors are purely PM related and technical complexity is surprisingly not among the main reasons for failure. In some business areas, in particular in IT projects, deviations from cost or schedule plans are rather the norm than the exception.

It is important to understand the factors that can lead to failure, because critical success factors are usually locked up in these factors. Understanding critical success factors in the project environment is vital for Project Success (Kerzner 2004). The Standish Group have done numerous studies of software Project Success and failure rates since 1994. They've observed some trends in PM suggesting things are marginally improving. In 2001, the CHAOS report identified key factors contributing to Project Success, as can be seen in Table 4.

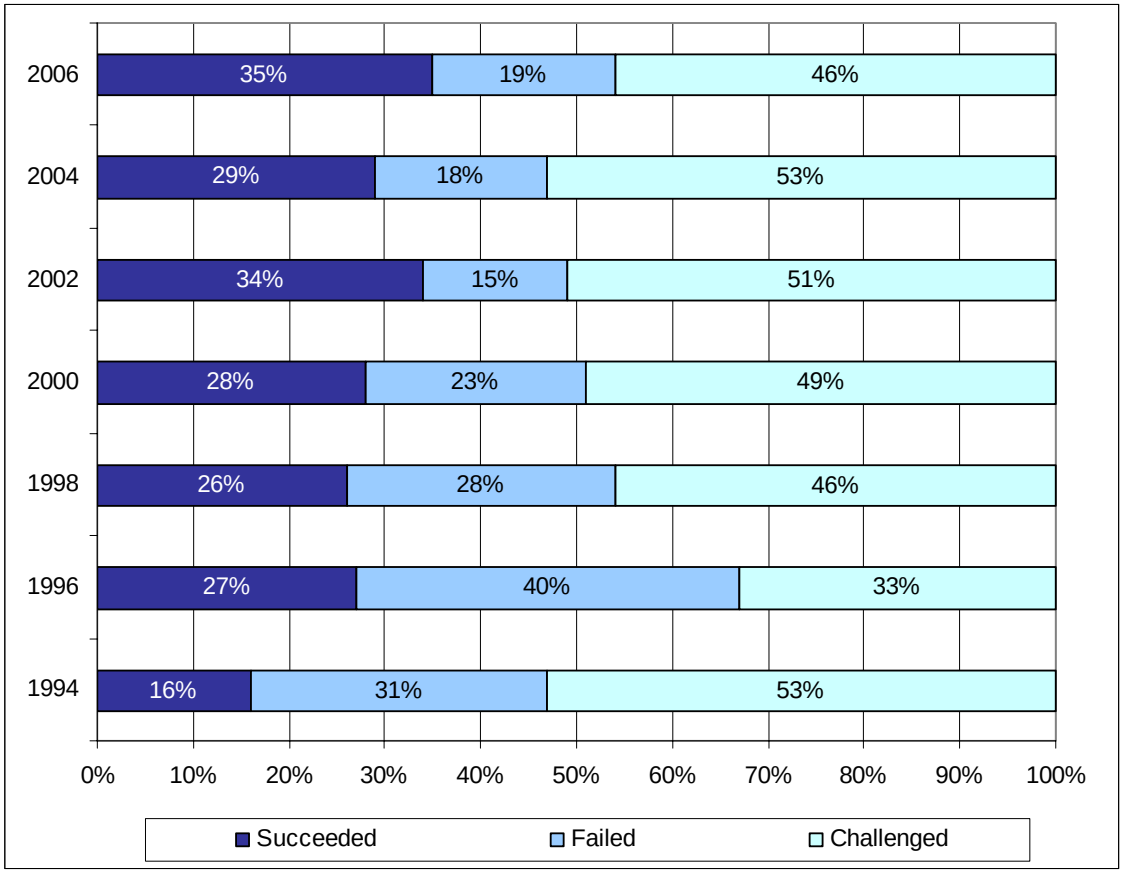
Table 4: Factors Contributing to Project Success (Standish Group, 2001)

No.	Key success factors
1.	Executive Management Support
2.	User Involvement
3.	Experienced Project Manager
4.	Clear Business Objectives
5.	Minimised Scope (instead of small iterations)
6.	Standard Software Structure
7.	Firm Basic Requirements
8.	Formal Methodology
9.	Reliable Estimates
10.	Other

Figure 5 indicates that during 1994 the success rate for projects was only 16%, while "challenged" projects (over time and cost) accounted for 53%, and failed (cancelled before completion) accounted for 31% of all projects. In 1998, 26%

were successful. Then in 2004, a success rate of 29% was reached. Figure 5 also shows that success rates are rising and in 2006, a success rate of 35% was reached. The 2006 study shows that only 19% of projects begun were outright failures, compared to 31% in 1994. Projects described as challenged, meaning they had cost or time overruns or didn't fully meet the user's needs, declined to 46 % in 2006 from 53% in 1994.

Figure 5: Project Resolution History (Rubinstein, 2007)



According to Baccarini (1999) the project team must have a clear understanding of their Project Success objectives. Baccarini (1999) proposed that Project Success consists of two components: product success and PM success.

Product success deals with goals and purpose and PM success deals with outputs and inputs.

According to Jugdev and Muller (2005) the perception or view of Project Success have changed over time from definitions that were limited to the implementation phase of the project life cycle, to definitions that reflect an appreciation of success over the entire project and product life cycle. Jugdev and Muller (2005), argue that several factors are involved when determining the success of a project: time, cost, and scope as well as customer satisfaction.

Success in projects has traditionally been defined as achieving the project's objectives within the following constraint (Kerzner, 2004): allocated time, budget cost, desired performance at technical or specification level and quality standards as defined by customers or users. In experienced organisations, the four preceding parameters have been extended to include the following (Kerzner, 2004):

- With minimal or mutually agreed scope changes,
- Without disturbing the organisation's corporate culture or values,
- Without disturbing the organisation's usual workflow.

There is no denying the fact that success means different things to different people and Project Success can be as hard to define as project quality – this explains why there is no universally accepted definition of Project Success. In today's competitive business world, Project Success goes beyond delivering on

time, on budget, safely and to specifications (PM success) and now generally encompasses “product” success. PM success would include the obvious indicators of completion within budget, satisfying the project schedule, adequate quality standards, and meeting the project goal. Project Success is a core concept of PM, but its definition remains elusive (Oni, 2007).

The question is: Why is PM expressed to be so valuable to organisations while at the same time, PM practices appear to be poorly applied? A large-scale study about “selling” PM to executives (Jugdev and Thomas, 2002), identified a “knowing-doing gap” with regards to PM with senior executives, they know how important PM is for them to reach their strategic goals, but they often fail to actually take the necessary steps for improving PM practices in their organisations.

2.5. Summary

This chapter locates the research within a wider context providing a survey of the key literature relating to PM Benchmarking, PM Maturity and Project Success.

Executives have long recognised that it is not acceptable to stand still in a world where change can lead to loss of competitive advantage in the blink of an eye. Leaders must monitor current performance and establish programs of improvement that continuously enhance the performance of their organisations. Benchmarking recognises and addresses the fact that you cannot effectively manage what you cannot measure.

According to Kerzner (2004) the foundation for achieving excellence in PM can best be described as the PMMM, which comprises of five levels. Each of the five levels represents a different degree of maturity in PM. Until a few years ago, the concept of “maturity” was seldom used to describe the state of an organisation’s effectiveness at performing certain tasks. Today, we find this maturity concept being used increasingly to map out logical ways to improve an organisation’s services.

The following chapter outlines the Research Hypothesis and Chapter 4 describes how the research was conducted, describing the research setting, the number and nature of the participants, the way in which data was collected and analysed.

3. HYPOTHESIS

3.1. Introduction

A hypothesis is an unproven proposition or supposition that tentatively explains certain facts or phenomena. It's a proposition that is empirically testable (Zikmund, 2001).

Besides the fact that not all companies know if their PM processes are adequate they also cannot always compare themselves with best practice or its competitors because they don't know their PM Maturity level.

The companies who attempt to determine their PM Maturity level use different methods and therefore varied conclusions are drawn from the results. All the themes discussed in the literature in Chapter 2, i.e. PM benchmarking, PM Maturity and Project Success will be used in the research to identify whether a higher PM Maturity level would go hand in hand with a higher project performance level.

3.2. Research Hypothesis

The research is intended to make use of empirical data from actual projects and a PM Maturity assessment of the related organisations to measure the effect that different PM Maturity levels have on project performance or more specific Project Success. The specific research hypotheses that will be tested are:

Null Hypothesis: There is no correlation between PM Maturity and Project Success.

Alternative Hypothesis: There is a correlation between PM Maturity and Project Success.

The contributing factors that need to be measured and analysed are the PM Maturity status and the Project performance or success.

3.3. Summary

A research hypothesis exists because the research problem or the sub problems issuing from it arouse curiosity in the researcher's mind, which in turn leads to a tentative guess about how to resolve the problem situation (Leedy and Ormrod, 2001). The research hypothesis, as outlined above, is an educated guess and according to Leedy and Ormrod (2001), its purpose is a practical one: it provides a tentative objective, a logical construct that guides researchers as they collect and analyse data as discussed in the chapters to follow.

In the next chapter the research methodology is discussed. The chapter explain the data collection and data analysis procedure that will be used to draw conclusions on the hypothesis. This process of comparing observed data with the results that we would expect from chance alone is called testing the null hypothesis. The statistical hypothesis testing is described in Chapter 6.

4. RESEARCH METHODOLOGY

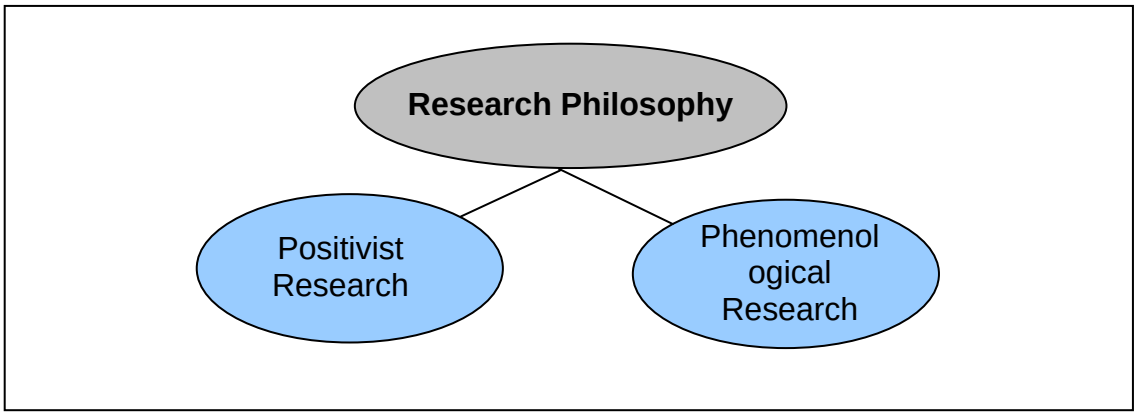
4.1. Introduction

This chapter presents the research approach, design and methods used to address the research problem as outlined in Chapter 1. This research project sought to analyse and explain (the purpose of the research), through mainly quantitative methods (the process of the research) using deductive logic. This is in line with the overall research problem as identified in Chapter1. There are three main sections to this chapter. These are the Research Philosophy (4.2), Research Approach (4.3) and Research Design or Strategy (4.4).

4.2. Research Philosophy

For this study, selecting an overall research philosophy is the choice between two primary alternatives: between a positivist and a phenomenological philosophy (Figure 6). When quantitative research is used to answer questions about relationships among measured variables with the purpose of explaining, predicting, and controlling we refer to a positivist approach. A qualitative approach that attempts to understand participants' perspectives and views of social realities is referred to as a phenomenological approach (Tobin, 2006). Given the research problem as outlined in Chapter 1, the best fit was to follow the positivist paradigm.

Figure 6: Research Philosophy Alternatives (Tobin, 2006)



4.3. Research Approaches

Research can have elements which are based upon a non-empirical approach, an empirical approach, or a combination of the two. This research project was designed to take into account both the non-empirical and empirical research approaches. One of the first considerations to be faced is the pre-existing body of knowledge that exists in a particular field. This should be used as a source of reference for research previously conducted in the chosen field of enquiry, as well as a source of the body of theory which pertains to the selected subject area. Tobin (2006) mentions that some research depends entirely upon this research method (more generally known as searching and reviewing the literature) on a certain subject, where the subject may be one, for example, of a historical nature which does not lend itself to any other form of investigation.

The non-empirical approach was used to inform the structuring and execution of the empirical research activities (Tobin, 2006). For the empirical approach, there are three primary dimensions which can be evaluated for use:

- . Qualitative / Quantitative,
- . Deductive / Inductive,
- Subjective / Objective.

4.3.1. Qualitative / Quantitative Approach

Another decision was whether to adopt a quantitative or qualitative approach, or some combination of the two. According to Leedy and Ormrod (2001), quantitative research is used to answer questions about relationships among measured variables with the purpose of explaining, predicting, and controlling phenomena. This approach is sometimes called the traditional, experimental, or positivist approach.

In contrast, qualitative research is typically used to answer questions about the complex nature of phenomena, often with the purpose of describing and understanding the phenomena from the participant's point of view. The qualitative approach is also referred to as the interpretative, constructivist, or postpositivist approach (Leedy and Ormrod, 2001). In this research, quantitative methods were used to assist in the assessment of PM Maturity within organisations and to determine the project performance, based on actual project data.

4.3.2. Deductive / Inductive

Deductive research is a study in which theory is tested by empirical observation. The deductive method is referred to as moving from the general to the particular. Deductive logic begins with one or more premises. These premises are statements or assumptions that are self-evident and widely accepted "truths". Reasoning then proceeds logically from these premises toward conclusions that must also be true (Leedy and Ormrod, 2001).

Inductive reasoning begins, not with a pre-established truth or assumption, but with an observation. In inductive reasoning, people use specific instances or occurrences to draw conclusions about entire classes of objects or events. In other words they observe a sample and then draw conclusions about the population from which the sample originates (Leedy and Ormrod, 2001). In this study a deductive approach has mainly been used.

4.3.3. Subjective / Objective

Another significant choice which exists in the research paradigm to be adopted is the extent to which the researcher is subjective (involved in, or has an influence on the research outcome) or objective (distanced from or independent) in the execution of the empirical work. The positivist research paradigm is, by its very nature, objective and with the use of this paradigm the observer is independent and therefore does not require involvement in both real world circumstances or involvement of the researcher himself (Tobin, 2006).

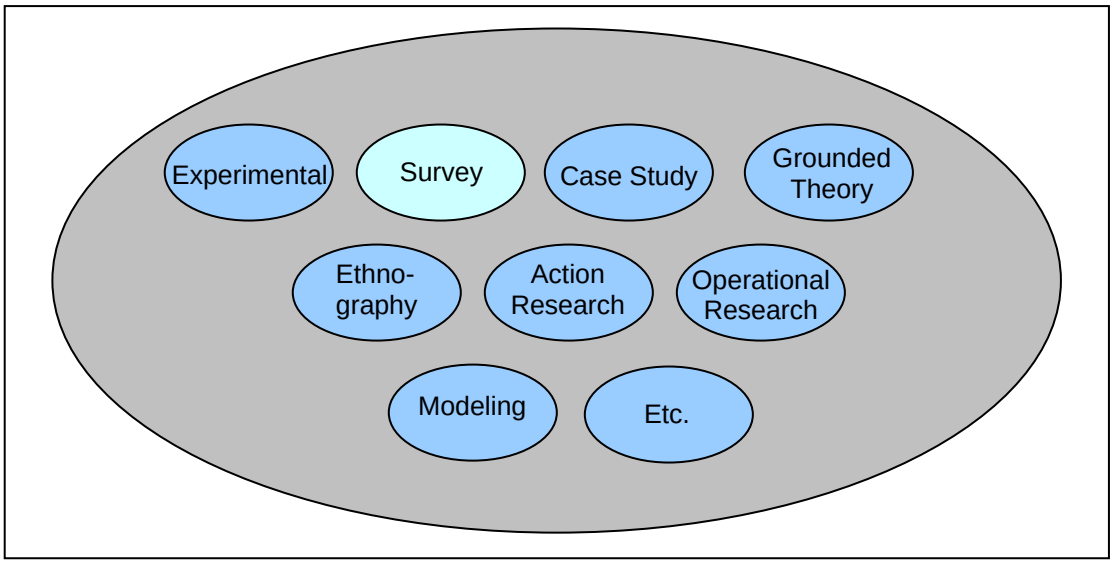
4.4. Proposed Research Design and Strategy

4.4.1. Research Design Alternatives

The research design or strategy alternatives are many, as can be seen in Figure 7. According to Leedy and Ormrod (2001) they include alternatives such as:

- The creation of an Experiment (common in pure scientific research),
- Surveys (often used where large volumes of data are involved with quantitative methods of analysis),
- Grounded Theory (where the theory is generated by the observations rather than being decided before the study),
- Ethnography (a phenomenological methodology which stems from anthropology, which uses observed patterns of human activity),
- Action Research (where the research takes more of the form of a field experiment),
- Modelling (where particular models are developed as the focus of the research activity),
- Operational Research (which looks at activities and seeks to understand their relationship, often with particular emphasis on operational efficiency),
- Case Studies (which seek to understand social phenomena within a particular setting).

Figure 7: Research Design Alternatives (Tobin, 2006)



Given the nature of the research problem as outlined in Chapter 1, it was decided to select the Survey alternative as being the most appropriate for this research project. This research paradigm will be explored in some detail in the following sections.

4.4.2. Survey Research Design Method

The most common method of generating primary data is through surveys (Zikmund, 2002). Survey research captures a fleeting moment in time, much as a camera takes a single-frame photograph of an ongoing activity. By drawing conclusions from one transitory collection of data, we may extrapolate about the state of affairs over a longer time period. At best, the extrapolation is a conjecture, and sometimes a hazardous one at that, but it is our only way to generalise from what we see (Leedy and Ormrod, 2001).

Reduced to its basic elements, a survey is quite simple in design: the researcher poses a series of questions to willing participants, summarises their responses with percentages, frequency counts, or more sophisticated statistical indexes and then draws inferences about a particular population from the responses of the sample (Leedy and Ormrod, 2001).

According to Leedy and Ormrod (2001), a survey research typically employs a face to face interview, a telephone interview, or a written questionnaire. The task of writing a list of questions and designing the exact format of the printed or written questionnaire is an essential aspect of the development of a survey research design (Zikmund, 2002). This research project is a quantitative study as mentioned in section 4.3, making use of a questionnaire (Appendix E).

4.4.3. Survey Research Data Methods

4.4.3.1 Data Sampling

A basic choice in formulating the approach to data sampling exists between probability sampling, which includes simple random sampling; systematic sampling; stratified random sampling, and cluster sampling and non-probability sampling (Tobin, 2006). Given the nature of the research problem outlined in Chapter 1, it is evident that non-probability data sampling methods would be appropriate for this research study.

According to Leedy and Ormrod (2001) non-probability sampling includes: the convenience sample, the quota sample and the purposive sample. Considering the nature of the research, the convenient sampling method was selected as the most appropriate. This is also in line with Leedy and Ormrod (2001) who used the term convenient sampling where people or other units that are readily available are chosen. This was the situation for this research project, with the focus on a group of people specialising in PM, given the time constraints for the research completion.

4.4.3.2 Population and Sample

According to Zikmund (2003), a population is any complete group of people, companies, hospitals, stores, college students, or the like, that share some set of characteristics. A sample is a subset, or part, of a larger population. The purpose of sampling is to enable the researcher to estimate some unknown characteristic of the population.

The target population was PM professionals working in South African companies. To secure as many responses from various industry sectors, a PM consulting company assisted in distributing the questionnaire. These questionnaires led to the majority of the responses in this Survey.

The questionnaire was send to approximately 150 individuals and 65 responses were received of which 6 were removed due to incomplete questionnaires.

4.4.3.3 Data Collection

When the Survey method is utilised, some form of direct participation by the respondent is necessary during the process. The respondent may participate by filling out a questionnaire or by interacting with an interviewer (Zikmund, 2002). Zikmund (2002) further argues that when the data is collected, it's important to minimise errors in the data collection phase. Often, there are two phases to the process of collecting data: pre-testing and the main study.

This Survey intended to identify and benchmark the key variables needed to understand where participating companies stand in the use of PM practices. This was accomplished by making use of a shortened version of Kerzner's PMMM as discussed in Chapter 2.

Many maturity assessment models are available and some have been designed to meet the need of a broad array of industries and cultures, such as Kerzner's model. They are generic. Other models have been developed for specific industries or applications. Kerzner (2004), urge organisations to consider to what degree, if any, the model must be tailored to fit the culture, industry, and business objectives.

Apart from the maturity measurement the Survey examined traditional project performances in terms of cost and schedule. A two-phased approach were utilised to gather the required data.

Phase 1: Pre-testing the questionnaire and the main study to evaluate organisation's PM Maturity using Kerzner's PMM assessment questionnaire.

Pre-testing was conducted through a pilot test by participants of the approached organisations. The main change implemented based on the outcomes of the pre-tests, was the decision not to host the questionnaire on a Web site, but to rather distribute an electronic Microsoft Excel version which could be printed and mailed or edited and e-mailed by the respondent, depending on his/her preference.

One of the major goals of this study was to design a maturity process which is as simple as possible and to avoid having to involve experts who would help administer the assessment and check the validity of answers. The idea was to create an assessment questionnaire that can be self-administered by the respondents, but which would still provide a minimal level of consistency. The approach chosen was to aim at having more than one team member of the same project respond to the questionnaire independently. The resulting maturity ratings for one project were then averaged.

The objective of the questionnaire was to effectively collect information about the organisation's PM practices to determine the PM Maturity level of the organisation, based on Kerzner's model. The final version of the questionnaire consisted of two parts: An introductory letter, shown in Appendix D, and a questionnaire form that was distributed to several project participants with 20 questions on a Likert Scale, shown in Appendix E.

Phase 2: Evaluate organisation's Project Success using actual data from the surveyed organisation's projects.

The purpose of this phase was to collect actual quantitative project performance information in terms of project cost and schedule. These data were collected from representative, recently completed projects from the participating companies.

4.4.3.4 Data Analysis and Interpretation

PM Maturity was statistically compared with actual project performance data using regression analysis to determine correlation coefficients. Regression analysis is the study of relationships between variables. According to (Albright, Winston and Zappe, 2006) it is one of the most useful tools for a business analyst because it can be used to understand how the world operates, and it can be used for prediction purposes.

It was discussed in Chapter 2 that quantifiable measures for Project Success are the conformance to cost and schedule plans. To evaluate these criteria an Absolute Cost Index (ACI) and an Absolute Schedule Index (ASI) were defined, as can be seen in Equation 1 (ACI) and Equation 2 (ASI). The closer ACI and ASI are to 1, the better the project performance or success. Note that the definitions for ACI and ASI are different from the Earned Value Ratios: CPI (Cost Performance Index) and SPI (Schedule Performance Index) as defined for example in PMI's PMBOK (Project Management Institute, 2004).

$$ACI = \frac{|\text{Actual project costs} - \text{Original budget}|}{\text{Original budget}} + 1 \quad \text{..... Equation 1}$$

$$ASI = \frac{|\text{Actual project duration} - \text{Original project duration}|}{\text{Original project duration}} + 1 \quad \text{..... Equation 2}$$

For the statistical correlation evaluation, a best-fit correlation between the Absolute Cost Index and the PM Maturity level was determined as well as for the Absolute Schedule Index and the PM Maturity level. Conclusions were made about the nature of the correlation between two variables that were compared.

4.4.3.5 Research Assumptions

The following Research Assumptions apply to this research:

- All of the participating organisations are treated equally,
- All questions have the same weight for assessing PM Maturity,
- Quantitative data from at least one specific, recently completed project represent the company's current PM practices.

4.4.3.6 Potential Research Limitations

The following aspects were limitations to this research:

- The research focussed only on projects from South African companies and is, therefore, not representative of companies outside South Africa,
- The subjectivity of the convenience sample technique limited the inferences made to the entire population,
- The sheer scope of the study and the depth to which each aspect may be evaluated given the time and resource constraints.

4.5. Summary

This chapter has explained the various options available for the execution of the Survey research and the logic for the selection of the specific approach, strategy and methods applied in this research project. In summary, the overall methodology is one based on a positivist philosophy. It combines non-empirical and empirical approaches, is objective rather than subjective, is deductive, uses mainly quantitative methods; employs the survey as the primary research strategy and uses a combination of data sampling, collection and analysis methods. The following chapter will present the empirical case data gathered during the fieldwork phase of this research project.

5. RESULTS

5.1. Introduction

This chapter presents the data gathered during the empirical-work phase of the research. The data of the Survey will be presented without formal analysis as this will be presented in the next chapter. The chapter opens with a general discussion around the data collection phase and the challenges that were faced during the data collection. The sample characteristics are also discussed in the Data Collection (5.2) section.

In the next section of the chapter the focus is on PM Maturity of the various organisations and the results of their PM Maturity levels are presented. The following section reports the data findings from the actual project data that was gathered and the project performance per organisation is presented. This is followed in the next section by the findings from the statistical correlation analysis between the PM Maturity and the actual project performance data. The chapter will conclude with a brief summary of the data findings and serve as an introduction to the next chapter, where the results are discussed.

5.2. Data Collection

One of the major goals of this study was to design a maturity process which is as simple as possible and to avoid having to involve experts who would help administer the assessment and check the validity of the answers. The idea was

to make use of an assessment questionnaire that can be self-administered by the respondents, but which would still provide a minimal level of consistency. The approach chosen aimed at having more than one team member of the same project respond to the questionnaire independently. The aim was to average the resulting maturity ratings for the project. Unfortunately, most organisations misunderstood the instructions and had the questions answered by only one person. In some cases, where inconsistencies were obvious, the answers were discussed with the respondents.

From the data gathered, it was obvious that the data collected are valid in the sense that a proven PM Maturity assessment questionnaire was used. The measurement instrument, therefore measured what it was intended to measure. The data is also reliable in the sense that the same measurement instrument yielded the same results when the data was compared to the pre-test data for that specific project. In order to have validity, one must also ensure reliability. This was achieved through accurate measurements consistently.

A total of 65 responses were received from the targeted 150 individuals of whom 6 responses were removed due to incomplete questionnaires. Therefore 59 usable responses from various industries were used in the final analysis. The projects were all conducted within South Africa by South African companies. The distribution among industries is shown in Table 5. The data show that 50.8% of the projects analysed came from the Engineering and Mining sector.

Table 5: Industry Representation

Industry	Count	Percentage (%)
Engineering	18	31%
Mining	12	20%
Retail	1	2%
IT	9	15%
Construction	4	7%
Services	3	5%
Other	12	20%

5.3. Project Management Maturity

The PMMM provides a baseline, which is followed by a framework for improving PM practices in an organisation as described in Chapter 2. The principle is that as the organisation progresses through the maturity levels, it becomes better at what it does, and also better equipped to deal with changes in procedures and practices. Respondents were asked to give an estimate of their organisations PM Maturity, using the shortened version of Kerzner's PM Maturity assessment questionnaire, described in Chapter 4. It is important to stress that Table 6 indicates the individual's perception of the organisations' maturity level.

Table 6: Perceived Overall Level of Maturity

Level	Count	Percentage (%)
Level 1	8	14%
Level 2	11	19%
Level 3	25	42%
Level 4	13	22%
Level 5	2	3%

According to the data, the majority of the surveyed organisations perceived themselves to be, on average, at level 3. Only 14% are at a level 1 (Embryonic Phase) according to the data analysed and 3% at a level 5 (Maturity Phase). The perceived levels of maturity according to the different industries are shown in Table 7.

Table 7: Perceived Overall Level of Maturity per Industry

Industry	Count	Average Maturity Level
Engineering	18	2.2
Mining	12	2.8
Retail	1	2.6
IT	9	2.7
Construction	4	1.9
Services	3	1.8
Other	12	1.9

From the data, it was observed that Engineering, Mining, Retail and the IT sectors are on average at level 3 and Construction, Services and Other sectors are at a level 2 on average. Although individual companies within the various sectors are perceived to be at higher levels, the average for the industry is depicted in Table 7. The Maturity level per project is shown in Appendix F. It must be noted however, that the Retail, Construction and Services sectors' sample sizes are small compared to the other sectors and might be bias.

5.4. Project Performance Data

To evaluate the project performance or success the ACI and an ASI per project were determined. The closer ACI and ASI are to 1, the better the project performance or success. The results are shown in Figure 8 and Figure 9 and the results per project are shown in Appendix F. From the data it is apparent that most organisations deliver projects within the 1.0 to 1.1 interval for the ACI and 64% fall within the 1.0 to 1.2 interval. The interval for 1.5 to 2.5 accounts for 15% of the delivered projects. Data analysed for the ASI show a similar trend. 61% of the projects fall within the 1.0 to 1.2 interval of which 32% are within the 1.1 to 1.2 interval. 17% of the projects fall within the 1.5 to 2.5 interval. Both figures show that projects are mostly delivered with an ACI and ASI within the 1.2 interval or within the 1.5 to 2.5 interval, with a lower count of projects between 1.2 and 1.5 for both indexes.

Figure 8: Absolute Cost Performance

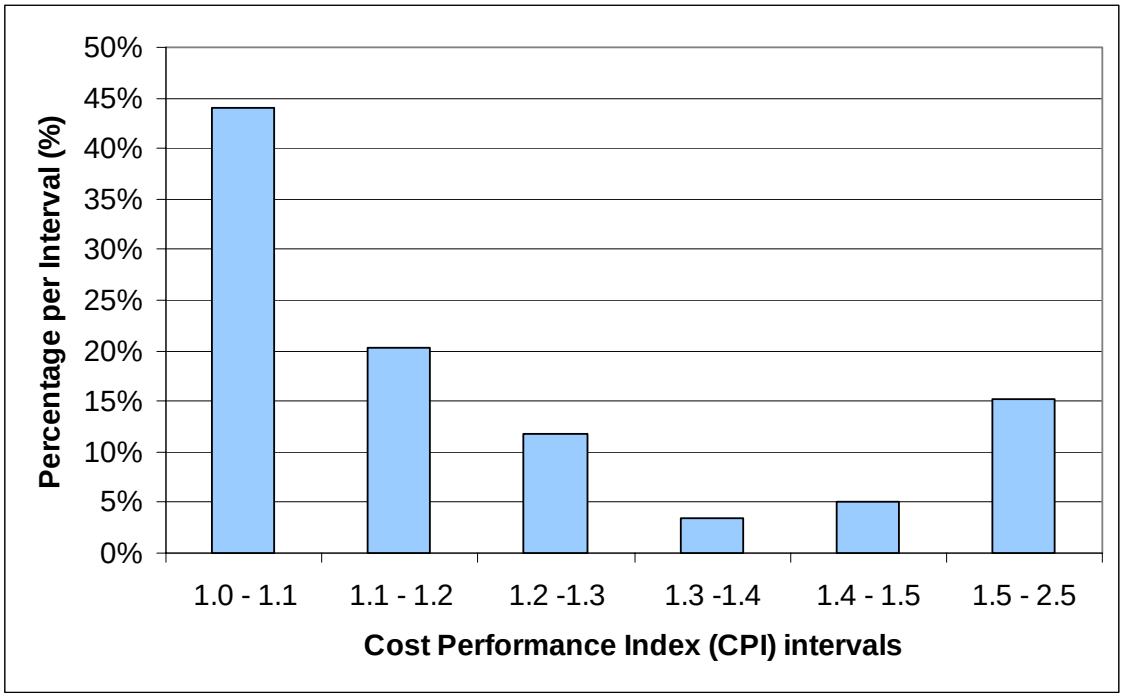
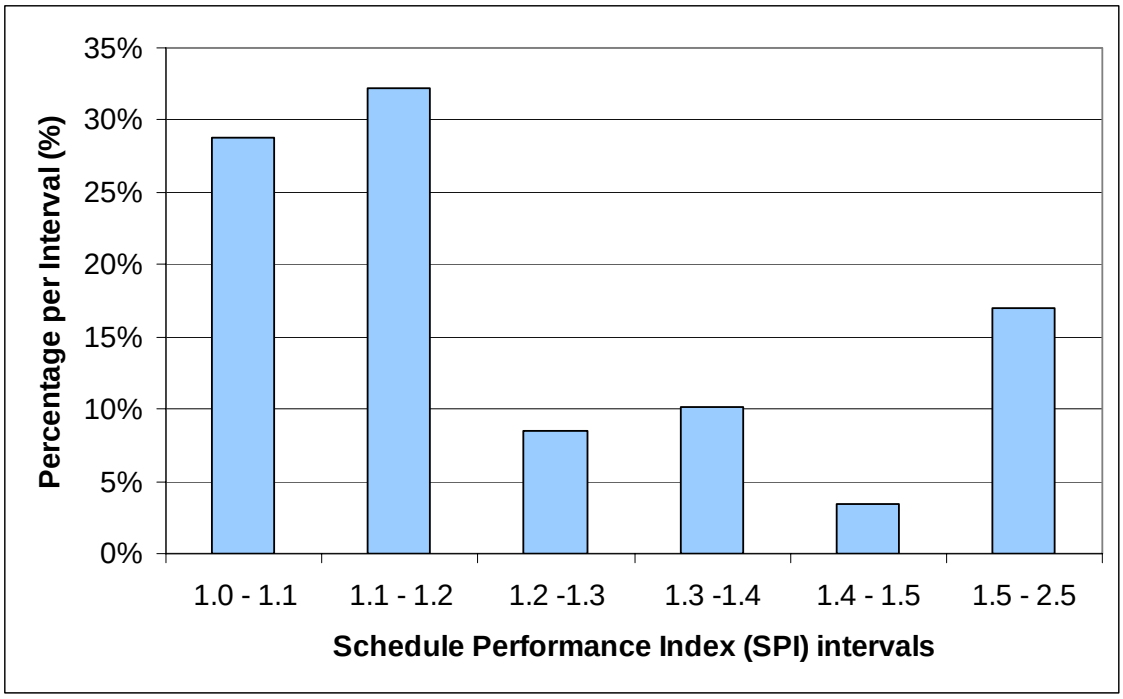


Figure 9: Absolute Schedule Performance



5.5. Statistical Correlation Analysis

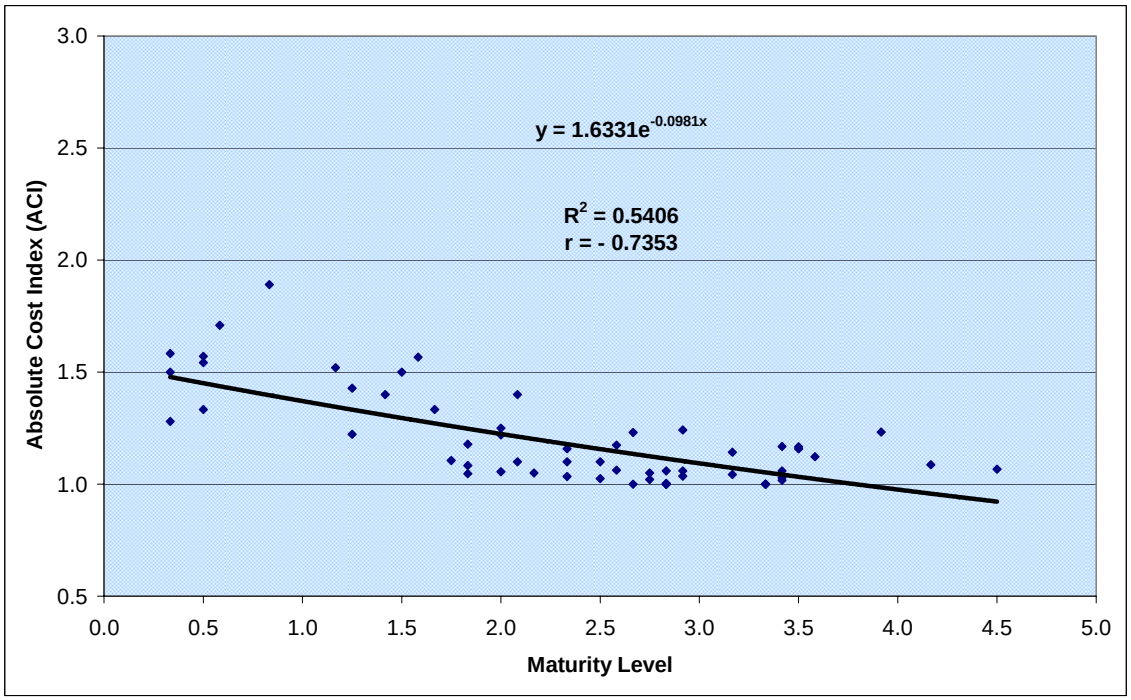
Regression analysis is the study of relationships between one or more variables. It is one of the most useful tools for a business analyst because it can be used to understand how the world operates, and it can be used for prediction (Albright, Winston and Zappe, 2006). Linear regression allows the analyst to estimate linear relationships. This means that that the relationships between variables are straight line relationships. The best way to begin any regression analysis is to generate scatter plots. If there is any relationship between the two variables, it is usually apparent from the scatter plot. The typical relationship viewed when there is linear relationship is a straight line.

Correlations are indicators of linear relationships. The scatter plots provide graphical indications of relationships, whether they are linear, nonlinear, or

essentially nonexistent. Correlations are numerical summary measures that indicate the strength of linear relationships between pairs of variables. A correlation between a pair of variables is a single number that summarises the information in a scatter plot. A correlation is very useful in the sense that it measures the strength of the linear relationship. The resulting statistic, called a correlation coefficient (r), is a number between -1 and +1; most correlation coefficients are decimals (either positive or negative) somewhere between these two extremes. The correlation coefficient indicates both the magnitude of the linear relationship and the direction of the relationship. The closer the correlation coefficient is to 1, the stronger is the correlation between the two variables. To determine the proportion of variance in one variable explained by the second variable, or vice versa, the coefficient of determination (R^2) were determined for each set.

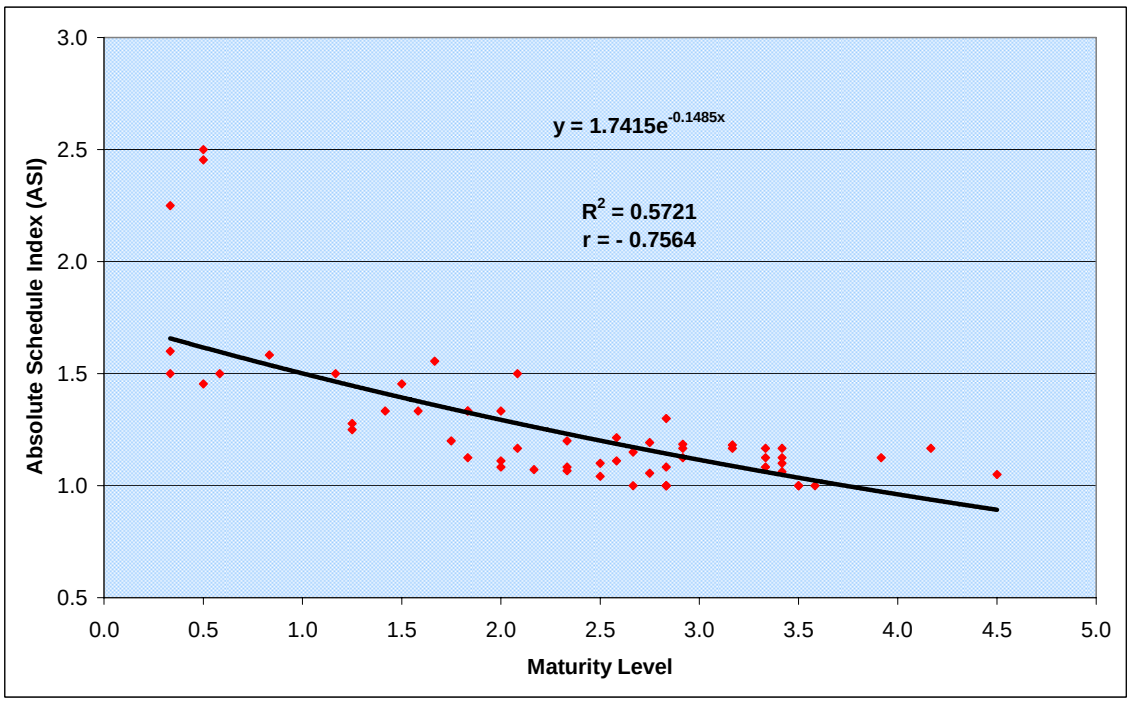
The data sets for the ACI and the PM Maturity and the ASI and the PM Maturity are shown in the scatter plots (Figure 10 and Figure 11). On the x-axis the perceived PM Maturity level is shown on a scale ranging from 1 to 5. On the y-axis either the ACI or ASI is shown, on a scale ranging from 0.5 to 3 although the absolute value will always be positive and therefore greater or equal to 1. Both graphs show a relative strong negative correlation, which indicates that the lower the maturity level the higher the ACI or ASI, and is also referred to as an inverse relationship. For the ACI the following equation was determined: $y = 1.6331e^{-0.0981x}$ The correlation coefficient is – 0.73 and the coefficient of determination are 0.54.

Figure 10: Correlation between ACI and PM Maturity



For the ASI the following equation was determined: $y = 1.7415e^{-0.1485x}$ The correlation coefficient is – 0.75 and the coefficient of determination are 0.57.

Figure 11: Correlation between ASI and PM Maturity



In statistics, a result is called significant if it is unlikely to have occurred by chance (Zikmund, 2002). A statistically significant difference simply means there is statistical evidence that there is a difference. The significance level of a test is the maximum probability, assuming the null hypothesis, that the statistic would be observed. Significance is usually represented by the Greek symbol, α (alpha). If a test of significance gives a p-value lower than the α-level, the null hypothesis is rejected. Such results are informally referred to as statistically significant. The descriptive statsistics for the two sets of data compared to the maturity level are shown in Table 8.

Table 8: Statistical Significance Analyses

	n	Mean	Standard deviation	r	R^2	Significance
ACI	59	1.20	0.21	0.74	0.54	t = 8.25 P>l t l = 0.01
ASI	59	1.26	0.31	0.76	0.57	t = 7.58 P>l t l = 0.01

For both ACI and ASI the statistical t-value is higher than the critical t-value. For the hypothesis test to be statistical significant at level 0.01, the statistical t-value must be higher than the critical t-value. At a significance level (α-level) of 0.01 the critical t-value is measured as 2.62. The calculated t-values far exceed the critical t-value for significance. The lower the significance level, the stronger the evidence.

5.6. Summary

This concludes the presentation of the data gathered during this project. In summary, data was gathered about the following aspects of the Survey:

- PM Maturity per organisation. This data was collected making use of a questionnaire,
- Actual project data per organisation.

The most significant data arose from the questionnaires concerning PM Maturity and actual project data per organisation. This data revealed the PM Maturity level for a specific organisation and assisted to determine the project performance per organisation making use of project performance indexes (cost and schedule) As a result of the data gathering activities, it was possible to determine the correlation between the PM Maturity level and project performance per organisation and it is possible to conduct an analysis of the findings in the next chapter. This analysis will be conducted against the background of the non-empirical research discussed in Chapter 2. Once this analysis has been completed conclusions will be drawn and a summary of findings presented.

6. DISCUSSION OF RESULTS

6.1. Introduction

The objective of this chapter is to analyse the data gathered during the empirical phase of this research project. The data presented in Chapter 5 represents information regarding PM Maturity levels, Actual Project Performance Data and Statistical Correlation Analysis.

This chapter will explore each of these areas in turn, using the findings from non-empirical research comprising this research project:

- PM Benchmarking,
- PMMM's and,
- Project Success and Failure.

This chapter is structured to address the hypothesis as described in Chapter 3 and will conclude with a summary of the analysis conducted.

6.2. Research Problem

Despite the broad usage of PM tools and practices across different industries, organisations are often confused, uncertain, and have difficulties locating their current application of PM (Kwak and Ibbs, 2002). Although most companies employ PM as a strategic tool to respond to this changing environment and to

outperform their competitors, the PM Maturity level and the Project Success rates for the particular company is not always known.

The process of bringing new projects on stream and into the market imposes demands on established organisations and necessitates different management techniques from those required to maintain day-to-day operations. These undertakings would call for more and faster decision making techniques, than possible in a normal operation and making the right choices will be critical to company success (Munns and Bjeirmi, 1996). Apart from this been known, not all companies know if their PM processes are adequate.

Hillson (2003) states that many businesses recognise PM as a core competence and seek to deliver benefits to the business through effective management of projects, but companies cannot always compare itself with best practice or its competitors because they don't know their PM Maturity level. For any company to understand if their PM process and practices are adequate, they need to understand what their PM Maturity level are and what benefit an improved level of PM Maturity will hold. Therefore the correlation between PM Maturity and Project Success needs to be understood.

6.3. Project Management Maturity versus Project Success

6.3.1. Project Management Maturity Analysis

Analysis is the application of reasoning to understand and interpret the data that have been collected (Zikmund, 2002). Making use of Kerzner's maturity model as discussed in Chapters 2 and 4, organisations from different industries were targeted to participate in the Survey. At the end 59 usable responses were received that represents 59 projects. The different organisations were assessed to determine their maturity level based on the shortened version of Kerzner's maturity model. Given the fact that that there are five defined maturity levels the average maturity level achieved in the surveyed organisations were a level 3.

Before drawing conclusions on the correlation between maturity levels and Project Success the various levels and organisations falling in that specific maturity level is analysed and discussed.

Level 1: Embryonic Phase

Looking at the data, it shows that 14% of the organisations surveyed are on a maturity level 1. To be on level 1, both middle management and senior management must recognise the need for, benefits of, and applications of PM. This recognition is more than simply providing "lip service" by telling people that PM should be used to achieve project objectives. Kerzner (2004) explains that senior management must understand that excellence in PM will affect the

corporate bottom line. Virtually no company anywhere in the world has made use of PM and then has given it up. The reason for this, according to Kerzner (2004), is that it works.

Once executives and managers realise that PM not only affects the corporate bottom line, (Net income is informally called the bottom line because it is typically found on the last line of a company's income statement), but also is a necessity for survival, the maturity process is accelerated. Unfortunately, it may take months or even years to recognise the true impact on the bottom line. Therefore companies at this level recognise the importance of PM and the need for a good understanding of the basic knowledge on PM, along with the accompanying language and terminology. As mentioned earlier only 14% of the companies surveyed are perceived to operate at this level and have therefore already realised the importance of project management.

Level 2: Executive Management Phase

In this phase, it is critical that executives visibly identify their support if the organisation is to become mature in PM. The key word here is "visibly." Before reaching this level, line management believed that PM support was simply lip service rather than reality. From the data, 19% of the surveyed organisations are at this level or phase.

The question in this phase is: how do executives convince lower-level personnel that they, the executives, actually understand PM? According to Kerzner (2004)

the best way is for the executives to function as a project sponsor. This not only demonstrates support for the process and a desire for PM Maturity, but it also shows an understanding of PM.

Kerzner (2004) states in explaining the various levels of his model that, lack of visible executive support is the biggest detriment to achieving maturity and excellence in PM. As an example Kerzner (2004, p36), mentioned that “during the 1980s and early 1990s, the telecommunications industry struggled with the problem of how to achieve maturity and excellence in PM without having visible executive support. In this industry, the top levels of management were politically astute, and executive-level appointments were based upon politics. As a result, senior managers were very reluctant to act as a project sponsor for fear that if they were the sponsor on a project that failed, it may be the end of their political career. Fortunately, this mentality is now changing, but at a slow pace. At level 2, organisations have informal PM processes in place and informal data collection takes place.

At industry level, the data shows that Construction, Services and Other sectors are at a level 2 on average. Although the number of projects for the various industries is fairly small, the surveyed data indicates that less focus on PM in these industries exists.

Level 3: Line Management Support

The third phase in Kerzner's maturity model is line management support. The biggest obstacle to obtaining line management support is the previous phase, executive management acceptance. Not many line managers will buy-in to PM, if the PM processes are not supported by their superiors. Line managers do not necessarily need a strong understanding of the PM tools, but they must understand the principles of PM since it is the line managers who are responsible for the staffing of the project (Kerzner, 2004). Understanding of the principles is a necessity for line managers to provide visible support and commitment for the process.

From the data 42% of the surveyed organisations operate at this level, which means that almost half of the organisations analysed have advanced to the third stage and that line management acceptance have been achieved. The data shows that the Engineering, Mining, Retail and IT sectors are on a level 3 which indicates that line management is supporting PM processes and are becoming willing to release employees for PM training. These organisations have more formal project planning and a system to control project management. Formal PM data are managed.

Level 4: Growth Phase

The fourth phase is the growth phase and 22% of the organisations operate in this phase. Although individual organisations have achieved PM Maturity level 3, no industry, on average operates on this level.

This phase can actually begin as early as the embryonic phase and run in parallel with the first three phases. However, the three preceding phases must be completed before this phase can be completed. Kerzner (2004) states that senior management's knowledge of PM and support can accelerate the growth phase. During the growth phase, PM systems are developed and refined for control and standardisation. Such systems reflect a company's commitment to quality and planning, as well as the need to minimize scope changes (also called scope creep). Scope creep results when features or functions are added to the project. Such changes drive up costs and lengthen the schedule. Although most scope creep changes are small, added together they can endanger the project. According to Kerzner (2004) there is a mistaken belief, that perfect planning can be achieved, thus eliminating scope creep. In excellent companies, scope creep is expected and planned for.

Organisations in this phase have selected a software package for project planning and control and they recognise that process improvement is necessary to maintain a competitive advantage. These organisations recognise the use of the life cycle phases and have developed a PM methodology. PM data and processes are integrated and PM processes data are quantitatively analysed, measured and stored.

Level 5: Maturity Phase

Although the Survey results show that only 3% of the organisations are in level 5, Kerzner (2004) states that most firms make it through the first four phases sooner or later. Kerzner (2004) states that, twelve to 24 months would be a reasonable time frame for aggressive companies to get into the growth phase. The maturity phase, as can be seen from the data analysed, is another story. The maturity phase mandates that the company understand the importance of integrating time and cost. Cost and schedule must be integrated to determine the status of a project (Griffith, 2005).

To integrate cost and schedule requires the use of earned value measurement. It means learning new systems and new practices, and even involves a change in culture. Since this phase is where the supporting tools are eventually put in place, there is also the risk that either excessive tools will be installed or overly heavy reliance will be placed upon the tools such that the tools are running the project (Kerzner, 2004).

The final item in the maturity phase is the development of a long-term educational program so that the organisation can maintain its maturity position. Without a sustained, long-term educational program, the organisation can revert from maturity to immaturity very quickly. Long-term educational programs to support PM demonstrate to employees that the organisation is committed to PM. In mature organisations, the best educational programs are those based on “lessons learned”. The project team is required to prepare a lessons learned file, which is then integrated into the appropriate training programs. This phase

focuses on continuous improvement and PM processes are fully understood and PM data are optimised and sustained.

6.3.2. Actual Project Data Analysis

Jugdev and Muller (2005) argue that several factors are involved when determining the success of a project. They are time, cost, scope and customer satisfaction. Success in projects has traditionally been defined as achieving the project's objectives within the following constraints (Kerzner, 2004): Allocated time, budget cost, desired performance at technical or specification level and quality standards as defined by the customers.

Two of the most important factors time and cost have been selected to determine or indicate the Project Success. To evaluate the project performance in terms of cost the ACI were used and to determine the performance in terms of time duration the ASI per project were determined, as discussed in Chapter 4. The results per project are shown in Appendix F. The closer ACI and ASI are to 1, the better the project performance or success.

Cost Performance Index

From the data shown in Chapter 5, 64% of the projects analysed fall within 20% of an ACI interval of 1.0. 44% of the projects fall within 10% of 1.0. This indicates that they come close to finish within budget and will be associated with successful projects pending the ASI rating. 36% of the projects fall outside an

index of 1.2, which means that the cost performance of these projects have been poor.

Schedule Performance Index

From the data shown in Chapter 5, 61% of the projects analysed fall within 20% of an ASI interval of 1.0. 29% of the projects fall within 10% of 1.0. This indicates that they come close to finish within the planned timeframe and will be associated with successful projects pending the ACI rating. 31% of the projects fall outside an index of 1.2, which means that the schedule performance of these projects have been poor.

When both indexes are taken into account only 20% or 12 of the 59 projects have an ACI and an ASI between 1.0 and 1.1. It is important to note that although some projects finish within budget they might not finish on time or visa versa. Also important to note is that some organisations prioritise either on cost performance or schedule performance.

6.3.3. Correlation Analysis

PM Maturity was statistically compared with actual project performance data using regression analysis to determine correlation coefficients. Regression analysis is the study of relationships between variables. It is one of the most useful tools for a business analyst because it can be used to understand how

the world operates, and it can be used for prediction (Albright, Winston and Zappe, 2006)

The correlation coefficient between ACI and the PM Maturity level is – 0.73. The closer the correlation coefficient is to 1, the stronger is the correlation between the variables. This means that there is a relatively strong inverse relationship between ACI and the PM Maturity level. That is, the greater the value measured by one variable, the less the value measured by the other variable. In terms of the data it implies that the higher the level of maturity the closer is the ACI to 1 and therefore the more successful is the project in terms of cost performance. In Figure 10 the correlation coefficient can be seen as well as the scatter diagram for this set of data.

The coefficient of determination is 0.54. The coefficient of determination measures that part of the total variance of one variable that is accounted for by knowing the value of the other variable. In the case of correlation between ACI and PM Maturity, where a relative strong correlation exists, about 54% of the variance in ACI can be explained the variance in PM Maturity level and vice versa. A coefficient of determination of 0.5 and greater indicates a strong correlation between the two variables and is significant.

The correlation coefficient between ASI and the PM Maturity level is – 0.76. The closer the correlation coefficient is to 1, the stronger is the correlation between the variables. This means that there is a relatively strong inverse relationship between ASI and the PM Maturity level. That is, the greater the value measured

by one variable, the less the value measured by the other variable. In Figure 11 the correlation coefficient can be seen as well as the scatter diagram for this set of data.

The coefficient of determination is 0.57. The coefficient of determination measures that part of the total variance of one variable that is accounted for by knowing the value of the other variable. In the case of correlation between ASI and PM Maturity, where a relative strong correlation exists, about 57% of the variance in ASI can be explained the variance in PM Maturity level and vice versa. A coefficient of determination of 0.5 and greater indicates a strong correlation and is significant.

As discussed in Chapter 5, the measurement instrument was proved to be valid and reliable, due to consistent results achieved and by making use of a proven reliable PM Maturity assessment questionnaire. It can therefore be seen that a strong correlation between ACI and the PM Maturity level exists as well as between the ASI and the PM Maturity level. This result was achieved through measuring the data with a reasonable degree of validity and reliability.

For both analyses when determining the correlation between maturity and project performance (ASI and ACI) the correlation coefficient indicated a strong inverse relationship, indicating that a higher maturity level result in a greater chance of Project Success. The regression for both was plotted on a scatter plot (Figure 10 and Figure 11) with a line fitted to observe the relationship. The goodness of the fit was determined through the coefficient of determination and

emphasised the relative strong correlation between PM Maturity and Project Success.

6.3.4. Reference to Literature Review

According to (Tobin, 2006) Benchmarking and Maturity are two key topics that measure world class performance and will either lead to success or failure. Kwak and Ibbs (1995), argues that Benchmarking is a continuous discovery process that opens the organisation to new and sometimes radical ideas that can play a pivotal role in improving effectiveness. Most of the organisations analised, operates at a maturity level 3 and only 3% at a level 5. The importance of Benchmarking is highlighted in the non-empirical research and the maturity models stipulates that to achieve level 5 of maturity, Benchmarking plays a key role.

The most common approach to PM benchmarking is through PMMM's. Maturity models are frameworks for helping organisations improve their processes and systems (Sonnekus and Labuschagne, 2004). These models attempt to measure an organisation's level of PM Maturity through a rating system based on the extent that different practices, processes, and skills are in place (Griffith, 2006).

According to Crawford (2006), the benefits of a structured assessment of PM Maturity lie in setting direction, prioritising actions, and beginning cultural change rather than in understanding the current level at which an organisation

is performing. The fact that the most common level of maturity achieved is level 3 emphasised the importance of a structured approach to analyse PM Maturity.

When a project fails it is not only because of poor project planning, a weak business case or lack of top management involvement and support, but also because of poor execution (Matta and Ashkenas, 2003). According to Jugdev and Muller (2005) our views of Project Success have changed over the years from definitions that were limited to the implementation phase of the project life cycle, to definitions that reflect an appreciation of success over the entire project and product life cycle. Jugdev and Muller (2005), argue that several factors are involved when determining the success of a project: time, cost, scope and customer satisfaction. When referring to the ACI and ASI for the various organisations a definite correlation between PM Maturity and Project Success is determined. This highlights the importance of PM Maturity. Kerzner (2004) argues we find this maturity concept being used increasingly to map out logical ways to improve an organisation's project performance.

6.3.5. Hypothesis Testing

The research motivation and problem statement for this study are presented in Chapter 1. The objective of this research was to prove that the correlation between an organisation's PM Maturity with the cost and schedule performance of its projects can be verified using a very simple and quick maturity assessment. The alternative hypothesis to be verified was that there is a correlation between PM Maturity and Project Success.

The correlation coefficients of the determined functions are such that the existence of the correlation can be considered verified and therefore it is concluded that the null hypothesis is rejected and the maturity assessment conducted with 59 projects in different industries has verified the alternative hypothesis.

6.4. Summary

The analysis presented in this chapter has demonstrated that there is a definite correlation between PM Maturity levels and Project Success. The objective of this chapter was to analyse the data, which was gathered during the empirical phase of the research, as presented in Chapter 5. Having completed that analysis, the next chapter will be devoted to some final conclusions, recommended actions and possible areas for future research.

7. CONCLUSION

7.1. Introduction

This chapter revisits the main research problem as outlined in Chapter 1, presents a number of recommendations arising from the research, and then indicates possible areas for further research identified during this project.

7.2. Answering the Research Problem

The main objective of the research was to determine the PM Maturity and success levels of organisations and to determine the correlation between them.

Non-empirical research into the fields of PM Benchmarking, PM Maturity and Project Success were used to motivate the findings of the empirical research. The non-empirical research emphasise the fact that organisations must monitor current performance and establish programs of improvement that continuously enhance the performance of their organisations. This can be achieved through benchmarking that recognises and addresses the fact that you cannot effectively manage what you cannot measure.

The foundation for achieving excellence in PM can best be described as the PMMM, which comprises of five levels. Each of the five levels represents a different degree of maturity in PM. For an organisation to move from level 1 to level 5, the organisation must first realise the need for PM and understand the benefits and application of PM. Executive and line management acceptance

plays a key role in moving from level 1 to level 5. Organisations at level 5 have developed an integrated cost and schedule control system and believe in organisational development by developing PM skills within the organisation.

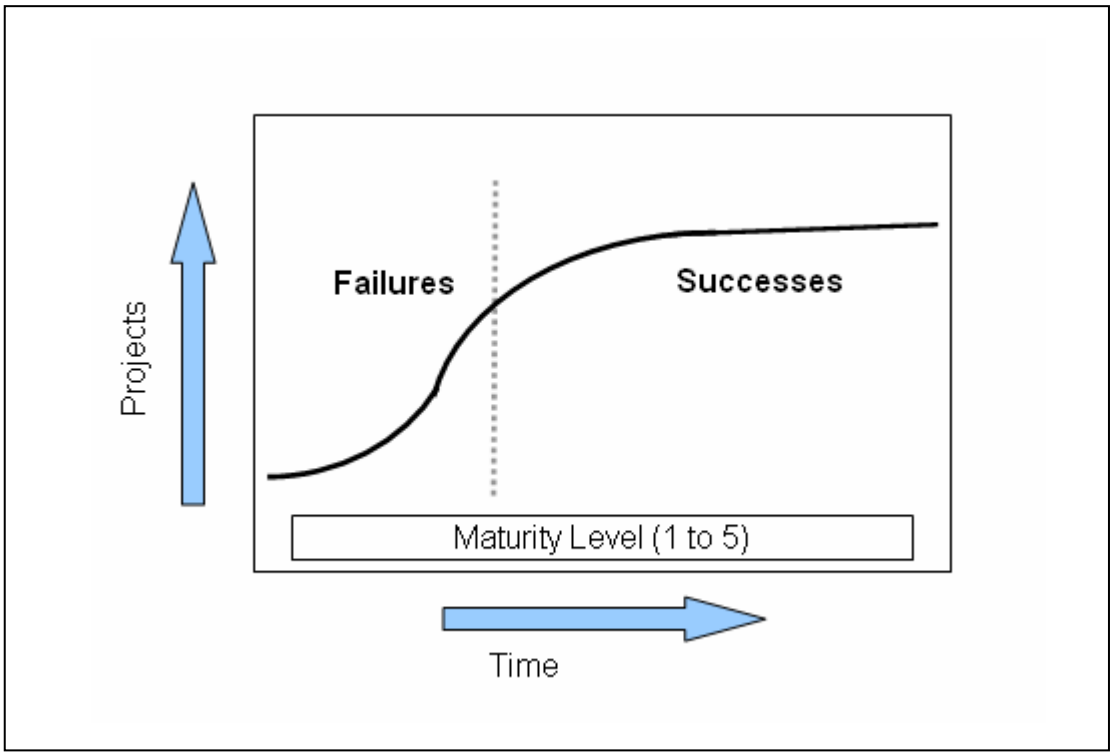
During the Survey research, a simple and quick maturity assessment procedure, using questionnaire based on a proven PMMM, has been pre-tested and utilized to determine the PM Maturity level of South African organisations involved in PM. The PM Maturity assessment was not a detailed assessment of the relevant organisations and was based on the individual's perception of the organisation's maturity level. Although this was identified as a limitation, the data collected was reliable and valid. Apart from completing a questionnaire, respondents were asked to provide actual project information of recently completed projects to determine their project performance.

The validity and reliability of the assessment has been proven with the confirmation of a correlation between the PM Maturity level and the project performance criteria (ACI and ASI) for the various organisations.

Based on the results from the data analysis it is clear that improving an organisations level of PM Maturity results in organisational project performance improvements. Although most surveyed organisations are at a level 3 PM Maturity level, 3% of the surveyed organisations are at a level 5 maturity level. This implies that level 5 or PM Maturity is achievable and improving the level of project management maturity results in significant project performance improvements. To illustrate this graphically, it is shown in Figure 12 that as the

PM Maturity level increases over time, the organisation will deliver more successful projects and fewer failures.

Figure 12: Project Success Rate versus PM Maturity



7.3. Recommendations

For an organisation to reach PM Maturity the organisation needs to adopt a proven PM system and use it consistently. The organisation must be able to assess its maturity through the system and conduct regular audits to understand the current level of maturity. Together with the PM system the organisation must implement a philosophy that drives it towards PM success. In other words the organisation must set objectives to be achieved that is

measurable and will drive performance. A SWOT (Strength, weakness, opportunity and threats) analysis might assist with the initial assessment.

A serious commitment to project planning at the start of a project is critical and will assist in minimising scope changes during the project. If the organisation commit to proper planning, realistic objectives can be set. Another crucial part of the planning phase is to implement PM software as a tool rather than as a substitute for effective planning and effective communication. During the planning or start-up phase of a project it's recommended that the project team discuss and consider lessons learned from previous projects.

The selection of the right people as project managers plays a critical role in implementing the PM processes and it's recommended that a proper recruitment strategy is implemented to ensure that the right people are recruited, not only as project managers, but also as project team members. Apart from people selection, executives must strengthen the involvement of line managers and support their efforts. Senior managers must share recognition for successful projects with the entire team and line managers. The organisation must strive to cultivate and reward effective communication, cooperation and trust.

To measure project performance or success a cost and schedule control system must be developed to track performance. Apart from tracking the performance and understanding that the cost and schedule performance are inseparable, only the critical information must be provided to the project

sponsor. This will enable him to focus on the critical success factors and to identify and solve problems early and cost effectively.

The maturity assessment tool used in the research does not provide a detail assessment and its recommended that a more detailed PM Maturity assessment tool is utilized, that will provide information not only related to five levels of progressive maturity, but also to the nine knowledge areas of project management identified by the PMI as key to Project Success:

- Project Integration Management
- Project Scope Management
- Project Time Management
- Project Cost Management
- Project Quality Management
- Project Human Resource Management
- Project Communications Management
- Project Risk Management
- Project Procurement Management

7.4. Future Research

A limitation to the research was the fact that the research only focused on South African companies. Apart from the fact that the sample is relatively small, not all industries were represented. Taking these limitations into account, the research findings can be used to compare to results with similar surveys conducted. The focus should be on understanding the differences, and reasons thereof,

between the surveys. This will provide a more in-depth understanding of the key drivers of Project Success for each PM maturity level.

The research aimed to understand the correlation between PM Maturity and Project Success. For future research the study can be developed further to justify the investment in PM, with specific reference to sound scheduling practices. The findings of this study helped to support the fact that proper planning contribute to Project Success and are therefore worth the money and effort invested. PM professionals should use the findings of the study to develop a proper benchmarking model with regards to scheduling practices, to be used within the particular organisation. The model can further be developed to integrate cost performance. This will enable the organisation to not only measure PM Maturity, but also to benchmark scheduling and costing practices.

7.5. Summary

This final chapter has reviewed the extent to which the original research problem was addressed, as well as discussing a number of recommendations for the improved use of PM Maturity models and processes. In addition, a number of areas for possible future research have been identified and discussed, arising from this research project.

8. REFERENCES

Albright, S.C. Winston, W.L. Zappe, C. (2006) *Data Analysis & Decision Making*. Mason: Thomson South-Western.

Baccarini, D. (1999) The logical framework method for defining project success. *Project Management Journal*, 30(4), 25 – 32.

Cabanis, J. (1998) Show me the money: A panel of experts dissects popular notions of measuring project management maturity. *PM Network,* 12 (9), 53 - 60.

Center of Business Practices (2006) *Project Management Maturity: A Benchmark of Current Best Practices* [Online] Available: www.CBPonline.com [Accessed: 27 October 2007].

Cooke-Davies, T.J. and Arzymanow, A. (2003) The maturity of project management in different industries: An investigation into variations between project management models. *International Journal of Project Management,* 21, 471 – 478.

Crawford, J.K. (2006) The project management maturity model. *Information Systems Management*, 23(4), 50 – 58.

Dinsmore, P.C. (1998) How grown-up is your organization? *PM Network,* 12 (6), 24 – 26.

Griffith, A.F. (2006) Improving Project System Performance through Benchmarking. *Proceedings of the PMI global congress,* Madrid, Spain.

Hillson, D. (2003) Assessing organizational project management capability. *Journal of Facilities Management*, 2(3), 298 – 311.

Jugdev, K. and Müller, R. (2005) A retrospective look at our evolving understanding of project success. *Project Management Journal,* 36(4), 19 – 31.

Jugdev, K. and Thomas, J. (2002) Project Management Maturity Models: The Silver Bullets of Competitive Advantage? *Project Management Journal*, 33(4), 4 – 14 .

Kerzner, H.K. (2004) *Advanced project management.* USA: John Wiley & Sons, Inc.

Kwak, Y.H. and Ibbs, C.W. (1995) *Financial and organisational impacts of project management*. University of California, Berkley, USA.

Kwak, Y.H. and Ibbs, C.W. (2000) *The Berkeley project management process maturity model: Measuring the value of project management*. IEEE EMS Int. Engineering management conference, 1 – 5.

Kwak, Y.H. and Ibbs, C.W. (2002) Project Management process maturity $(PM)^2$ model. *Journal of management and engineering,* 18(3), 150 – 155.

Leedy, P.D. and Ormrod, J.E. (2001) *Practical research: planning and design 7th edition.* New Jersey: Merrill Prentice – hall.

Matta, N.F. and Ashkenas, R.N. (2003) *Why good projects fail anyway.* Harvard: HBR Onpoint collection.

Munns, A.K. and Bjeirmi, B.F. (1996) The role of project management in achieving project success. *International Journal of Project Management,* 14(2), 81 – 87.

Oni, A (2007) The operation was successful but the patient died. St. Albert, AB: Centre for Innovative Management, Athabasca University.

Paulk, M.C. Weber, C.V. Garcia, S.M. Chrissis, M.B. and Bush, M. (1993) *Key Practices of the Capability Maturity Model.* Pittsburgh: CMU/SEI-93-TR-25.

Pennypacker, J.S and Grant, K.P. (2003) Project Management Maturity: An Industry Benchmark. *Project Management Journal*, 34(1), 4 – 11.

Pinto, J.K. and Kharbanda, O.P. (1996) How to fail in project management without really trying. *Business horizons*, Jul/Aug, 39 (4), 45 – 55.

Project management institute. (2007) *List of benchmarking articles.* [Online] Available: http://www.pmi.org/prod/groups/public/documents/info/search_result.asp?query=benchmarking [Accessed 15 February 2007].

Pricewaterhousecoopers (2004) *Boosting business performance through programme and project management*. Connectedthinking.

Project Management Institute, (2004) A guide to the Project Management Body of Knowledge, third Edition. USA: PMI Publications.

Rao, R. (2005) Implementing OPM3 – The challenges and next steps. *PMI global congress*, Toronto, Canada.

Rose, K.H. (2004) Organisational project management maturity model. *Project Management Journal*, 35(1), 59.

Rubinstein, D. (2007) *Standish Group Report: There's Less Development Chaos Today.* [Online] Available: www.sdtimes.com/article/story-20070301-01.html [Accessed 1 September 2007].

Schiltz, S.J. (2003) *A practical method for assessing the financial benefit of project management*. A thesis submitted in partial fulfillment of the requirements for the degree Master of Science, Graduate School of Business & Management of City University, London.

Skulmoski, G. (2001) Project Maturity and Competence Interface. *Cost Engineering*, 43(6), 11-18.

Sonnekus, R. and Labuschagne, L. (2004) Establishing the relationship between IT project management maturity and IT project success in a South African context, *Proceedings of the 2004 PMSA International conference*, Johannesburg, SA.

Standish Group (1994) *The CHAOS report - 1994.* [Online] Available: www.projectsmart.co.uk/docs/chaos-report.pdf [Accessed: 21 October 2007].

Standish Group. (2001) *Standish Group CHAOS Top 10.* [Online] Available: http://blogs.infosupport.com/richardz/archive/2006/06/11/Standish-Group CHAOS-TOP-10-_2D00_-2001.aspx [Accessed: 27 October 2007].

Tobin, P.K.J. (2004) World – class knowledge management: a proposed framework. *South African Journal of Information Management.*

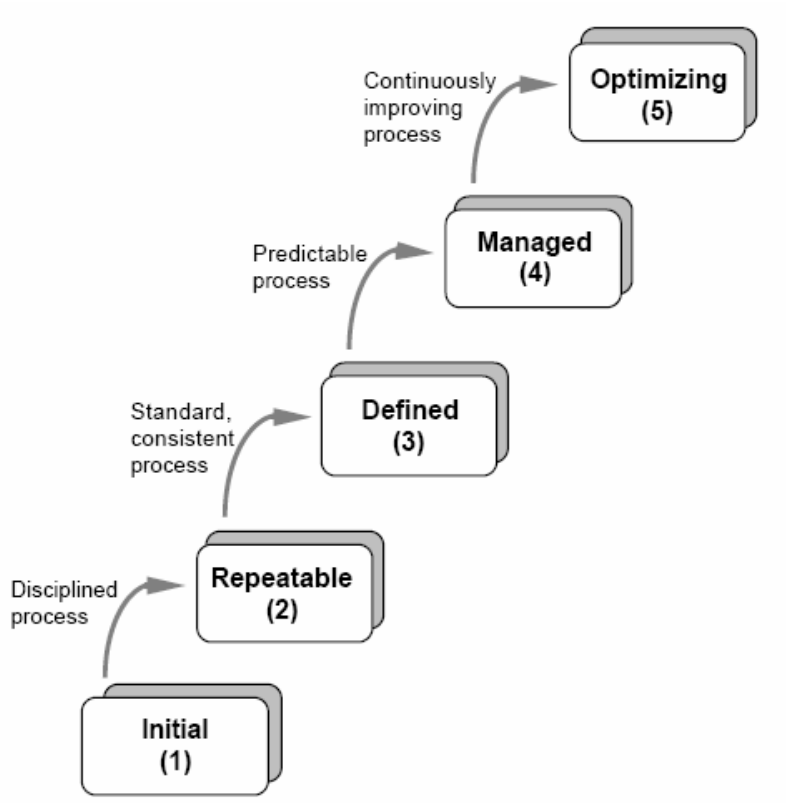
Tobin, P.K.J. (2006) *The use of stories and storytelling as knowledge sharing practices: a case study in the South African mining industry.* A thesis submitted in partial fulfillment of the requirements for the degree Doctor Philosophiae (Information Science) in the Faculty of Engineering, Built Environment and Information Technology, University of Pretoria, Pretoria.

Zikmund, W.G. (2002) *Business Research Methods*. Ohio, USA: Thomson South-Western.

APPENDIX A - Comparing different PMMM's (Kwak & Ibbs, 2000)

Comparing Different Project Management Maturity Models	Software Engineering Institute's Capability Maturity Model	McCauley's Project Management Maturity Model	Hinks IT and Process model	Fincher's Project Management Maturity Model	Microframes Project Management Maturity Model	Dooley's New Product Development Maturity Model	Berkeley's Project Management Process Maturity (PM)2 Model.
Primary Targeted Disciplines	Software Development	Project Management	Engineering and Construction	Project Management	Project Management	New Product Development	Project Management
Level of Maturity	1 TO 5	1 TO 5	1 TO 5	1 TO 5	1 TO 5	Unclear	1 TO 5
Level of Detail	High	Low	Medium	Low	Medium	Medium	High
Evaluating Organisational Effectiveness	Yes	Yes	Yes	Yes	Yes	YES	YES
Evaluating Financial Effectiveness	No	No	No	No	No	No	YES
Evaluate Maturity by Processes and Project Phases	No	No	No	No	No	No	YES
Compare and Correlate with Actual Project Performance	Yes	No	No	No	Unclear	No	YES
Derive Return on Investment (ROI) Calculations	No	No	No	No	No	No	YES
Applied to actual organisations	Yes (Successful)	No	No	No	Unclear	YES	Yes (Successful)
Commitment for Continuous Improvement	Yes	Unclear	Unclear	Unclear	Unclear	Unclear	YES
Potential Impact on Project Management Community	High	Medium	Medium	Medium	Medium	Medium	Very High

APPENDIX B - CMM Maturity Levels (Paulk et al., 1993)



The levels (for software development) are defined as follows (Paulk et al., 1993):

Level 1 – Initial Level: The organisation does not provide a stable environment for software development. Project success depends on having good software managers or teams.

Level 2 – Repeatable Level: At the repeatable level, the organisation establishes basic guidelines for managing the software project and its various procedures.

Level 3 – Defined Level: The organisation has a formally documented standard process for developing and maintaining software engineering and management.

Level 4 – Managed Level: At the managed level, the organisation sets quantitative goals for both software products and processes. They have a predictable process.

Level 5 – Optimising Level: The entire organisation is focused on continuous process improvement. Software processes are evaluated to prevent known types of defects from recurring and lessons learned are spread to other projects.

APPENDIX C - Kerzner's Maturity Levels (Kerzner, 2004)

Level 1 – Common Language: The organisation recognises the importance of PM and the need for a good understanding of the basic knowledge on PM, along with the accompanying language and terminology.

Level 2 – Common Processes: At his level, the organisation recognises that common processes need to be defined and developed such that project successes on one project can be repeated on other projects. Also included in this level is the recognition that PM principles can be applied to and support other methodologies by the company.

Level 3 – Singular Methodology: In this level, the organisation recognises the synergistic effect of combining all corporate methodologies into a singular methodology, the center of which is PM. The synergistic effects also make process control easier with a single methodology than with multiple methodologies.

Level 4 – Benchmarking: This level contains the recognition that process improvement is necessary to maintain a competitive advantage. Benchmarking must be performed on a continuous basis. The company must decide whom to benchmark and what to benchmark.

Level 5 – Continuous Improvement: At this level, the organisation evaluates the information obtained through benchmarking and must then decides whether or not this information will enhance the singular methodology.

APPENDIX D - Introductory Letter

To whom it may concern

I am a student in the Masters of Business Administration program at Gordon Institute of Business Science (GIBS), University of Pretoria and I am currently working on my research project with the title “Project management maturity versus Project Success in South African companies”

Making use of Kerzner’s Project Management Maturity Model (PMMM) questionnaire, I intend to determine a correlation between an organisations’ Project Management Maturity (PMM) and their ability to meet schedule and cost goals in projects. The results of my study only have statistical significance if as many organisations as possible participate in this Survey. I would therefore be extremely grateful if you accepted to contribute no more than 10 minutes of your time to this study. I would like to ask you to:

- Identify one or more projects that was completed within the past 24 months, performed within your organisation or which your organisation was involved in.
- For each of these projects, indicate the original budget and planned duration (in months) at project launch, as well as the actual costs and duration (in months) at completion in the attached table.
- Distribute the attached questionnaire to: two project (core) team members per participating project.

You may use fictitious project and respondent names, but please use them consistently so that I can match the responses. All information provided to me will be held strictly confidential. My research will not relate participating organisations to the results of PMM assessments.

Please feel free to copy this letter as well as the attached questionnaire and distribute it to interested colleagues within and outside your organisation and encourage them to participate. Every contribution is greatly appreciated.

Regards,

Andre Roux

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Fax: + 27 (11) 688 4127

Email: Andre.Roux2@bhpbilliton.com

APPENDIX E - PM Maturity Questionnaire (Kerzner, 2004)

On the next several pages you will find 20 questions concerning how mature you believe your organisation to be. As part of the questionnaire you are also requested to indicate some actual project related information in the following table.

Actual Project Data:

Project Name	Original Budget	Planned duration	Actual Cost	Actual duration

Beside each question you need to indicate the number that corresponds to your opinion. In the example below your choice would have been “Slightly Agree.”

-3 Strongly Disagree

-2 Disagree

-1 Slightly Disagree

(+1) Slightly agree

+2 Agree

+3 Strongly Agree

Example: (-3, -2, -1, 0, +1, +2, +3)

The row of numbers from -3 to +3 will be used later for evaluating the results. After answering question 20, you will grade the exercise.

The following 20 questions involve maturity. Please answer each question as honestly as possible. Circle the answer you feel is correct, not the answer you think the instructor is looking for.

1. My company recognises the need for project management. This need is recognised at all levels of management, including senior management.

   -3 -2 -1 0 +1 +2 +3

2. My company has a system in place to manage both cost and schedule. The system requires charge numbers and cost account codes. The system reports variances from planned targets.

   -3 -2 -1 0 +1 +2 +3

3. My company has recognised the benefits that are possible from implementing project management. These benefits have been recognised at all levels of management, including senior management.

   -3 -2 -1 0 +1 +2 +3

4. My company (or division) has a well definable project management methodology using life cycle phases.

   -3 -2 -1 0 +1 +2 +3

5. Our executives visibly support project management through executive presentations, correspondence, and by occasionally attending project team meetings/ briefings

-3 -2 -1 0 +1 +2 +3

6. My company is committed to quality up-front planning. We try to do the best we can at planning.

-3 -2 -1 0 +1 +2 +3

7. Our lower- and middle-level line managers totally and visibly support the project management process.

-3 -2 -1 0 +1 +2 +3

8. My company is doing everything possible to minimise "creeping" scope (i.e., scope changes) on our projects

. -3 -2 -1 0 +1 +2 +3

9. Our line managers are committed not only to project management, but also to the promises made to project managers for deliverables.

. -3 -2 -1 0 +1 +2 +3

10. The executives in my organisation have a good understanding of the principles of project management.

-3 -2 -1 0 +1 +2 +3

11. The executives in my organisation have a good understanding of the principles of project management.

-3 -2 -1 0 +1 +2 +3

12. Our lower - and middle – level line managers have been trained and educated in project management.

-3 -2 -1 0 +1 +2 +3

13. Our executives both understand project sponsorship and serve as project sponsors on selected projects.

-3 -2 -1 0 +1 +2 +3

14. Our executives have recognised or identified the applications of project management to various parts of our business.

-3 -2 -1 0 +1 +2 +3

15. My company has successfully integrated cost and schedule control together for both managing projects and reporting status.

-3 -2 -1 0 +1 +2 +3

16. My company has developed a project management curriculum (i.e. , more than one or two courses) to enhance the project management skills of our employees.

-3 -2 -1 0 +1 +2 +3

17. Our executives have recognised what must be done in order to achieve maturity in project management.

-3 -2 -1 0 +1 +2 +3

18. My company views and treats project management as a profession rather than a part – time assignment.

-3 -2 -1 0 +1 +2 +3

19. Our lower- and middle-level line managers are willing to release their employees for project management training.

-3 -2 -1 0 +1 +2 +3

20. Our executives have demonstrated a willingness to change our way of doing business in order to mature in project management.

-3 -2 -1 0 +1 +2 +3

Note: An example of the actual questionnaire that was send to participants are shown below, with the 20 questions as listed previously.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Project management maturity questionnaire

GORDON INSTITUTE OF BUSINESS SCIENCE
University of Pretoria

Below you will find 20 questions concerning how mature you believe your organisation to be, from a project management point of view.Please indicate your choice by selecting only one option per question. As part of the questionnaire you are also requested to indicate some actual project related information in the table shown.

Nr	Question	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1	My company recognises the need for project management. This need is recognised at all levels of management, including senior management.	☐	☐	☐	☐	☐	☐
2	My company has a system in place to manage both cost and schedule. The system requires charge numbers and cost account codes. The system reports variances from planned targets.	☐	☐	☐	☐	☐	☐
3	My company has recognised the benefits that are possible from implementing project management. These benefits have been recognised at all levels of management, including senior management.	☐	☐	☐	☐	☐	☐
4	My company (or division) has a well definable project management methodology using life cycle phases.	☐	☐	☐	☐	☐	☐
5	Our executives visibly support project management through executive presentations, correspondence, and by occasionally attending project team meetings/briefings	☐	☐	☐	☐	☐	☐
6	My company is committed to quality up-front planning. We try to do the best we can at planning.	☐	☐	☐	☐	☐	☐
7	Our lower- and middle-level line managers totally and visibly support the project management process.	☐	☐	☐	☐	☐	☐
8	My company is doing everything possible to minimise "creeping" scope (i.e., scope changes) on our projects	☐	☐	☐	☐	☐	☐
9	Our line managers are committed not only to project management, but also to the promises made to project managers for deliverables.	☐	☐	☐	☐	☐	☐
10	The executives in my organisation have a good understanding of the principles of project management.	☐	☐	☐	☐	☐	☐
11	My company has selected one or more project management software packages to be used as the project tracking system.	☐	☐	☐	☐	☐	☐
12	Our lower - and middle – level line managers have been trained and educated in project management.	☐	☐	☐	☐	☐	☐
13	Our executives both understand project partnership and serve as project partners on selected projects.	☐	☐	☐	☐	☐	☐
14	Our executives have recognised or identified the applications of project management to various parts of our business.	☐	☐	☐	☐	☐	☐
15	My company has successfully integrated cost and schedule control together for both managing projects and reporting status.	☐	☐	☐	☐	☐	☐
16	My company has developed a project management curriculum (i.e., more than one or two courses) to enhance the project management skills of our employees.	☐	☐	☐	☐	☐	☐
17	Our executives have recognised what must be done in order to achieve maturity in project management.	☐	☐	☐	☐	☐	☐
18	My company views and treats project management as a profession rather than a part – time assignment.	☐	☐	☐	☐	☐	☐
19	Our lower- and middle-level line managers are willing to role-are their employees for project management training.	☐	☐	☐	☐	☐	☐
20	Our executives have demonstrated a willingness to change our way of doing business in order to mature in project management.	☐	☐	☐	☐	☐	☐

APPENDIX F - ACI, ASI and Maturity level per Project

Nr.	Industry	ACI	ASI	Maturity
1	Mining	1.06	1.06	3.42
2	IT	1.17	1.10	3.42
3	IT	1.02	1.13	3.42
4	IT	1.03	1.17	3.42
5	IT	1.23	1.13	3.92
6	Engineering	1.22	1.25	1.25
7	Mining	1.06	1.21	2.58
8	Mining	1.00	1.00	2.83
9	Mining	1.00	1.00	2.83
10	Mining	1.00	1.00	2.83
11	Retail	1.17	1.11	2.58
12	Mining	1.06	1.30	2.83
13	Other	1.25	1.11	2.00
14	IT	1.00	1.08	3.33
15	Other	1.04	1.19	2.92
16	Other	1.06	1.13	2.92
17	Services	1.18	1.13	1.83
18	Services	1.08	1.33	1.83
19	Services	1.05	1.33	1.83
20	Mining	1.12	1.00	3.58
21	Engineering	1.24	1.17	2.92
22	Engineering	1.03	1.10	2.50
23	Engineering	1.00	1.08	2.83
24	Other	1.50	1.60	0.33
25	Other	1.28	2.25	0.33
26	Other	1.58	1.50	0.33
27	Engineering	1.10	1.04	2.50
28	Construction	1.16	1.20	2.33
29	Construction	1.10	1.17	2.08
30	Construction	1.40	1.50	2.08
31	Mining	1.05	1.07	2.17
32	Other	1.05	1.06	2.75
33	Other	1.40	1.33	1.42
34	Mining	1.03	1.08	2.33
35	IT	1.50	1.45	1.50
36	IT	1.57	1.33	1.58
37	Engineering	1.02	1.19	2.75
38	Other	1.14	1.18	3.17
39	Other	1.09	1.17	4.17
40	Engineering	1.52	1.50	1.17
41	Engineering	1.07	1.05	4.50
42	IT	1.04	1.17	3.17
43	Mining	1.17	1.00	3.50
44	Mining	1.16	1.00	3.50
45	Other	1.71	1.50	0.58
46	Engineering	1.22	1.33	2.00
47	Engineering	1.06	1.08	2.00

48	Engineering	1.33	1.56	1.67
49	Mining	1.10	1.07	2.33
50	Other	1.11	1.20	1.75
51	IT	1.89	1.58	0.83
52	Engineering	1.00	1.13	3.33
53	Engineering	1.00	1.17	3.33
54	Engineering	1.23	1.15	2.67
55	Engineering	1.00	1.00	2.67
56	Construction	1.43	1.28	1.25
57	Engineering	1.33	2.45	0.50
58	Engineering	1.54	2.50	0.50
59	Engineering	1.57	1.45	0.50