The contribution of the project management office to project delivery in the consulting engineering industry

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ABSTRACT

Effective project management (PM) is increasingly required for strategy implementation, business transformation management, continual improvement and pioneering product development and service provision. The systematic approach of PM (based on best practices and experience) aims to improve the chances of project success in a competitive environment where scarce resources (capital, human, opportunity, time, etc.) needs to be utilized most effectively.

The contribution a project management office (PMO) can make in the medium sized consulting engineering industry to deliver more successful projects was investigated. The investigation involved determining the current state of both PM and PMO maturity in medium sized consulting engineering organisations in South Africa. Furthermore, the required maturity, or level of development, of PM and PMOs were also determined using the prediction orientated Delphi survey method.

In the literature study, the concepts of PM, PMO and their maturity determination, successful project delivery, background to the consulting engineering industry in South Africa and similar PM and PMO maturity studies were investigated. From the literature study, an existing maturity survey was selected for each of the concepts PM and PMO.

These existing and tested maturity surveys were combined into a single survey. Some demographic information deemed applicable from the literature study was also included in the survey and distributed in a multi-round survey to medium sized organisations similar to the author's organisation, operating in the mining and energy sectors mainly. The current PM and PMO maturity of the organisations taking part in the survey were determined in round 1 of the survey. The required PM and PMO maturity were determined from the round 2 survey results that were completed after the respondents were provided with the round 1 survey statistically averaged maturity levels in an effort to reach a form of consensus amongst the respondents. The round 1 survey was distributed to 161 respondents (response rate of 53%). Round 2 was distributed to the 86 respondents that completed round 1 (response rate of 55%).

From the survey results and literature study it was found that there is a definite increase in PM and PMO maturity required in order for medium sized consulting

engineering organisations to deliver more successful projects in the mining and energy sector. It was also seen that the maturity levels required for both PM and PMO are not the maximum maturity levels possible. From the empirical study, a definite relationship between PMO and PM was confirmed and it was seen that generally an organisation with a PMO tends to have higher PM maturity levels. For a PMO to be successful, from literature it was seen that the PMO needs to adapt to the organisation and environment it functions in. It was also discovered that a PMO is successful if it reaches the goals it set for itself. The PMO also contributes by systematically and continuously improving and adapting the PM of the company to add the most value to both internal and external customers of the PMO.

It is the researcher's opinion that the study is not representative of all medium sized consulting engineering organisations in SA and further research is required to determine industry specific PM and PMO maturity levels and to determine the resulting contribution a PMO can make in this regard.

Key terms: project management office (PMO), project management (PM), PM maturity, PMO maturity, PMO functionality

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"Therefore I do not run like a man running aimlessly; I do not fight like a man beating the air. No, I beat my body and make it my slave so that after I have preached to others, I myself will not be disqualified for the prize." 1 Corinthians 9:26-27 (Bible, 1995).

I would like to express my appreciation and thanks to the following people and organisations for their support during the past three years:

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Although we were taught many new skills and gained a lot of business knowledge, the realisation of the primary importance of time spent with loved ones and starting to discover the difference between urgent and important, I treasure the most.

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LIST OF ACRONYMS

CAPM: Certified Associate in Project Management

CEO: Chief Executive Officer

CESA: Consulting Engineers South Africa

CMM: Capability Maturity Model

ISO: International Organisation for Standardization

OPM3: Organisational Project Management Maturity Model

PgMP: Program Management Professional

PM: Project Management

PMBOK®: Project Management Body Of Knowledge

PMI: Project Management Institute

PMI-ACP: PMI Agile Practitioner

PMI-RMP: PMI Risk Management Professional

PMI-SP: PMI Scheduling Professional

PMIS: Project Management Information System

PMMM: Project Management Maturity Model

PMO: Project Management Office

PMP: Project Management Professional

PRINCE®: Projects in Controlled Environments

QMS: Quality Management System/s

SA: South Africa

SEI: Software Engineering Institute

SWOT: Strength, Weaknesses, Opportunities and Threats

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CHAPTER 1: NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

In recent years project management (PM) have been used increasingly for implementation of new strategies, management of business transformation, constant improvement and innovative product development and service delivery (Winter *et al.*, 2006:638).

Sub-Saharan African countries' wealth of minerals such as gold, platinum, diamonds and numerous other commodities resulted in both local and international businesses being established. This has and will continue to lead to economic, skills and technology development in traditionally impoverished communities (Mittermaier & Steyn, 2009:96). Companies ranging from small local specialist consulting engineering firms to large international mining houses form the landscape that harness the potential value of the natural resources. The more value that can be added locally increases the potential yield from the available natural resources.

Another big international focus is energy/power generation and effective harnessing of the generated power while conserving the environment. Locally, Eskom is developing the world's largest dry cooled power station (Medupi) (Eskom, 2013a) and one of the world's largest coal-fired power stations (Kusile, more than R170 billion project) (Eskom, 2013b). These mega-projects will be constructed in a dynamic international environment where sustainable development is required (environment conservation and social responsibility) in addition to economic considerations (IOD, 2009). The last power stations built in South Africa in the late 1980's were not subject to these constraints. Eskom plans to grow its capacity expansion projects to more than a trillion Rand by 2026 (Eskom, 2013c).

For African countries to attract international investments and to competitively engage the international market, successful project completion/delivery is essential in this dynamically changing environment. Marnewick and Labuschagne (2010:249) developed a holistic framework to assist in understanding the factors that influence organisations to successfully deliver projects through applying project management.

Two of the guiding organisational mechanisms for project managers are the Project Management Office (PMO) and the current project management maturity level of a company. These concepts are discussed in more detail in the following sections.

1.2 PROBLEM STATEMENT

1.2.1 Project management and project management maturity

Internationally it is estimated that between 2010 and 2020, one fifth of the world's annual gross domestic product (GDP) will be spent on projects. Furthermore, more than 60% of companies worldwide will be affected if experienced practitioners of project management leave the workforce due to retirement. These facts highlight the importance and dependence of organisations world-wide on effective project management (Zandhuis & Stellingwerf, 2013:5).

Project management success traditionally depends on the "iron triangle" of cost, time and quality. Atkinson (1999:337) however considers these traditional project management success factors to only consist of two best guesses and a phenomenon. Project management has a role to play in implementing corporate strategy (Aubry, Hobbs & Thuillier, 2007:329) and can contribute value to finance, people, process and innovation (Aubry *et al.*, 2007:331).

The project methodology can be defined as the procedures, systems and practices that can be repeated for each project and in the process good and best practices are consistently used and applied to ensure efficient and effective project management (Labuschagne & Steyn, 2010:70). It seems that there is not a "one size fits all" methodology for successful project management (Labuschagne & Steyn, 2010:71)

The maturity of project management in a company can be measured to evaluate the current state and to identify possible growth/development areas to ensure an improved project success rate and the resulting larger market share opportunity (Mittermaier & Steyn, 2009:97). Individual companies can be compared or a company can be compared to industry standards to benchmark its project management maturity and its ability to deliver projects successfully and repeatedly under similar conditions (Mittermaier & Steyn, 2009:97). Project management maturity models can be used by

a company to persistently and progressively develop its capability to deliver successful projects (Mittermaier & Steyn, 2009:97).

The lack of project management knowledge and project management maturity prevents the successful implementation of a project management methodology (Labuschagne & Steyn, 2010:69). In addition, continuous criticism is raised against project management theory for not being relevant as it is implemented in practice today, and therefore not resulting in improved performance (Winter *et al.*, 2006:638). Project management is therefore not always perceived as useful (Winter*, Smith, Morris & Cicmil*, 2006:646), good investment of resources (Ibbs & Kwak, 2000:32) or implemented correctly (Mittermaier & Steyn, 2009:97).

1.2.2 Project management office (PMO)

Companies function in a dynamic environment where competition, increased rates of innovation and time to market requirements are at the order of the day (Hobbs *et al.*, 2008:547). The consequence is that multiple projects are undertaken simultaneously with the resulting complexity of managing these projects (Aubry *et al.*, 2007:328).

Due to these challenges and strategic importance of projects, companies have resorted to implementing an organisational entity called a Project Management Office (PMO). The project management institute defines PMO as "An organisational body or entity assigned various responsibilities related to the centralised and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing project management support functions to actually being responsible for the direct management of a project" (PMI, 2004a). PMOs vary significantly in terms of function and form across industry and is considered to be an unstable structure that is reconfigured regularly (Hobbs *et al.*, 2008:547).

It seems that a PMO structure is moulded by economic, political, client relationship, standardisation/flexibility and resource allocation tensions within a company. The PMO structure is also influenced by one of two key areas: accountability and a focus on process vs. business (Hobbs *et al.*, 2008:553). A PMO is therefore closely related to the organisation it functions in and will co-evolve with its host company (Hobbs *et al.*, 2008:554). There is also no standardised PMO structure evident in the industry (Hobbs

et al., 2008:554; Desouza & Evaristo, 2006:415), since the development of a successful PMO is customised for a company and is an unrelenting effort (Desouza & Evaristo, 2006:415). The PMO function/structure is dependent on the organisational size, structure and the intended function of the PMO (Andersen, Henriksen & Aarseth 2007:98). PMO implementation can take anything from 3 months on a project level to 7 years on a corporate PMO level (Andersen *et al.*, 2007:98).

The roles/approach of a PMO can be defined on three levels: strategic, tactical and operational (Desouza & Evaristo, 2006:416). The PMO models normally map to the project management maturity level of a company. Purely administrative PMOs are, for example, normally found at relatively immature project management companies.

Hill (2006:45) assesses project management maturity in terms of a five stage PMO competency model:

a) Stage 1: Project office for project oversight.
b) Stage 2: Basic PMO for process control.
c) Stage 3: Standard PMO for process support.
d) Stage 4: Advanced PMO for business maturity.
e) Stage 5: Centre of excellence for strategic alignment.

Hill (2006:46) states that not every company requires a stage 5 PMO to achieve their organisational objectives. The PMO can even contribute to the improvement of company project management maturity and effectiveness by being used to train and distribute knowledge of lessons learned (Do Valle, Silvia & Soares, 2008:1).

From the above background it is therefore clear that proper understanding of the relationship between a PMO and a company PM maturity is essential to ensure these two tools are utilised efficiently and effectively in a specific company or industry sector.

The nature of the consulting engineering industry requires of firms to execute multiple projects at different stages of completion simultaneously in a dynamically changing environment.

The aim of this study is therefore to investigate the relationship between the project management maturity of a company and the possible contribution of an applicable PMO in order to deliver projects successfully, sustainably and repeatedly. The elements investigated will be applied to medium sized (10 to 100 employees) consulting engineering firms.

Since the PMO seems to be a dynamic structure that changes continuously or regularly, the insight gained from the study could guide medium sized consulting engineering companies to strategically structure their PMO based on the current PM and PMO maturity. Furthermore, not all companies need to attempt to achieve a stage five PMO and therefore the study also aims to identify the factors that influence what stage PMO is required for medium sized engineering consulting companies with a multitude of projects.

1.3 RESEARCH OBJECTIVES

1.3.1 Primary objective

The general objective of this research is formulated as follows:

a) Assess and identify how a PMO, for a medium sized consulting engineering company in South Africa (as selected by the researcher), can contribute to successful project delivery using project management maturity as starting point.

1.3.2 Secondary objective

The secondary research objectives are formulated as follows:

a) Investigate the concepts of project management, project management maturity, project management office and successful project delivery from the literature.
b) Make use of a literature review to relate the concepts mentioned above to the consulting engineering industry.
c) Conceptualise the typical maturity level of a PMO based on structure, responsibility and function for medium sized organisations from the literature review.
d) Select a project management maturity measurement questionnaire from literature to measure the current level of project management maturity as well

as the required level of project management maturity to deliver projects successfully in a medium sized consulting engineering company.

e) Select a project management office maturity measurement questionnaire from literature to measure the current level of PMO maturity as well as the required level of PMO maturity to deliver projects successfully in a in a medium sized consulting engineering company.
f) Identify one or more consulting engineering firm/s that are willing to participate in this study and gather information of the study elements by using the selected PM and PMO maturity questionnaires.
g) Determine if there is a relation between the level of PMO and PM maturity for medium sized consulting engineering organisations from both the literature and empirical study.

1.4 SCOPE OF THE STUDY

1.4.1 Field of study

The field of study can be grouped into the following academic fields applied to the service industry of consulting engineers:

a) Value chain in operations management in service organisations.
b) Project management.
c) Organisation management.

1.4.2 Organisations and geographical demarcation

Medium sized consulting engineering companies in South Africa similar to the author's company and companies related to the author's company will be targeted in the empirical study.

The author's company is M-Tech Industrial (Pty) Ltd. M-Tech is an ISO9001:2008 accredited consulting engineering company with a staff of approximately 40 graduate engineers and 20 support personnel. M-Tech initially focussed on consulting work in the fields of thermal-fluid mechanics and thermodynamics as well as the design of thermal-fluid systems. The company rapidly expanded into a multi-disciplinary consulting engineering company that offers both products and services that are all complimentary to each other and operates mainly in the mining and energy sectors.

Project managers, PMO managers and employees involved in PM and PMO from all seniority levels will be requested to complete the questionnaires to gauge the current and required PM and PMO maturity levels.

1.5 RESEARCH DESIGN

1.5.1 Research approach

The research will make use of the Delphi technique (Cuhls, 2010:93) due to the nature of the study of investigating a projected or future required maturity level. The Delphi survey method consists of both quantitative and qualitative research with predictive, explorative and normative elements. The Delphi technique consists of a survey performed in two or more rounds where an anonymous summary of the first round results are distributed the second time round. Participants may change their initial answers based on the results from the panel.

The PM and PMO maturity of the author's company will be assessed and compared to a number of medium sized consulting engineering organisations and also companies working with medium sized consulting engineering companies. The PMO and PM maturity will be assessed using an existing, standardised self-assessment PM and PMO maturity model selected from literature. The models should be easy to use and should determine the current state of PM and PMO maturity as well as the required maturity level to deliver projects successfully.

Based on the research results and the findings from the literature, it is aimed to provide insight into the perceived value a PMO can add to project delivery by managing the gap between the current and required project management maturity.

1.5.2 Research method

a) Literature review

Research is a process of obtaining scientific knowledge by being objective in diverse methods and procedures (Welman *et al.*, 2010:2). Research methods and techniques are tools to do the research and research methodology is the broader concept that contemplates and clarifies the logic behind these tools (Welman *et al.*, 2010:2).

The method of research that will be followed is firstly a literature review, the research method where secondary data from published sources are gathered, filtered for relevance and presented in a structured manner. Sources of information that will be consulted includes the internet; the NWU (North-West University) Intranet; dictionaries; scientific databases such as EBSCO Host, JSTOR, Science Direct, and others; journal articles; theses and dissertations in the field of project management; books; and so-called "grey" literature including relevant documents such as booklets, advertisements, pamphlets, publications and others. Specific focus will be placed on finding literature from project management institutes such as PMI that focus on standards and doing research to improve the field of project management and making the theory applicable and relevant to industry.

Keywords to be used in the literature review will include but is not limited to:

a) Project management office.
b) Organisation(al) management.
c) PM maturity levels.
d) PMO maturity levels.
e) PMO implementation.
f) Project delivery requirements/success factors.
g) Consulting engineering industry.
h) Project success rates for different industries/engineering projects specifically.

b) Measuring instruments

The self-assessment survey provided by Crawford (2002) was selected and used to measure the PM maturity in all nine the knowledge base areas of project management[1]. The maturity of each knowledge area would be assessed and the lowest level of maturity is then the organisation maturity level. The questionnaire would be used to gather the current and required project management maturity for successful delivery of projects within the consulting engineering companies.

[1] In the newest version of PMBOK® 5 (PMI, 2013:423) a tenth knowledge area was introduced (Project stakeholder management). For the purposes of this study, however, the previous version of PMBOK®4 applying nine knowledge areas was used since the latter version was in use while this study was being conducted.

A similar additional self-assessment questionnaire was selected from literature to measure the current and required level of PMO maturity to deliver projects successfully for mutually exclusive different scope PMOs. The well developed PMO maturity cube model of Pinto *et al.* (2010:2) was selected due to its generality and wide application in industry.

Based on the fact that the selected PM and PMO maturity models are well developed and validated and the fact that the required PM and PMO maturity needs to be determined from a group of experts based on their experience, the Delphi research approach was used. Previous researchers have used this same technique (Labuschagne & Steyn, 2010; Mittermaier & Steyn, 2009). It is proposed that the Delphi technique described in Mittermaier and Steyn (2009:100) be used in this study as the studies are related.

c) Research procedure

Applying the Delphi technique, described in Mittermaier and Steyn (2009:100), the following stages are planned:

Stage 1: Defining the Delphi questionnaire

The following questions must be answered to ensure success in this study:

What are we interested in our study?

This study will assess the current PM and PMO maturity of medium sized consulting engineering companies and the maturity required to deliver projects successfully.

What do you need to know that you do not know now?

The gap between the current and required maturity level of PM and PMOs for successful project delivery and the potential role the PMO can play in closing the gap. It is not known what the required PM and PMO maturity levels are for medium sized consulting engineering companies to contribute towards successful project delivery in a consistent fashion.

How will the results from the Delphi influence decision-making once the study is completed?

The required PM and PMO maturity levels will be identified to assist in the successful delivery of projects specific for medium sized consulting engineering companies. For a specific PMO maturity level, different levels of PMO functions can be derived to guide the PMO to reach the required PMO maturity applicable.

Stage 2: Selection of participants

The intended population will consist of project managers, PMO managers and employees involved in PM and PMOs in medium sized consulting engineering organisations with relevant experience in delivering projects, both successful and unsuccessful. In essence the survey is distributed to a panel of experts according to the Delphi technique. This is not a large population and participants usually have limited time to complete questionnaires not related directly to their work. Due to this constraint caused by the narrow definition of the research title, the PM and PMO maturity questionnaire will be distributed to as many engineers/project management engineers in medium consulting engineering organisations that can be located and are willing to participate.

Stage 3: Sample size

For a national projection on a specific research subject a value of 100 responses are proposed by Cuhls (2010:104) depending on the size of the country and the pool of available experts. From previous related studies using the Delphi technique (Labuschagne & Steyn, 2010; Mittermaier & Steyn, 2009) it seems that a sample size of at least ten was considered sufficient. The second questionnaire will only be sent to the participants who took part in answering the first questionnaire.

Stage 4: First questionnaire

The first survey is divided into five sections of information relevant to this study. The first section contained general demographic information on the participant, their position, experience and the size and nature of the engineering company they work for. The second section contains the instructions and PM maturity model questionnaire to assess the current state of project management maturity in the organisation. The third section contains a repeat of the project management maturity model questionnaire but with the instruction to give the participant's perception of the required PM maturity to deliver projects successfully. The fourth section contained a survey of

the current PMO maturity in the company. The fifth section contained the same questionnaire as section four but with the instruction to give the participant's perception of the required PMO maturity to manage the project management maturity gap to ensure consistent successful project delivery. The questionnaire was created in MS Excel to reduce the effort to analyse the data.

Stage 5: Analysis of first questionnaire

The current level of PM and PMO maturity in medium sized consulting engineering companies and the required maturity to deliver projects successfully were analysed and summarised. Only the averaged required PM and PMO maturity levels were sent out with the second round of the survey.

Stage 6: Second questionnaire

The second questionnaire gathered the respondents' perception of the required PM and PMO maturity levels similar to the first round of the survey. The only difference was that the summary of the round 1 required PM and PMO maturity levels were disclosed to the respondents in an effort to influence the group of respondents towards a consensus of the required maturity levels in a structured fashion.

1.6 CHAPTER DIVISION

The chapters in this mini-dissertation are presented as follows:

Chapter 1: Nature and scope of the study

The background to the study, problem statement and research objectives are defined in this chapter. The intended population to gather information from and how the study will be conducted is also described in this chapter.

Chapter 2: Literature review

The following concepts or study elements will be investigated in the literature review chapter:

a) Nature of engineering consulting industry.
b) Value addition in the value chain.
c) Project management.
d) Project management maturity.

e) Project management office.
f) Project management office maturity.
g) Successful project delivery/project performance.
h) Link between project management office and project management maturity.

The chapter will be concluded with a summary or concluding remarks.

Chapter 3: Empirical study

The questionnaires used and developed, the framework of the empirical study defined, statistical analysis performed and the survey results are discussed in this chapter. The chapter concludes with the main findings and summary of the empirical study.

Chapter 4: Conclusions and recommendations

The main findings and recommendations from the literature and empirical study is made in this chapter with mention of some limitations and future recommendations to conclude the chapter.

Annexures providing examples of the questionnaires etc. are also included for completeness.

CHAPTER 2: LITERATURE STUDY

2.1 INTRODUCTION

To stay competitive in today's market, companies need to systematically measure, monitor and continuously improve their service delivery. Service delivery is effected in two sections/stages: the front stage that the client interacts with directly and the back stage that the client does not see, but which forms an integral part of the service being delivered (Gomes *et al.*, 2007:561). Service effectiveness can be measured by taking availability, quality and efficiency into account for both of these stages (Gomes *et al.*, 2007:560). The client is one of the most important role players in a service company, and its value perception is an important measure in service effectiveness (Gomes *et al.*, 2007:564).

This chapter starts with a general background discussion on the nature of the consulting engineering industry. A consulting engineering company in essence has a service as its main product. Performance of and success factors identified for consulting engineering companies are discussed followed by an industry overview. As a service provider, the main resource of a consulting engineering company is its human resources. The typical percentage of the budget spent on the training of these resources and the challenge of managing the capacity or resource loading are then discussed. Some environmental pressures acting on consulting engineering companies such as the effect of competition when tendering for new work are touched on before quality control and industry challenges are presented.

The concept of value addition in the value chain of a service company is investigated next and followed by what can be found in the literature on competitive advantage requirements applicable to this study.

The general definition of project performance or requirements for successful project delivery is then defined. This is followed by a in-depth investigation into the concept of project management, the profession of project management and the available certifications and accreditation to ensure the quality of project management professionals. Project management is understood and applied in varying levels of

development/maturity and the concept of PM maturity is also briefly discussed in terms of what models are available and what the levels of maturity mean for a few of the models identified.

The concept of a project management office (PMO) is then discussed in terms of background, definition, functions, scope, approach and also PMO maturity models available in industry.

Although each of the subjects discussed in this study can warrant an in-depth and detailed literature study on its own, the literature study presented here was focused on achieving the main study objective. The primary study objective is to determine what contribution a PMO can make towards successful project delivery in a medium sized consulting engineering company. The literature study is therefore intended to provide only a broad overview.

At the end of this chapter a conclusion is drawn from the literature study. The aim of this chapter is to highlight the dynamic environment of the consulting engineering industry, provide background to the concepts of PM, PMO, project success definition, maturity levels of project management and how these concepts are used to add value to clients and provide a sustainable competitive advantage to the company.

2.2 NATURE OF ENGINEERING CONSULTING INDUSTRY

One of the major role players in the international professional services industry is the engineering services performed by consulting engineering firms and company in-house engineering services departments. The 2009 global recession caused the engineering industry to experience restrained growth the past five years (IBISWorld, 2013).

The engineering services industry is predominantly labour intensive with low levels of capital intensity. The service is highly dependent on fundamental engineering knowledge and the need this industry satisfies is engineering design, assessment and technical management services (IBISWorld, 2013).

Consulting engineering is defined by the Association of Consulting Engineering Companies in Canada as a professional service that provides independent expertise in

engineering, science and related areas to governments, industries, developers and construction firms (ACEC-Canada, 2013:1).

A profession is defined as any type of work that needs special training or a particular skill, often one that is respected because it involves a high level of education (CAEOD, 2013:1). It follows therefore that a professional would be a person performing such work.

2.2.1 Service industry

The customer should be the pivotal point of all processes, actions and decisions made in a service organisation (Jacobs & Chase, 2011:254). The service triangle illustrates this focus on the customer.

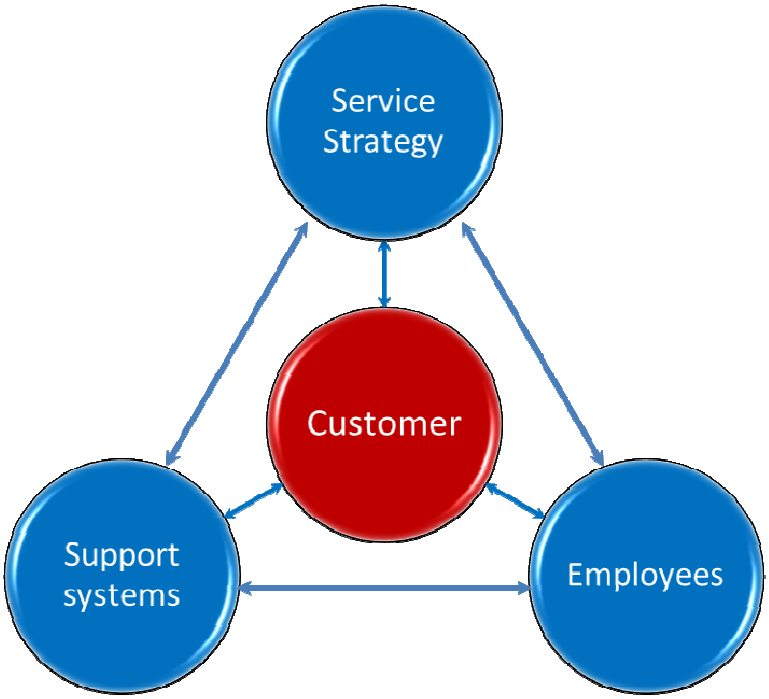


Figure 1: Service triangle.

Source: (Jacobs & Chase, 2011:254).

With a high degree of contact with the customer comes the challenge of increased difficulty to control the service delivered. The more the customer is involved in the process, the more he/she can influence the time demand, exact nature of the service and the perceived quality of the service (Jacobs & Chase, 2011:256). An increase in customer contact typically will increase the sales opportunity, but also may decrease the production efficiency. The more the nature of projects require increased contact

time with the client and a wide range of customisable services required by the customer, the more diagnostic skills are required, less procedural and clerical skills are required and the more the project team will consist of both customer and service company resources (Jacobs & Chase, 2011:258).

The following are seven characteristics of a well designed service system (Jacobs & Chase, 2011:266):

- Each element of the service system is aligned with the company service strategy.
- It is user friendly in terms of easy and understandable customer interaction, logical process steps and availability of resources to answer questions.
- It is robust in that it can effectively cope with demand variations and resource availability.
- The service is structured in such a way that consistent performance by the people and systems is easily maintained. This requires reliable supporting technologies and systems.
- Effective links between the front and back office to ensure no gaps arise in terms of information and communication.
- It should manage and market (make visible) the evidence of quality service in such a way that the customer realise, understand and appreciate the service provided.
- The service should be cost effective. The customer should perceive the service delivered as performed with the least amount of time and resource wastage.

2.2.2 Service industry performance

Technical performance of professional service companies can be improved by properly managing them (Heineke, 1995:255). Professional service can be defined as a complex and customisable service delivered by a person or a team of people with knowledge and expertise (Heineke, 1995:255).

Operational decisions can be structural (e.g. location of building, vertical integration, product and process technology) or infrastructural (e.g. policies defined as organisation, quality and resource management, planning and control) (Heineke, 1995:256). Although structural decisions generally have long term effects, they are not

necessarily the most difficult to change, since infrastructural decisions are deterministic in business performance, quality and capacity (Heineke, 1995:256).

Implementation issues to consider when implementing any change in the operation of a company to enhance service performance are as follows (Gomes *et al.*, 2007:566-567; Heineke, 1995:266):

- One of the key success factors of implementing the service operation effectiveness is to implement it systematically.
- Resources should be made available to implement the proposed changes and management should show support.
- Inefficient implementation may lead to dysfunctional behaviour.
- Implementation success is directly dependent on the availability of information to monitor. Initially start off with good enough, procedurally correct information and systematically improve information accuracy.
- Professional technical resources are normally left to monitor and control themselves and are not managed or difficult to manage. Infrastructural operational decisions can improve performance and client outcome perceptions.

One of the challenges for a service company is that their product/output is intangible and for that reason the customer can not view the service outcome beforehand and even similar examples do not necessarily exist to convince the customer of the quality and applicability of the service quoted for (Jacobs & Chase, 2011:45). Another challenge to be managed is the interaction with the customer that is required (Jacobs & Chase, 2011:45). Thirdly the outcomes of most services are largely unpredictable and vary from day to day depending even on the attitudes of clients in some instances (Jacobs & Chase, 2011:45). A fourth challenge is that services can not be stored and is perishable by definition (Jacobs & Chase, 2011:45).

The fifth challenge is that service consists of and is evaluated according to a collection of features that the client values (Jacobs & Chase, 2011:45):

- The supporting facility in which the work is done and located and decorations and infrastructure where the results/services are presented/delivered.

- Facilitating goods (e.g. consistency, quantity and quality of goods that accompany the service) may include the printing quality of the report. Quality and consistency is also considered to be brand reputation (Walters, 2009:96).
- Explicit services may include the training and professionalism of the service personnel, consistency of the service such as report templates and formats being similar between projects and provided by different departments, punctuality of the service and ability of the personnel to help comprehend the value of the service.
- Implicit services include attitudes of personnel, convenience for the client, atmosphere, respect for client's privacy, punctuality, responsiveness, dependability, etc.

Both monetary and non-monetary costs of doing business with a company is evaluated by a client. To add value in any of the features listed above requires effort, planning and monitoring (Walters, 2009:96).

Most companies today do not only provide service or products. There is normally a variation of both involved to make companies competitive and agile (Jacobs & Chase, 2011:46).

2.2.3 Consulting engineering industry success factors

A successful consulting engineering company can be evaluated against the following key success factors (Hecker, 1997:63):

- **Project management**: One of the essential elements required of the consulting engineer is project management. Clients have a need for a consulting engineering firm with a proven, proactive project management track record (Hecker, 1997:63).
- **Client relations:** Recurring work from the same client is a good measure of the perceived satisfaction of work performed/service delivered to the client. Building a good relationship with the client is as important as the actual technical service delivered (Hecker, 1997:63).
- **Marketing:** Clients prefer consulting engineering companies with a proven track record of effective communication and executing projects. The trend seems to be that clients assume that all engineers are technically competent and base

their procurement decisions more on marketing of previous track record than trying to evaluate the technical competence of the consulting engineering company (Hecker, 1997:64).

- **People management:** The difference between a successful project being delivered and a failed project is often determined by the engineer/project manager's ability to fully harness the project team's capability and skills. Project managers need to be leaders that inspire and motivate instead of just being a manager of the project scope, quality and cost (Hecker, 1997:94). The biggest contributor of a professional service firm's competitive advantage is its ability to attract, mature, retain and utilise human resources effectively (Maister, 1993:93). Engineers in a consulting engineering company therefore need both technical and non-technical skills of which effective communication is essential to master. The non-technical skills requirement in consulting engineering companies is not a skill focused on by the engineering educational institutions (Hecker, 1997:62).
- **Operations management:** Based on the argument of Yang and Chou (2010:1183) that a consulting company can gain management advantage by being able to systematically assign and align projects and resources, Mocke (2012:24) argues that the resource loading element of operations management is also a key success factor of successful consulting engineering companies.

2.2.4 Consulting engineering industry overview

The global economic growth history and projections until 2014 show that the world economies are recovering from the 2009 recession (see Table 1). In general the emerging/developing economies (such as China, Africa) were less affected by the recession and show better growth outlook compared to developed economies.

Table 1: Global economic growth summary and projections.

	2009	*2010*	*2011*	*2012*	*2013*	*2014*
World	**-0.80%**	**5.00%**	**3.80%**	3.50%	3.50%	4.10%
US	-2.50%	2.80%	1.80%	1.80%	2.00%	3.00%
Eurozone	-3.9%	1.80%	1.60%	-0.40%	-0.20%	1.00%
UK	-4.80%	1.70%	0.90%	0.20%	1.00%	1.90%
China	8.70%	10.30%	9.20%	7.80%	8.20%	8.50%
Sub-Saharan Africa	1.60%	5.00%	4.90%	4.80%	5.80%	5.70%
South Africa	**-1.80%**	**2.70%**	**3.40%**	**2.05%**	**2.70%**	**3.50%**

Source: CESA (2013:3).

The consulting engineering industry comprises of many sub-disciplines. For large consulting engineering companies (more than 100 people employed) the key sub-disciplines contributing to income include civil and structural services and project management (PM). For smaller and micro companies electrical and mechanical building services contribute the most to earnings. PM is a fast developing sub-discipline and contributes between 16 and 18% of the total earnings in consulting engineering (CESA, 2013:19). A bi-annual survey administered by the Consulting Engineers South Africa (CESA) reveals that the distribution of income from industry sectors varies over time and with the size of the consulting engineering company (see Figure 2).

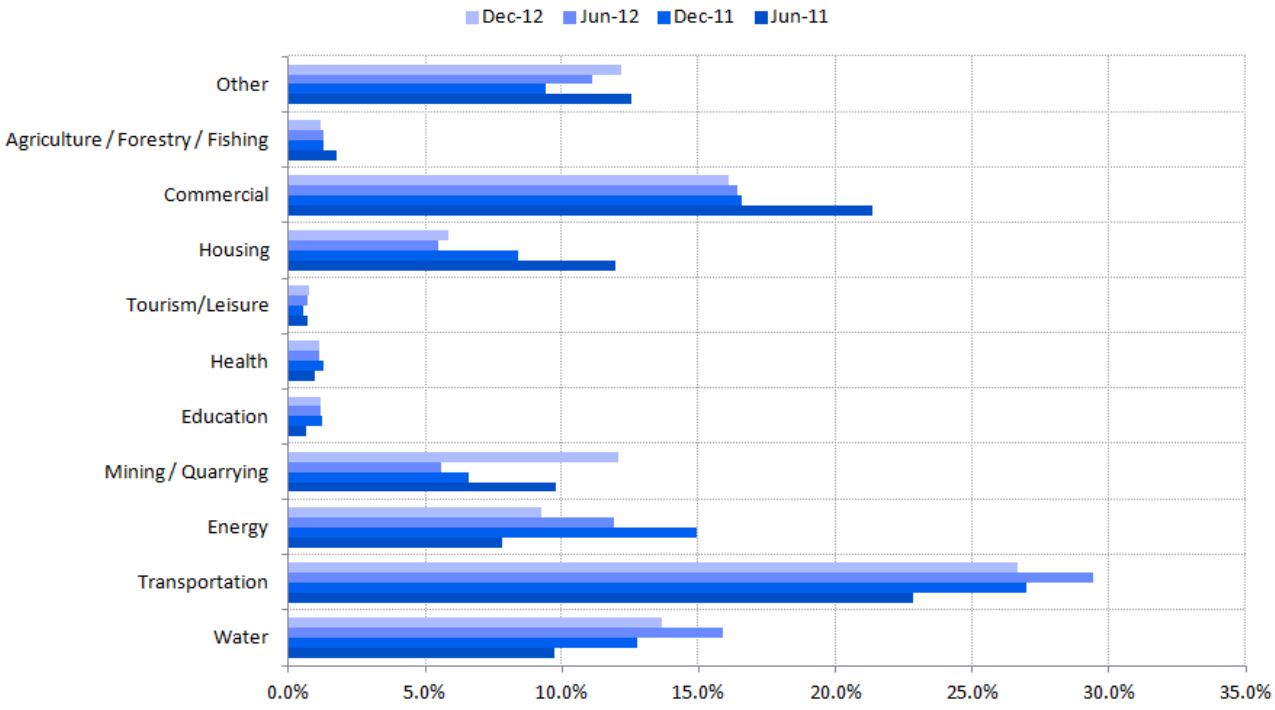


Figure 2: Consulting engineering fee income distribution per economic sector.

Source: (CESA, 2013:19).

The variety of clients over the past decade or two is illustrated in Figure 3. The key clients in South Africa (SA) have constantly been from the private sector and local government (CESA, 2013:23). The impact of the recession can also be clearly seen by the major decline around 2009 in Figure 3.

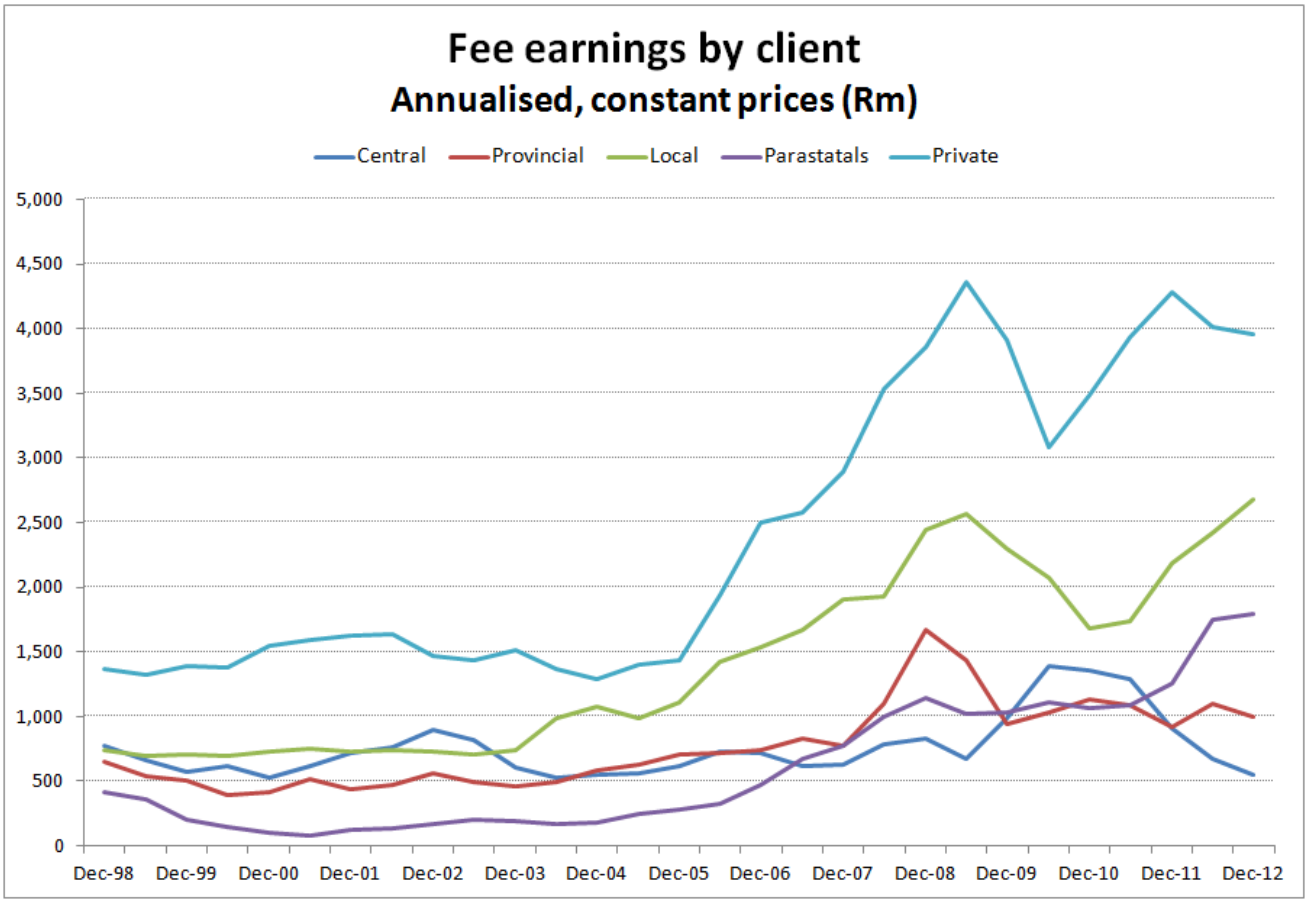


Figure 3: Consulting engineer earnings from major client categories.

Source: (CESA, 2013:23).

2.2.5 Human resources

Human resources are the backbone of the service being delivered. Although there are procedures in place to capture experience and knowledge, not all can be captured in this way and therefore looking after the intellectual capital of the company is very important. Satisfied resources result in employee loyalty and unlocks their capability and this leads to quality customer service that satisfies the clients and creates client loyalty (Heskett, Jones, Loveman, Sasser & Schlesinger, 2008:2).

The typical resources employed by consulting engineering companies in SA are engineers, technicians, technologists, other technical staff and support staff. The December 2012 survey of CESA showed that companies outsource only about 16 to 20% and there seems to be a tendency to reduce the amount of work outsourced and to better utilize the internal resource capacity (CESA, 2013:12).

2.2.6 Training

Direct and indirect training expenses, as shown in a December 2012 survey of CESA, amounted to between 17 and 20% of salaries paid. Direct training and bursary expenses of consulting engineering companies both amounted to approximately 1% of salaries. Training and education is important for productivity improvement and future employment opportunities (CESA, 2013:12).

2.2.7 Service company capacity utilisation

Service and manufacturing firms often have to make capacity decisions before the demand is known (Hollins & Shinkins, 2006:218). One of the biggest challenges with a service company is that if demand is higher than the service capacity, it may equate to lost revenue, since a service cannot be stored (Easton & Goodale, 2005:7). According to Hollins and Shinkins (2006:218), capacity planning can be defined as: "A process to predict the types, quantities and timing of critical resource capacities that are needed within an infrastructure to meet accurately forecasted workloads." From an operational management point of view, capacity planning requires capacity measurement, demand forecasting and a capacity management strategy selection.

Capacity measuring in a service company equals the workforce capacity expressed in time (effective working hours) (Hollins & Shinkins, 2006:223). In the measure of capacity, it is necessary to consider the difference between design capacity (theoretical output of an operation) and effective capacity (actual output of an operation).

The measuring of demand can be problematic due to its fluctuating nature, especially in a consulting engineering service company. A forecast rather than a measure is used to quantify demand. These forecasts might be very inaccurate when using the wrong method for the particular industry (Hollins & Shinkins, 2006:220). The different prediction methods include qualitative and quantitative methods (Hollins & Shinkins, 2006:220). It is the role of the operations manager to get an in depth understanding of the demand pattern for the particular firm.

Various strategies exist to help organizations plan their capacity for unknown demand (Eppen *et al.*, 1989:517) or unplanned absenteeism (Easton & Goodale, 2005:3). The

different capacity management strategies are discussed here in brief (Hollins & Shinkins, 2006:224):

- **Level capacity plan:** This strategy ignores the fluctuating demand by keeping activity levels constant. Since service organizations cannot store "over-capacity" as inventory, this strategy might be unwanted when dealing with major demand fluctuations.
- **Chase demand plan:** This strategy requires the adjustment of capacity to match demand. From a service organisation's point of view, this means hire and layoff. For organisations like restaurants this strategy may be acceptable due to the low skill-level required. For engineering services this might not be a viable strategy to follow.
- **Demand management:** This strategy will attempt to manage the demand to match the available capacity. Demand can be managed by adapting the price, introducing an appointment system or selling alternative products during low-demand periods. This strategy is a viable option in a consulting engineering firm.

A good measure to evaluate whether a company will successfully overcome unplanned absenteeism/increased demand is a service capacity per hour variable (slack/hour). The higher value of slack/hour indicates a greater ability to respond to unplanned absenteeism with internal staff (Easton & Goodale, 2005:20). The best strategy is the one that provides the least amount of strain on the solution quality to the client, on employees required to absorb the additional work and on the company profit (Easton & Goodale, 2005:2).

2.2.8 Competition in tendering

Consulting engineering companies obtain orders by competing for work, mostly by means of tendering. Tenders are awarded on the basis of compliance to specification, cost and quality offered. In times of abundant work, the competition on tenders is lower and as a result, fewer discounts are required to win tender bids. Tendering is expensive and time consuming and the more competition there is on tenders, the higher the risk for the company. Larger firms tend to give bigger discounts compared to smaller firms. The discount given and the perceived competition over the past few years in SA are illustrated in Figure 4 (CESA, 2013:14).

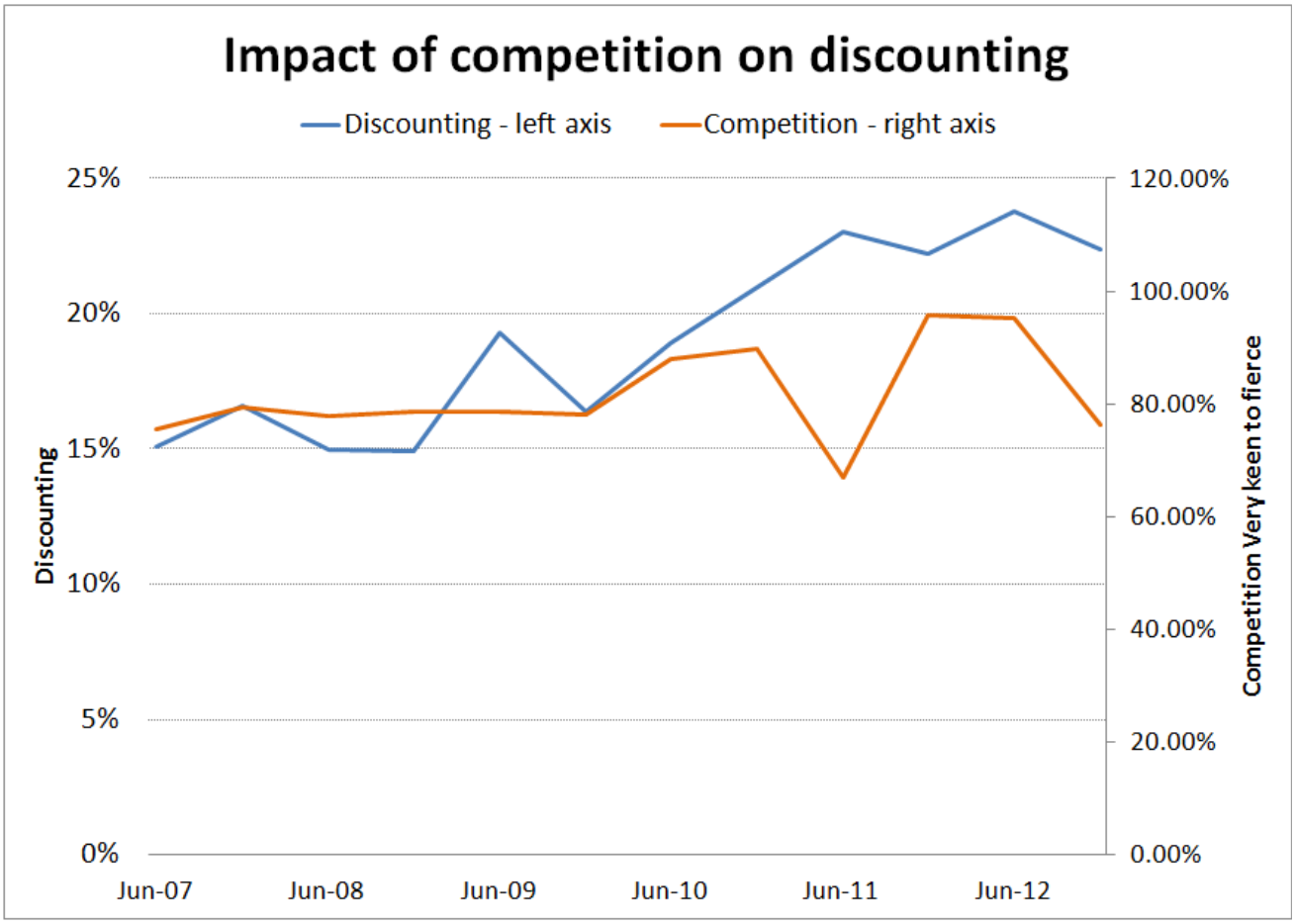


Figure 4: Competition and discounting in the engineering industry of SA.

Source: (CESA, 2013:13).

2.2.9 Quality management systems

By meeting and exceeding the quality of service expected by clients, organisations differentiate themselves from their competitors, resulting in a competitive advantage that is difficult to copy (Wilshaw & Dale, 1996:401). In terms of operational management activities, quality control is perceived as one of the three top priorities of organisations (Prajogo, 2006:1374). This was proven by client retention as a result of sustained quality. Service quality perception is reliant on people and this is tested whenever employees have contact with clients (Wilshaw & Dale, 1996:401).

Quality has traditionally been defined as the level of service provided (Nwabueze & Mileski, 2008:1328). However, clients define quality as service that meets their expectations. According to Nwabueze and Mileski (2008:1328), the difference between expected service and perceived service by the client can be defined as a measure of

quality. The following are the major reasons for the lack of sustainability of quality control, as identified by Wilshaw and Dale (1996:403):

- Key quality control personnel leave the company or are moved to a new position, which leads to important information falling through the cracks and opportunities for quality demise.
- Quality control personnel become disillusioned by the operating difficulties they face, in that the pressures of work make it difficult to find time to hold quality control meetings. Normally the difficulty is solved by meeting outside of normal working hours. However, organisations are hesitant to remunerate for after-hours meetings.
- When quality control personnel feel that they have resolved all the problems which they perceived their department had, new problems are not attended to.

Employee empowerment, information and communication, client care and development are key areas to be inspected during quality control (Samat *et al.*, 2006:713).

Quality management systems (QMS) are controls implemented at various stages of product or service delivery. CESA recommends the ISO 9001:2008 quality assurance system to its members as it is considered to be comprehensive and internationally recognised (CESA, 2013:24).

2.2.10 Industry challenges

In a SA consulting engineering industry survey the following key industry challenges were highlighted (CESA, 2013:18):

- Fraud and corruption in awarding contracts.
- Unlocking private sector involvement to improve municipal efficiency and capacity.
- Lack of attention to infrastructure maintenance.
- Obtaining a standardized procedure how government procurement is executed.
- Adapting to lower growth environment due to the local and international economic environment.
- Contracts awarded to lowest bidder without considering the company capability or service quality standards.

- Companies competing in tenders not adhering to the same standards and performance.

2.3 VALUE ADDITION IN THE VALUE CHAIN

In the day to day operations of an organisation, resources such as raw material, information, knowledge and experience are transformed into a physical product or intangible service required by the client (Jacobs & Chase, 2011:42). For a company or department to align with the company strategy and be sustainable in a dynamic global market, the following operations and supply chain process categories are applicable throughout the supply chain (Jacobs & Chase, 2011:45):

a) Planning and matching market demand and available resources as well as metrics to monitor the efficiency of the supply chain delivering value to the client. How well a company can anticipate future needs and competition will definitely provide a competitive advantage.
b) Sourcing of suppliers, subcontractors, etc. and metrics to monitor and improve the relationships among partners and resources and with suppliers.
c) Making or providing the service/product and include scheduling and coordination of critical resources and metrics to measure quality and productivity.
d) Delivering, including mostly logistics but also the managing of receipt of orders, payments etc.
e) Returning or after sales support.

Value is defined as quality divided by price paid and is related to both efficiency and effectiveness (Jacobs & Chase, 2011:47). Value can also be defined as the monetary worth of the service/product net benefits the client receives in return for the price it pays (Walters, 2009:105). The net benefits include all costs the client had to make, to obtain the service/product. Making a client more productive can be considered as value adding (Walters, 2009:106).

For a service or supply chain to be both effective (create most value for company and client) and efficient (service at lowest cost) it needs to satisfy a client's request/need at the right or best price (do the right things right) (Jacobs & Chase, 2011:47). Value is therefore only achievable if there is fulfilment of both the client and company needs

and not just a cost efficiency supply chain management approach where only the company benefits (Walters, 2009:96).

Transforming raw materials and information into something the client wants is a value adding process (Jacobs & Chase, 2011:454). Activities that only consume resources and does not add value or contribute to the end result requested by the client is considered a waste (Jacobs & Chase, 2011:455).

A value chain is a term broadly defined as a process where each step of a supply chain is identified and evaluated based on whether the step adds value or not (Jacobs & Chase, 2011:454; Porter, 1985:11). In essence, the analysis of the value chain results in a simplified and more effective process, product or service of the same or higher quality at the same or lower price (Jacobs & Chase, 2011:87). The value chain provides a structure that links and highlights the activities of a company or department that create customer value and profit for the company (Jacobs & Chase, 2011:492). Looking holistically at the value chain, it is a balancing act between three distinct players that needs to be managed with the available resources (Walters, 2009:106):

a) Client needs and value expectations.
b) Company needs and value expectations.
c) Partner and collaborating company needs and value expectations.

The resources in this value chain include assets, capability and processes (Walters, 2009:106).

All steps that adds little or no value to the client's needs/request can then be eliminated to optimise the supply chain as a value chain (Jacobs & Chase, 2011:454). In managing value, it is important to comprehend that value relies on customer perceptions and is not part of any product, service or system alone (Walters, 2009:96). In this regard even suppliers should be viewed as customers and that each link in a value chain represents a supplier-client relationship that needs to be managed (Walters, 2009:96).

Inputs and supportive tools that over the years have transformed the value chain may include:

a) Some sort of lean production methodology to reduce waste.
b) Quality management such as ISO 9001 certification.
c) Business process re-engineering.
d) Electronic commerce that makes internet communication possible.
e) Web based presentations and training facilities are freely available at a fraction of the price of travelling overseas to deliver the message in person.

The strategy of the company should indicate how a company will create and sustain value for both the company and the client (Jacobs & Chase, 2011:58). This strategy should be guided by the market and more specifically the client needs and demand, i.e. customer-centric (Walters, 2009:100).

When proper project management, quality procedures, etc. are being used to add value to an existing value chain, it requires an investment initially of time and even large contributions from government, should the value chain create jobs and have benefits for the country as a whole (Anon., 2011:16). Looking at the bigger picture from a value chain perspective allows for social wellness, environmental needs and profit and sustainability (Anon., 2011:17). The value chain is a continuously evolving and improving method that not only looks at the short term financial gains but also the client and long term success of the company (Porter & Kramer, 2011:4).

2.4 COMPETITIVE ADVANTAGE

The competitive advantage provided by delivering projects successfully is placing more emphasis on assessing and improving the state of project management in organisations (Farrokh & Azhar, 2013:50). According to Papulova & Papulova, (2006:1) today's organizations have to deal with dynamic and uncertain environments. In order to be successful, organizations need to be strategically aware of the environment they are competing in. The need to know what the business is about, what it is trying to achieve and which way it is headed, is a very basic requirement in determining the effectiveness of every member's contribution. Every successful entrepreneur has this business self-awareness and every successful business seems to have this clarity of vision, even though it does not arise from a formal planning process. Thinking strategically requires an awareness of alternative strategic purposes and objectives and the ability to recognize critically different environments. In addition

it requires the ability to diagnose an organization in terms of various critical characteristics and to be able to shape those characteristics so that the organization is best fitted to its environment in order to achieve its strategic purposes and objectives. The following factors obtained from strategic thinking can influence an organisation's competitive advantage:

- Seek ways to minimize client waiting times. This could be attained by identifying ways to optimally match capacity with anticipated demand and temporarily increasing capacity to better match supply with demand (Dickson *et al.*, 2005:169).
- Building and maintaining strong client relationships (Raciti & Dagger, 2010:103). Clients will broadcast their good/bad service experiences (Dickson *et al.*, 2005:170).
- Value the clients' participation in service delivery by taking into account their view of quality, employees and new products (Dickson *et al.,* 2005:170).
- Recognition by managers that "cutting corners" due to price influences will be perceived by clients as receiving poor quality service (Dickson *et al.*, 2005:171).
- Internal and external service quality initiatives lead to loyalty and supplier satisfaction, which in turn are determinants of competitive advantage (Prakash, 2011:362).
- Staff should receive adequate attention (internal service quality) regarding training (Dickson *et al.,* 2005:172).
- Clients and their needs are constantly changing and the organisation should adapt accordingly (Dickson *et al.*, 2005:174).
- Operational decisions should be made in support of the business strategic goals (Heineke, 1995:256).

The three methods for creating a sustainable competitive advantage are through:

Cost leadership: When a firm delivers the same services as its competitors but at a lower cost (Bani-Hani & Alhawary, 2009:2; Porter, 1998:15; Hollins & Shinkins, 2006:15). One way for an organization to lower cost is by eliminating costly, non-value adding steps in the value chain (Hollins & Shinkins, 2006:15). By doing an in-depth value chain analysis, an organization can identify ways to lower costs.

Differentiation: Differentiation advantage occurs when a firm delivers greater services for the same price as its competitors or even at a slightly higher price in return for the perception of greater value received. They are collectively known as positional advantages, because they denote the firm's position in its industry as a leader in either superior services or cost (Bani-Hani & Alhawary, 2009:2; Hollins & Shinkins, 2006:15).

Focus (economics): A focused approach requires the firm to concentrate on a narrow, exclusive competitive segment (market niche), hoping to achieve a local rather than industry-wide competitive advantage. There are cost focus seekers, who aim to obtain a local cost advantage over competition and differentiation focuser, who are looking for a local difference. This allows for effective differentiation by lowering the number of competitors in the focused market (Hollins & Shinkins, 2006:15).

Organizations must learn from their environment how to survive and produce competitive conditions that shape the character of success. Time is an important factor, and it eventually renders nearly all advantages obsolete (Papulova & Papulova, 2006:1).

2.5 SUCCESSFUL PROJECT DELIVERY/PROJECT PERFORMANCE

Success can be defined as achieving results or positive results wanted, hoped for or aimed at (CAEOD, 2013; OOD, 2013). There is, however, no agreement on a standard for assessing project success or a generic framework for all projects (Lehtonen & Martinsuo, 2006:6). A project delivered successfully is usually measured/evaluated in terms of the so-called iron triangle of time, cost and quality (Julian, 2008:43; Lehtonen & Martinsuo, 2006:6):

- Cost: Project is delivered within budget.
- Time: Project is delivered on time without compromising delays.
- Quality: Project deliverables meet the client expectations.

Project performance is essentially the measuring and tracking of actual current project status against the project output control mechanisms such as targets/milestones (Liu & Yetton, 2007:796). Project success, however, goes beyond simply meeting budget and time constraints and includes evaluating the project impact on the customer and stakeholder benefits, organisational infrastructure and impending prospects. This

perceived quality compliments the iron triangle project success evaluation and is necessary to constantly and repeatedly succeed (Lehtonen & Martinsuo, 2006:6).

Atkinson (1999:341) advocates that apart from the iron triangle (cost, time and quality) of project management, there are other success factors that should also be considered and are categorised as follows:

- **The information system** (maintainability, reliability, validity, quality of information).
- **Organisational benefits** (improved efficiency and effectiveness, increased profits, strategic goals and organisational learning, reduced waste).
- **Stakeholder community benefits** (satisfied users, social and environmental impact, personal development, professional learning, contractors profits, capital suppliers, content project team, economic impact to surrounding community).

Project success may also be evaluated based on how well it contributes towards organisational governance and how well it is aligned with organisational strategies in addition to the other project success factors defined in Section 2.5 (PMI, 2013:15).

Project performance can also be improved by reducing the amount of task uncertainty. Changes can be made to operating procedures based on standardised feedback in low task uncertainty or routine working environments by means of simple project reviews. However, this is not the case in high uncertainty environments where high capacity information systems are required (Liu & Yetton, 2007:790). A project management office (PMO) has the ability to co-ordinate the information gathered through project reviews and manage diverse project portfolios accordingly. PMOs therefore have a high impact on performance in a high uncertainty environment (Liu & Yetton, 2007:797).

Companies succeeding in project management use some sort of systematic project management methodology. This includes setting goals and making systematic decisions during the project. Failing in one of these two areas of project management success may lead to subsequent failures elsewhere (Lehtonen & Martinsuo, 2006:6). Organisations in the project environment that consistently apply a structured project management best practices method to their dynamic environment produces better

performing projects with lower cost, faster delivery times, less surprises during project execution, better communication between all stakeholders and superior customer satisfaction (Zandhuis & Stellingwerf, 2013:13).

2.6 PROJECT MANAGEMENT (PM)

A project can be defined as a temporary activity to achieve a unique product, service, requirement or objective (PMI, 2004a:5; PMI, 2013:5). A project is also defined as a sequence of associated tasks typically focused on some key output/deliverable and demanding substantial time to complete (Jacobs & Chase, 2011:373).

The Project Management Institute (PMI) defines PM as the use of knowledge, skills, tools and procedures in project activities to meet project requirements. PM can also be defined as planning, guiding and governing resources (people, equipment, material) to meet the technical, cost and time constraints of the project (Jacobs & Chase, 2011: 373). Project management is achieved through procedures and includes the integration of the different phases of a project lifecycle (Zandhuis & Stellingwerf, 2013:15)

The Project Management Institute (PMI) has three areas of focus (Baltzan & Phillips, 2010:260):

- **Ethics:** The distinctive characteristics of a practising professional project manager.
- **Standards:** The content and organization of the project management body of knowledge.
- **Accreditation:** Recognition of professional achievement.

The world-wide project management standards are the Project Management Body of Knowledge (PMBOK®) and Projects in Controlled Environments (PRINCE2®) (Labuschagne & Steyn, 2010:71). Recently a new standard that is claimed to be the first real universally accepted standard for project management have been introduced in the form of ISO 21500 (Zandhuis & Stellingwerf, 2013:5). The content of ISO 21500 and the newest version of PMBOK®5 (5th edition) corresponds more than 95% (Zandhuis & Stellingwerf, 2013:6). The expertise required by the project management

team for effective project management is illustrated in Figure 5 and includes (PMI, 2004a:13):

- **Interpersonal skills:** Interpersonal skills involves interpersonal relationships and includes the following skills:
    - Effective communication.
    - Influencing the organisation and getting things done.
    - Leadership as opposed to only management.
    - Motivation to energize employees to achieve high levels of performance.
    - Negotiation and conflict management.
    - Problem solving.
- **General management knowledge and skills:** General management skills include planning, organising, execution and control. General management forms the foundation for project management skills.
- **Understanding the project environment:** Practically all projects are planned and executed in a cultural, social, international, political and physical environment. Projects therefore have intended and unintended positive and negative impacts.
- **The application area knowledge, standards and regulations:** Application areas are substantial elements of projects that are not present in all projects. Application areas are defined in terms of functional departments and supporting disciplines (legal, marketing, logistics, etc.), technical elements (software development, engineering), management specialization (government contracting, community development, innovation) and industry sectors (automotive, chemical, agricultural, financial, etc.).
- **The project management body of knowledge:** PMBOK defines the knowledge exclusive to project management and that overlaps with other management disciplines. PMBOK includes the project life cycle definition, the project management process groups and the nine knowledge areas of PM as applied to this study.

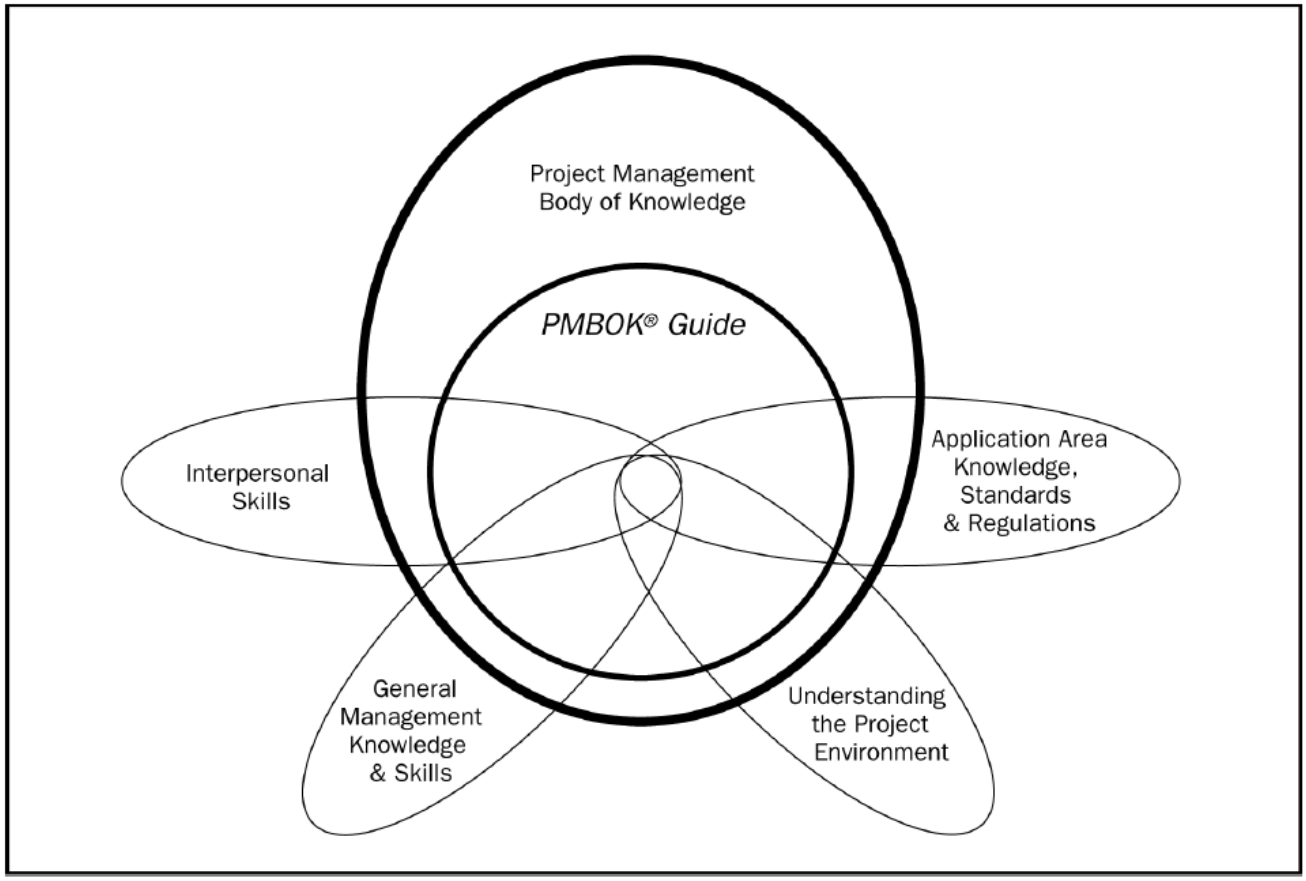


Figure 5: Areas of expertise needed by the project management team.

Source: (PMI, 2004a:13).

PM is accomplished through processes that convert project inputs into outputs/deliverables. These processes should not always be applied homogeneously on all projects and only appropriate processes should be applied with the necessary degree of strictness. One underlying principle for the interaction between these processes is the *Plan, Do, Check, Act* cycle where the result of one cycle is the input for the next. PM involves the following PM processes or process groups that are repeated for each phase of a project (PMI, 2004a:8; PMI, 2004b:41; PMI, 2013:49):

a) **Initiating:** Definition and authorisation of the project or phase.
b) **Planning:** Definition and refinement of objectives and plans the sequence of actions to achieve the project objectives and scope.
c) **Executing:** Integration of people and other resources to accomplish the project plan.
d) **Monitoring and controlling:** Measuring, scrutiny and governance of project progress, identifying variances from the project plan to allow for corrective action to be able to achieve the project objectives.

e) **Closing:** Formal acceptance of the product or service delivered to the customer is performed and a project or project phase is closed in a systematic, orderly fashion.

Project management has nine knowledge areas according to the project management guide issued by the Project Management Institute (PMI, 2004a:8):

1) **Project integration management:** Integration is primarily concerned with effectively selecting and integrating the applicable PM processes to achieve the project objectives within the organisation's defined procedures.
2) **Project scope management:** Identify and control the applicable processes required to ensure the work required (and nothing more or less) is delivered to successfully complete the project.
3) **Project time management:** Includes all processes to complete the project on time.
4) **Project cost management:** Includes processes involved in planning, estimating and governing costs to enable the project to be completed within the approved budget.
5) **Project quality management:** Includes all activities that govern the quality procedures, objectives and responsibilities to accomplish the project quality objectives.
6) **Project human resource management:** Includes all processes that arrange and manage the project team and clearly assigns roles and responsibilities.
7) **Project communication management:** Includes the processes that ensure timely and applicable generation, gathering, spreading, storage and disposition of project information. This provides the essential link between the project information and resources that ensure successful communication.
8) **Project risk management:** Includes the processes concerning risk management planning, identification, analysis, responses, monitoring and control on a project that is regularly updated during the project execution.
9) **Project procurement:** Includes the processes to purchase or acquire the products, services or results needed from outside the project team to perform the work required. This includes contract management and change control processes.

In the newest version of PMBOK® 5 (PMI, 2013:423) a tenth knowledge area was introduced:

10) **Project stakeholder management:** Includes the processes to identify, plan, manage and control stakeholder engagement of all individuals or groups that could impact or be impacted by the project.

This tenth knowledge area was introduced to take into consideration the comments received motivating that the knowledge area of project communication management be focused on project specific communication and that stakeholder management be grouped on its own (PMI, 2013:469).

2.7 PROJECT MANAGEMENT PROFESSION AND ACCREDITATION

With increasing global competition and more complex projects, the demands on the skills of project managers also rise. In recent years the acquisition of knowledge, skills and education have been recognised to better fulfil the function of project management. PM has matured to such a stage that it can be considered a profession. With a universal PM language and vocabulary, it enhances better communication. Some of the competencies required in project management include (Zandhuis & Stellingwerf, 2013:22):

- Technical competencies: Applying PM knowledge to projects in a structured fashion.
- Behavioural competencies: Capability to build and maintain relationships with all stakeholders.
- Contextual competencies: Ability to apply and adapt PM to different organisation environments.

Acknowledgement of an individual's professional project management achievement may include any one of the following but is not limited to those listed below (PMI, 2013:2; ILX Group, 2013:1):

- Certified associate in project management (CAPM).
- Project management professional (PMP).
- Program management professional (PgMP).
- PMI agile certified practitioner (PMI-ACP).
- PMI risk management professional (PMI-RMP).

- PMI scheduling professional (PMI-SP).
- PRINCE2® Foundation.
- PRINCE2® Practitioner.

The newest addition of the tenth knowledge area in PMBOK®5 has only been part of the above PMI accreditations since July 2013 and again indicates the evolving nature of project management.

Since the ISO 21500 is still only a guideline and not a standard such as the ISO 9001 standard for quality assurance, companies can not yet be certified as being ISO 21500 certified PM compliant companies (Zandhuis & Stellingwerf, 2013:26). The PMI does not offer certifications such as ISO, but measures a company's PM maturity with the OPM3 model (Zandhuis & Stellingwerf, 2013:27).

2.8 PROJECT MANAGEMENT MATURITY

The organisation's maturity in respect of the project management coordination, principles, values, organisational structure and project management office can all influence the project and its outcome (PMI, 2004b:27).

Maturity is generally defined as a very advanced or developed form or state (CAEOD, 2013). Organisational maturity evaluation models have the objective to provide a structured systematic approach based on industry best practice to guide the maturity process and continuous improvement (Pinto *et al.*, 2010:2). There are more than 30 PM maturity models to measure and progressively improve a company's PM performance, maturity and service. The PM maturity models all make use of questionnaire surveys or interviews to assess the company PM maturity (Beset, 2007:25). Evaluating the current company project management maturity and comparing it to the required maturity level can be used to identify any gaps and develop a strategy to close these gaps (Craig-Jones, 2007:3). Not one of the PM maturity models are accepted worldwide as the best or most preferred (Pretorius, Steyn & Jordaan, 2012:2).

The first maturity model was developed by the Software Engineering Institute (SEI) and called the Capability Maturity Model (CMM) with five levels of maturity (Beset,

2007:25). Another such model is the Organisational Project Management Maturity Model (2003) (OPM3) developed under the guidance of the Project Management Institute (PMI, 2004b; Mittermaier & Steyn, 2009:98). OPM3 defines four levels of PM maturity over three different scope levels from project level to programme and portfolio levels (Brewer & Dittman, 2013: 433).

Table 2: OPM3 model maturity level dimensions.

OPM3		Project Management	Programme Management	Portfolio Management
Level 1:		Standardize: Characterised by standardisation of the whole project life cycle.		
Level 2:		Measure: Company is able to measure and analyse actual project performance and critical characteristics against standards.		
Level 3:		Control: Company measures and control performance and stability of process.		
Level 4:		Continuously improve: PM performance is improved through PM process problem identification and improvements.		

OPM3 is a multidimensional maturity model as indicated in Table 2 and Figure 6.

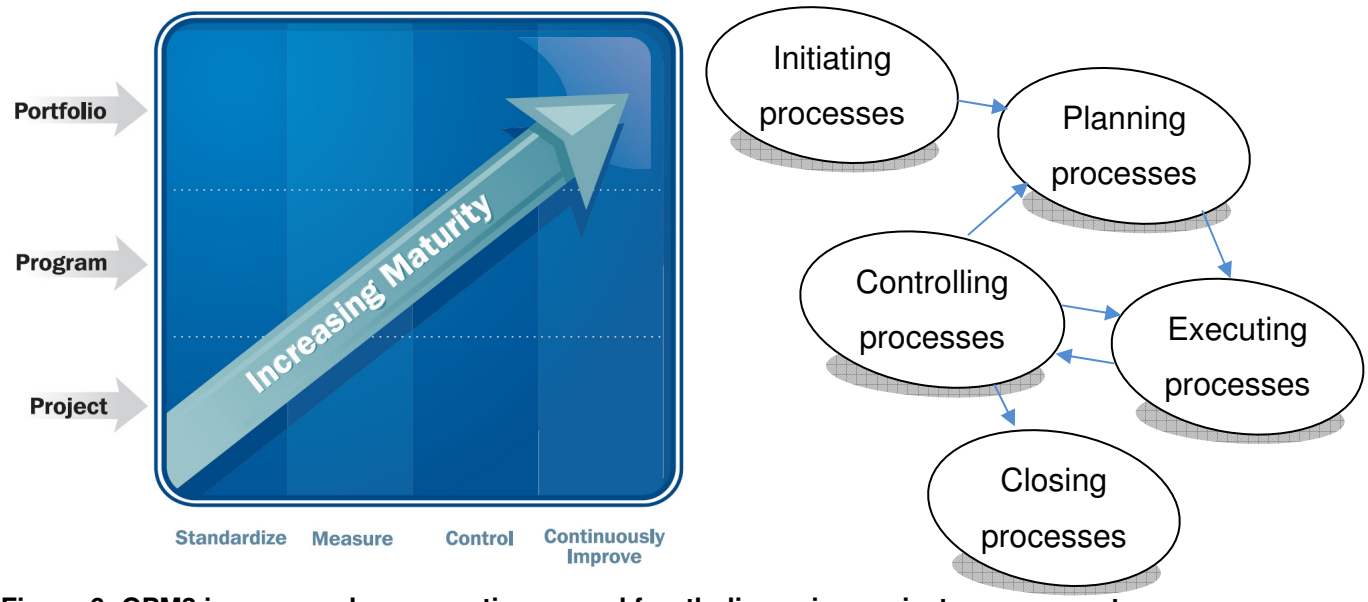


Figure 6: OPM3 increases along a continuum and fourth dimension project management process groups.

Source: (PMI, 2003:6).

The PM maturity measured against the nine PMBOK®4 knowledge areas is another maturity model presented by Crawford (2006). The five levels of project management maturity according to the five levels defined in the SEI CMM is shown in Table 3. The implementation of the expanded key component knowledge requirements of the nine

knowledge areas are evaluated against the five maturity levels as conceptually indicated in Figure 7.

Table 3: Levels of project management maturity.

Source: (Crawford, 2006:5).

Level 5	**Continuous Improvement/Optimized process**: Proactive problem management.
Level 4	**Managed process:** Projects managed according to future plans. Metrics to evaluate PM performance.
Level 3	**Defined/Organisational standardisation:** All PM processes are in place and institutionalised. Process modified according to project. Process stakeholders act as one project team.
Level 2	**Planned/Repeatable:** Many different PM processes applied, no standardisation or systematic application of management activities
Level 1	**Initial:** No formal practices and standards. Ad-hoc solutions. Awareness of PM processes.

The standardised best practices proposed by OPM3 for example depends on the unique characterisation of the company and therefore supports the literature that a "one size fits all" approach is not applicable in PM for all companies (Liu & Yetton, 2007:789).

There are generally five PM maturity levels depending on the PM maturity model used. The higher the maturity of project management in a company is, the higher the numerical level will be from one to five. A level three PM maturity indicates that the majority of PM processes are used by the majority of people in the company. A level five indicates all PM processes are in place and the PM processes are also measured and continuously improved upon. A company can mature from one level to the next and cannot mature from a level one to a level three, since the one level builds on the processes implemented in the previous level (Marnewick & Labuschagne, 2010:257).

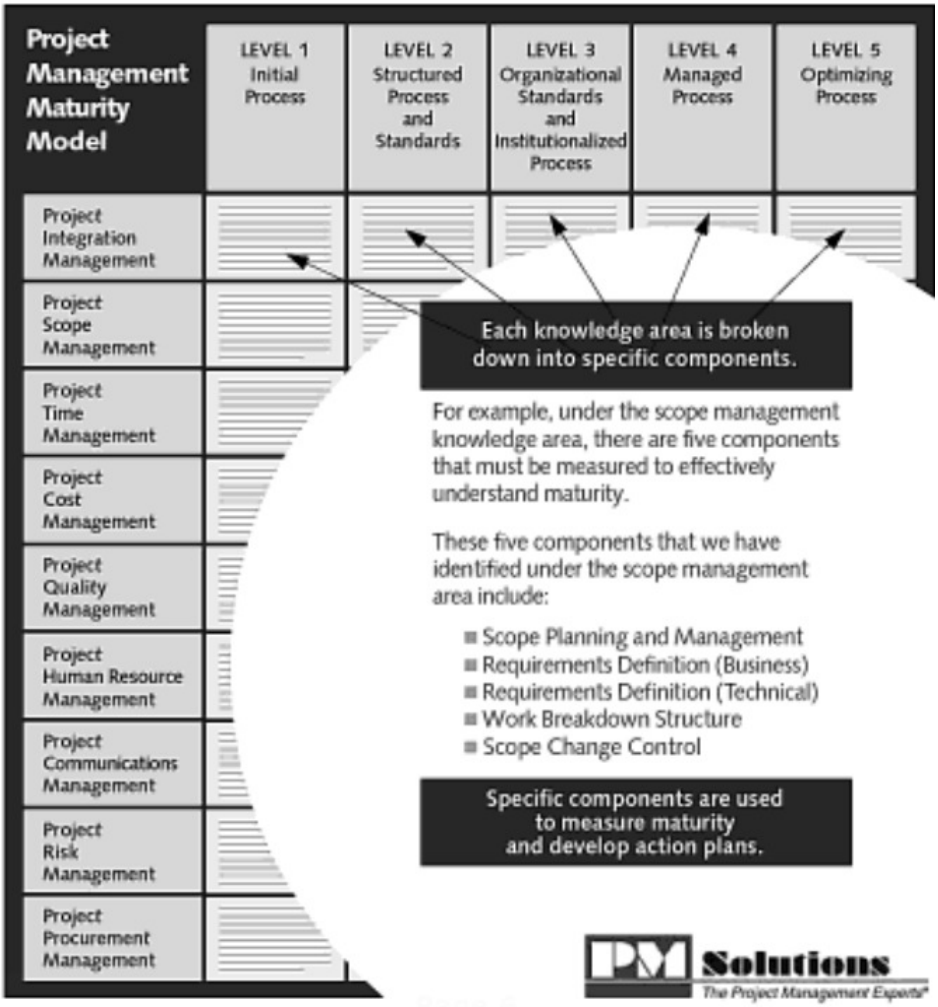


Figure 7: Maturity level evaluated for the key components of the nine PMBOK knowledge areas. (Crawford, 2006:6).

In a previous study, engineering and construction industries showed a higher project management maturity than the IT industry (Ibbs & Kwak, 2000:32). Cooke-Davies and Arzymanow (2003:478) found that PM maturity differs between the different industries and tend to be more mature in industries where project management originated. The engineering industries tend to be more mature than industries that adopted PM more recently like pharmaceutical research and development and information technology industries. Organisations involved in business critical and safety systems such as in the defence or aircraft manufacturing industry typically strive towards a level 5 maturity (Craig-Jones, 2007:3).

Pretorius, Steyn and Jordaan (2012:2) conducted a study where they tried to relate project success in the engineering and construction industry to the PM maturity of Southern Africa companies. There seems to be no consensus whether the PM maturity

of a company directly relates to more successful projects delivered (Pretorius *et al.*, 2012:2). Pretorius *et al.* (2012:2) found that project success does not automatically depend on PM maturity and that a project can be successful despite the PM maturity level. The study showed that companies with the following more mature PM knowledge areas tend to be more successful:

- Project integration management.
- Project scope management.
- Project time management.
- Project cost management.
- Project human resource management.

Project success may therefore depend on other factors than only standardised processes implemented by a PMO (Pretorius *et al.*, 2012:9).

The PMO is one instrument that is used to assist a company to mature the PM processes from one level to the next (Marnewick & Labuschagne, 2010:257).

2.9 PROJECT MANAGEMENT OFFICE

The primary objective of the study is to determine what contribution a project management office (PMO) can make towards successful project delivery using PM maturity as departure point.

PM can also be applied in a wider framework on programmes, portfolios and project management offices. Project management, programme management and portfolio management differs in the way they each contribute to the organisational strategic objectives. A programme is a collection of smaller related projects that are managed together in a co-ordinated way to achieve more efficiency, effectiveness and control than would have been achieved by managing them separately. The projects are managed together in order to achieve the programme strategic goals and objectives (PMI, 2003:4; PMI, 2004a:16; PMI, 2013:9).

A portfolio is a collection of projects and programmes that are grouped together to manage them more effectively and achieve a strategic business goal. The projects

and/or programmes in a portfolio do not necessarily need to be inter-related or directly inter-reliant (PMI, 2003:4; PMI, 2004a:17; PMI, 2013:9).

The project management office (PMO) concept started in the 1930 to 1950s to administer large projects but only really took shape during the 1990s (Aubry *et al.*, 2007:330; Pinto *et al.*, 2010:1). PMOs were created with one collective goal of obtaining better results in projects developed by a company (Pinto *et al.*, 2010:2). The PMO is an organisational unit with a variety of mandates depending on the specific organisational need. The PMO can be created for a single large project, or for managing a multitude of smaller projects (project portfolio) and programmes. PMOs in general are implemented to improve project management performance/effectiveness and to reduce the number of poor/failed projects (Julian, 2008: 43; Kwak & Dai, 2000:333; Pinto *et al.*, 2010:3). The PMO is typically a centralised division or management structure that implements PM procedures (standardises project governance) and provides support in the form of applying PM tools and techniques effectively (Kwak & Dai, 2000:333; Pinto *et al.*, 2010:3; PMI, 2013: 10). One of the primary objectives of the PMO is to educate the organisation on techniques and procedures to run successful projects (Baltzan & Phillips, 2010:260). There can also be more than one PMO per company, for example one for each programme or region (Hill, 2006:46).

The project management office is also known by the name program management office, project office, program office, project support office, etc. (PMI, 2004a:17). Some distribution of different names for a PMO is displayed in Table 4 from a large survey conducted (500 respondents involved in PMOs). The PMO is seen by many as a support department similar to the finance, marketing or information technology (IT) department (Pinto *et al.*, 2010:4). However, the critical requirement that a PMO should generate value differentiates it from traditional support department functions. The benefits of the value generation are not always noticed or measurable.

Table 4: Name of organisational entity.

Source: (Hobbs & Aubry, 2007:79).

Entity	Percentage
Project Management Office	59%
Name containing the term "project" and somewhat similar to project management office (e.g. project department)	4%

Entity	Percentage
Project Support Office	7%
Project Office	2%
Program Management Office	12%
Center of Excellence	2%
No name	2%
Other (a great variety with none greater than 1%)	12%

Companies in a project environment have the challenge that learning from previous projects is seldom used for the benefit of future projects due to project teams disassembling at the end of a project. A central and coordinated management of such projects will in effect be able to cause organisational learning and continuous improvement (Julian, 2008:43). PMOs therefore are central business units basically responsible for enforcing PM standards and to improve project performance by exploiting previous lessons learned (Julian, 2008:44).

For a company to have ideal conditions for organisational learning there are two requirements (Julian, 2008:55):

a) Individuals, whether appointed by the company or their peers, that takes the PM learning back to the system; and
b) Company structures, procedures and culture to enable organisational learning.

Companies with projects that make use of the same routines/procedures are ideal to benefit from previous lessons learned being managed by the PMO. It should be noted that if the majority of lessons learned are from failed projects, then these lessons learned being implemented in routines may constrain a company. Company routines/procedures are essentially the way of doing things and implementation of lessons learned in new routines can help companies to overcome previous project challenges in a progressive manner. It should be borne in mind that lessons learned in a defensive situation where the project is under time or cost pressure may mislead or limit organisational learning (Julian, 2008:55).

Understanding the complex and diverse phenomenon of PMOs can be related/ investigated from the history and culture of the company and development of organisational project management (Aubry *et al.*, 2008:38).

The PMO has been shown to be an unstable structure that is of dynamic and even temporary nature. In three surveys conducted between 2002 and 2007 the average age of PMO's were found to be 2 years, highlighting the dynamic nature of PMOs that are formed and restructured regularly (Aubry *et al.*, 2010:767). The sustainability of PMOs can even be considered to be fragile in nature should they not have the ability to adapt, evolve and continuously mature with the company (Pinto *et al.*, 2010:2).

Both the internal company environment and the external business environment contribute to the significant changes witnessed in company PMO structures (Aubry *et al.*, 2010:767). The following typical external drivers of PMO change were identified (Aubry *et al.*, 2010:772):

- International or local economy.
- Industry or market.
- Nationwide or local political environment.
- Social responsibility, ethical or environmental impact pressure.

The following internal drivers of change or organisational evolutionary factors were identified (Aubry *et al.*, 2010:772):

- New ownership.
- New CEO or executive team changes.
- New PMO manager.
- New business vision and or strategy.
- Broad organisational restructuring.
- Unsatisfactory project performance or failures.
- Internal competition.
- Overall project workload changes.

PMO's experience the following tension within a company (Hobbs *et al.*, 2008:552):

- Economic (value added by PMO's existence).
- Political (where power and control over a project resides: PMO or program).
- Client relationship (project customer relationship access to understand project need).
- Standardisation methodology vs. project execution flexibility requirements.
- Resource allocation during capacity building or reduction.

The roles or approach of a PMO can be defined on three levels or a hybrid of the three (Do Valle *et al.*, 2008:3; Pinto, Cota & Levin, 2010:5):

- **Strategic:** Deliver services that are related to organisation strategy such as how to manage a portfolio of projects and programs, decision making information provision to top management, monitor and implement strategy, prioritise projects, etc.
- **Tactical/directional:** Supply service for a group of projects or individuals such as cultivating a project management methodology, developing project management tools, offering training for managers and teams, etc.
- **Operational/support:** Provides service to a project or individual such as supporting project planning and control, coaching/mentoring, managing a strategic project, recovering a troubled project, etc.

The scope of a PMO can generically be summarised on three levels determined by how far reaching the PMO actions are within the organisation (Pinto *et al.*, 2010:5):

- **Project/program:** Covers only one project or program within the organisation.
- **Departmental:** Covers only part or specific area of the organisation.
- **Enterprise/Corporate:** Covers the organisation as a whole.

The PMO models normally map to the project management maturity level of a company. Administrative PMOs are for example normally found at relatively immature project management companies. Four PMO models are defined as follows (Desouza & Evaristo, 2006:416):

a) The supporter is a purely administrative function of reporting project standing, identifying risk and maintaining project records. No authority resides with the supporter.
b) The information manager is knowledge intensive and provides summarised, dashboard type information about project status.
c) The knowledge manager stores knowledge of best practices that provides mentoring, training and project know-how with no administrative duties. This type of PMO is the central point of accountability for the successful delivery of specific projects.

d) The coach is the most knowledge intensive model and is a centre of excellence that is responsible for enforcing project excellence in the organisation.

Aubry *et al.* (2010:767) are of opinion that PMOs are mostly grouped into three or four maturity levels and that the most influential function categorisation is:

a) Project repository.
b) Coach.
c) Enterprise.

The PMO functions have been investigated and summarised by various authors (Hill, 2006:48; Desouza & Evaristo, 2006:416; Hobbs & Aubry, 2007:82). The PMO may integrate any combination of the following (Desouza & Evaristo, 2006:416):

a) Project knowledge management.
b) Project processes and procedures.
c) Training for project teams.
d) Project resources.
e) Project portfolio management.
f) Project financial management.

In a large survey conducted (500 respondents involved in PMOs) twenty seven PMO functions were identified and prioritised as shown in Table 5 (Hobbs & Aubry, 2007:82).

Table 5: PMO functions in decreasing order of importance.

(Hobbs & Aubry, 2007:82).

PMO function	% of PMOs where important
Report project status to upper management	83%
Develop and implement a standard methodology	76%
Monitor and control of project performance	65%
Develop competency of personnel, including training	65%
Implement and operate a project information system	60%
Provide advice to upper management	60%
Coordinate between projects	59%
Develop and maintain a project scoreboard	58%
Promote project management within organisation	55%
Monitor and control performance of PMO	50%

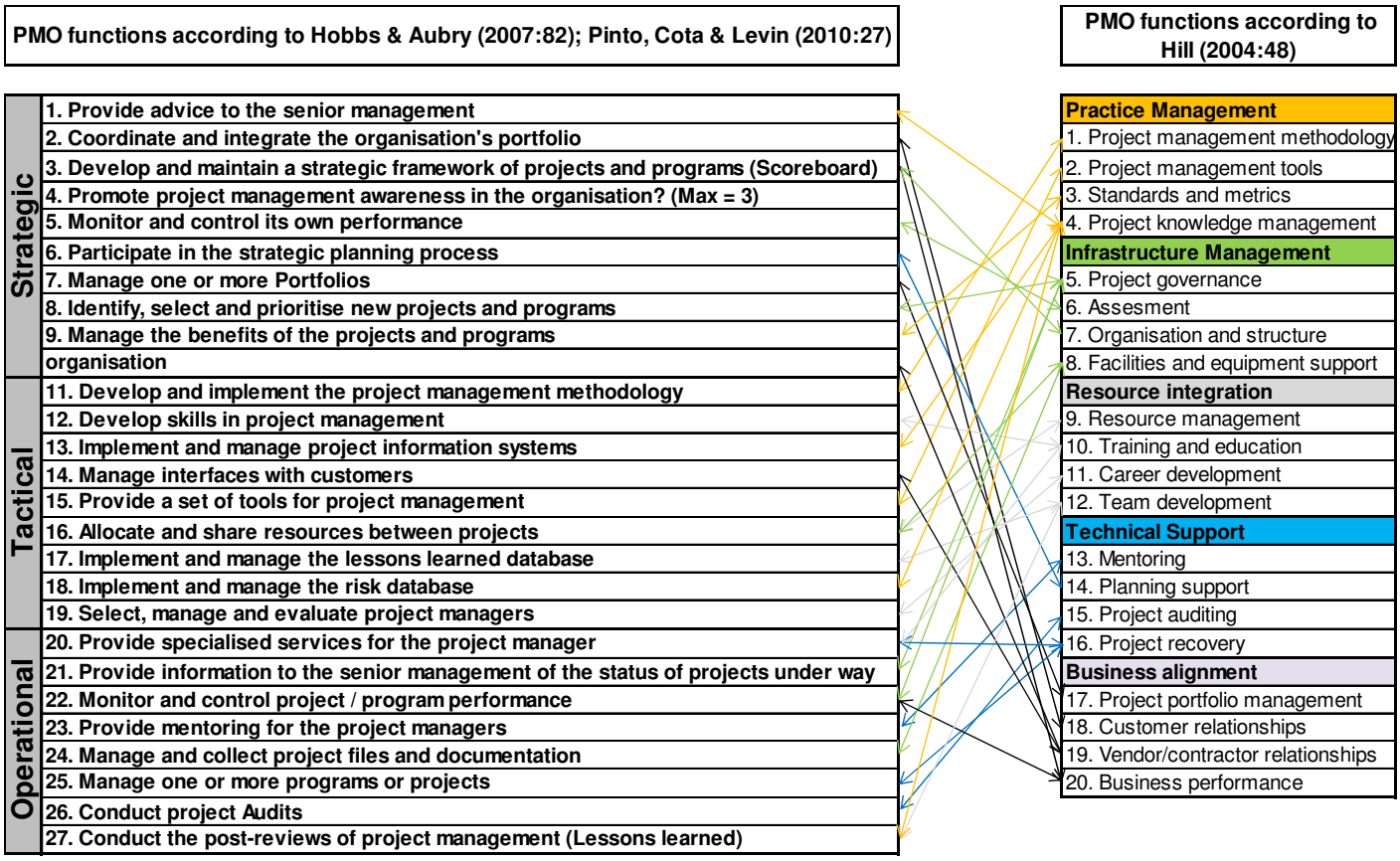
PMO function	% of PMOs where important
Participate in strategic planning	49%
Provide mentoring for project managers	49%
Manage one or more portfolios	49%
Identify, select and prioritize new projects	48%
Manage archives of project documentation	48%
Manage one or more programs	48%
Conduct project audits	45%
Manage customer interfaces	45%
Provide a set of tools without an effort to standardize	42%
Execute specialized tasks for project managers	42%
Allocate resources between projects	40%
Conduct post-project reviews	38%
Implement and manage database of lessons learned	34%
Implement and manage risk database	29%
Benefits management	28%
Networking and environmental scanning	25%
Recruit, select, evaluate and determine salaries for project managers	22%

Hill (2006:48) also listed twenty (20) PMO functions of a mature PMO. The PMO functions as defined by these different authors (Hill, 2006:48, Hobbs & Aubry, 2007:82; Pinto *et al.*, 2010:27) are grouped and categorised differently but essentially point to the same functionality as can be seen in the qualitative comparison and mapping of the different functions in Table 6. Hill (2006:51) states that it is unlikely that a single PMO will implement all the PMO functions and that variations of the different functions will be at the order of the day.

Kendall and Rollins (2003:207) consider the biggest mistakes companies make in terms of project portfolios to be related to one of the following four factors:

a) Too many open projects competing for limited resources.
b) Wrong projects that do not add value to the organisation.
c) Projects that are not aligned with the company vision and strategy.
d) An unbalanced portfolio of projects with for example too many short term projects and no long term projects, not utilizing the company's most valuable resources, etc.

Table 6: Project management office function comparison and mapping according to different authors.



The value that a PMO brings to a company should be measurable in the following three items (Kendall & Rollins, 2003:316):

a) On average projects should be completed faster.
b) More projects should be completed per year with the same number of resources.
c) Some financial indicator such as improved ROI, reduced costs, etc.

The success of a PMO implicates its capacity to understand who its customers are, what their needs are, and how to meet those needs by creating clear and sufficient benefits and generating traceable and measurable value (Pinto *et al.*, 2010:4).

The rule of thumb for the time requirements to implement a PMO is as follows (Andersen *et al.*, 2007:98):

- 3 months to a year for a project.
- 1 to 3 years on divisional or departmental level.
- 3 to 7 years on a corporate/enterprise level.

2.9.1 Criticism against the PMO

PMO's were originally developed for large companies and not necessarily adapted for smaller companies. The three major reasons for negative perceptions of PMO's are (Kwak & Dai, 2000:334):

- PMO is purely considered as an overhead cost, being expensive and dispensable.
- PMO only adds another layer of administration, makes business processes sluggish and consume resources.
- It is hard to quantify the return on investment in the PMO.

2.9.2 Difference between project management and project management office objectives

The differences between the objectives of a project manager and a PMO are as follows (PMI, 2013:12):

- The project manager focuses on the project objective where the PMO focuses on company, portfolio or programme scope changes that may improve the ability to reach the business objectives.
- The project manager focuses on controlling the resources best to achieve the project objectives, whereas the PMO manages the optimal utilisation of shared resources across all projects.
- The project manager manages the project constraints (time, cost, quality, etc.), whereas the PMO manages procedures, standards, business risks, metrics and interdependencies for the organisation as a whole.

2.10 PMO MATURITY MODELS

The Organisational Project Management Maturity Model (2003) (OPM3) developed under the guidance of Project Management Institute (PMI, 2004b; Mittermaier & Steyn, 2009:98) discussed in the previous section was already a step towards a PMO maturity model as it not only measures project management maturity but also the project management maturity on a programme and portfolio or enterprise level. PMOs can perform a self-assessment using any one of the PMO maturity models. The better the PMO delivers its service and only the services required, the more the PMO is perceived to deliver value to the organisation (Pinto *et al.*, 2010:1). The process of a PMO maturing comprises the skills to meet the new needs resulting from the normal

evolution of the company and its customers. The PMO should continuously offer new services, and make the level of service more sophisticated in response to evolving demands (Pinto *et al.*, 2010:4).

PMO maturity evaluation models have the generic objective to assist the maturity process by providing an organised route based on best practices and to nurture continuous improvement (Pinto *et al.*, 2010:2). The development of different levels/ stages/types of PMO is intended to follow an incremental evolution from a low level to an advanced level model (Aubry *et al.*, 2010:767).

Although there is a strong correlation between the maturity of the company and the PMO maturity, it is possible for a relatively immature PMO to exist in a mature company should that be the required level of sophistication to achieve its goals (Pinto *et al.*, 2010:3). The evolution of a more mature company will normally require more and increasingly sophisticated needs from the PMO, indicating a continuous evolution of the PMO to align and adapt to evolving company needs (Pinto *et al.*, 2010:4).

Kendall and Rollins (2003:371) propose a dedicated eight level PMO maturity model to assess the progress made by the PMO on all nine PMBOK® knowledge areas. These eight PMO maturity levels are (Kendall & Rollins, 2003:371):

1) **Level I:** PMO defining value proposition during the initiation and identifying the PM current state and PMO purpose. Standardised reporting of project status and risks are not in place. Project managers constantly fight over resource availability without knowing which project delivers the critical or most strategic value add at a specific point in time.
2) **Level II:** PMO becomes organised and each project is managed according to scope and schedule of each project individually. Project managers understand the different active projects on a high level but do not have sufficient information to understand or predict project interdependencies. Not all projects are aligned with the business vision and strategy. Resources cannot accurately forecast their future workload past two weeks. PMO mentors provide subject matter expert advice to strategically important projects. Pre- and post-project dependencies are not known.

3) **Level III:** Searching for delivery value in terms of how project delivery can be improved/sped up. Communication of strategic critical project threats and improvement opportunities are communicated to the PM team. What is in the scope of work and what not is identified and planned for. Resource utilization is known, workload for 80% of the resources is known for 30 days in advance and strategic resources are identified. Project managers are using the PMO as source of information and advice on how to improve their project delivery and efficiency. Project financials (planned vs. actual) are tracked monthly. Project portfolio baseline for the year is known and available. Critical path items start to be delivered before the planned schedule.
4) **Level IV:** Portfolio management – working on the right projects and project dependencies are understood and communicated within the PM team. When one project accelerates, the other project managers can respond accordingly. The project portfolio scheduling causes project re-ranking in terms of critical path tracking. Resource manageability is a key value-add of the PMO. Problem vendors/contractors are identified and managed. Processes are established to manage inter-project dynamics.
5) **Level V:** Community buy-in by executives and PM team. The project control/governance board is responsible for and managing the portfolio delivery outcomes and order. Risk management is a standard part of status reporting. Quality goals are managed with project management metrics. A project management information system (PMIS) is used throughout the project lifecycle and resources start to feel comfortable reporting issues as an opportunity to make a difference.
6) **Level VI:** Project teams delivering on schedule or even faster in some instances and the project delivery is more predictable. Resource load is managed with minimum excessive peaks and valleys. Quality concerns causing interruptions are documented and managed. Project managers and team members have information in time to take preventative action and utilize any acceleration opportunities.
7) **Level VII:** Project teams calibrated with portfolios and more projects per year. Poor multi-tasking is noticeably reduced, every resource is looking for project acceleration opportunities and resource utilization is improved. The PM

governance board is strategically investing in marketing and assets. Vendors are part of the project scheduling and use the same procedures and approach.

8) **Level VIII:** Organisation delivering where 95% of projects are delivered on time in a worst case scenario. PM maturity is continually scrutinized and enriched.

Hill (2006:45) links project management maturity to a five stage PMO competency model:

a) Stage 1: Project office for project oversight.
b) Stage 2: Basic PMO for process control.
c) Stage 3: Standard PMO for process support.
d) Stage 4: Advanced PMO for business maturity.
e) Stage 5: Centre of excellence for strategic alignment.

The PMO maturity cube model typifies PMOs according to two dimensions: scope and approach (Pinto *et al.*, 2010:5) (see Figure 9) and evaluates the maturity according to the 27 functions of a PMO as defined by Hobbs & Aubry (2007:82).

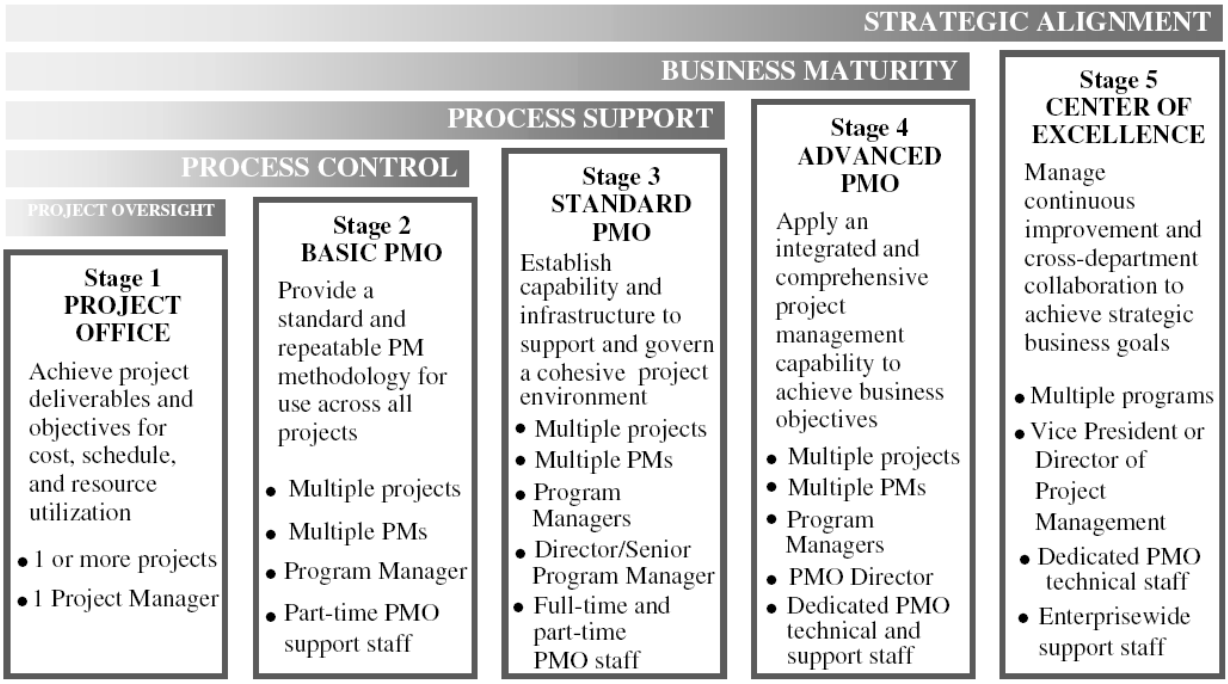


Figure 8: Five stage PMO competency model.
Source: (Hill, 2006:46).

The scope of a PMO is summarised on three mutually exclusive levels determined by how far reaching the PMO actions are within the organisation (Pinto *et al.*, 2010:5):

- **Project/program:** Covers only one project or program within the organisation.

- **Departmental:** Covers only part or area of the organisation such as a department or business unit.
- **Enterprise/Corporate:** Covers the organisation as a whole.

In this specific questionnaire for each scope, the model identifies which services are offered under each different approach and will determine the level of sophistication/maturity of their implementation. The approach is defined from the way in which the PMO interacts with its customers or the PMO mission. For the approach the following definitions apply (Pinto *et al.*, 2010:5):

- **Strategic:** Deliver service that are related to organisation strategy such as how to manage a portfolio of projects and programs, decision making information provision to top management, monitor and implement strategy, prioritise projects, etc.
- **Tactical/directional:** Supply service for a group of projects or individuals such as cultivating a project management methodology, developing project management tools, offering training for managers and teams, etc.
- **Operational/support:** Provides service to a project or individual such as supporting project planning and control, coaching/mentoring, managing a strategic project, recovering a troubled project, etc.

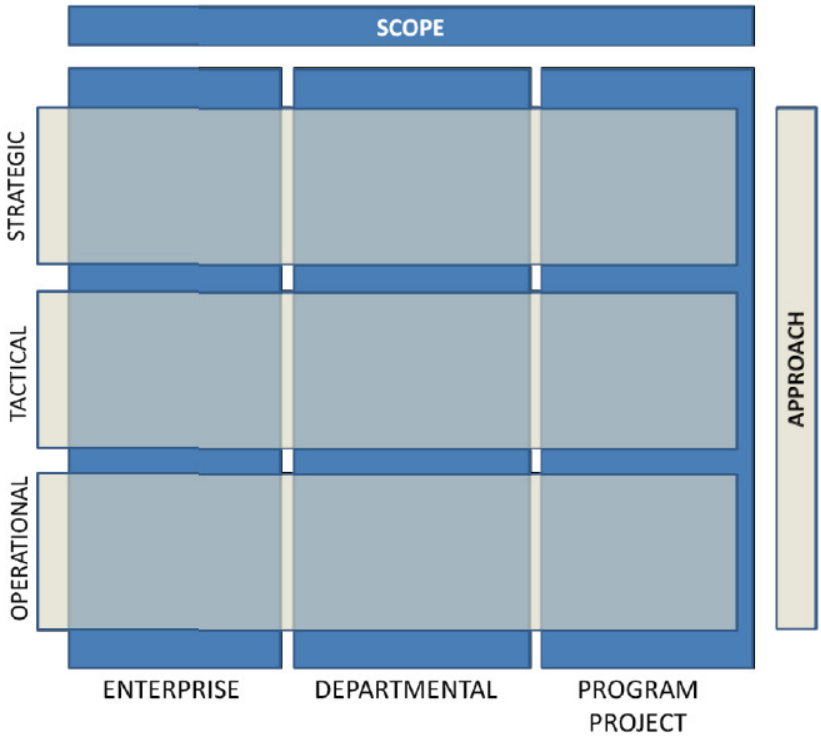


Figure 9: The nine quadrants resulting from the relationship between scope and approach. Source: (Pinto et al., 2010:6).

A specific PMO may operate on an operational, tactical and strategic approach at any given time, depending on the specific scope. In effect there are twenty one (21) types of PMOs. With the three mutually exclusive PMO scopes, there are a possible seven (7) combinations of the three PMO approaches that can be offered by a PMO as service (Pinto *et al.*, 2010:9):

- Strategic.
- Strategic-tactical.
- Strategic-operational.
- Tactical.
- Tactical-operational.
- Operational.
- Strategic-tactical-operational.

Hill (2006:46) states that not every company requires a stage five or most mature PMO to achieve their organisational objectives. The PMO can even contribute to the improvement of company PM maturity and effectiveness by being used to train and distribute knowledge of lessons learned (Do Valle *et al.*, 2008:1).

2.11 CONCLUSIONS FROM THE LITERATURE REVIEW

From the literature study it is evident that consulting engineering industry functions in a dynamic project environment with high uncertainty. In order to be successful, organizations need to be strategically aware of the environment they are competing in. The nature of the consulting engineering business is service orientated and project success is not merely dependent on the delivery of quality on time and within budget. The customer should be the focal point of all processes, actions and decisions made in a service organisation such as a consulting engineering company. The perception of quality by the client is essential to enable a sustainable competitive business. Technical performance of professional service companies can be improved by properly managing the projects and resources. Human resources are the backbone of the consulting engineering service offering. Some of the challenges faced by consulting engineering companies include professional technical resources that are normally left to monitor and control themselves and are challenging to manage.

Some of the key success factors for consulting engineering firms identified in the literature include:

- Established pre-emptive project management reputation.
- Building good relationships with the client in addition to the actual technical service delivered.
- Marketing of previous track record.
- PM's ability to fully utilise resource team skills, capability and capacity.
- Operations management to systematically align resources and projects, since the service delivered by a consulting engineering firm can generally not be stored and if demand is higher than the service capacity, it may equate to lost revenue.

Project management is an integrated part of consulting engineering companies that typically manage a whole portfolio of projects simultaneously in different project life cycle stages. PM is defined as the use of knowledge, skills, tools and procedures in project activities to meet project requirements as a generic recipe alone is not always effective. PM is guided by PM standards such as PMBOK and PRINCE2, and lately the proclaimed first universally accepted PM guideline, ISO 21500[2].

Companies achieve a sustainable competitive advantage by meeting and exceeding the client expected quality of service. The client perception of value is related to both efficiency and effectiveness. ISO 9001 (quality management systems) certification is considered to be one of the supportive tools that have transformed the value chain over the years. Literature shows that cross-project learning and knowledge transfer adds value to the client, the company and shareholders, since project delivery success is increased and projects are delivered more efficiently and effectively. PM can even contribute towards an additional revenue stream.

Project success (achieving results aimed at) goes beyond the so-called iron triangle of budget, time and scope. Project success includes the project impact on the customer and stakeholder benefits, organisational infrastructure and forthcoming prospects. This perceived quality from the client's perspective compliments the iron triangle and contributes towards sustainable successful project delivery.

[2] The ISO 21500 is still only a guideline and not yet a standard.

PMOs are company units that systematically apply PM to projects. PMOs in general are implemented to improve project management performance/effectiveness and to reduce the number of poor/failed projects. The PMO's ability to co-ordinate information and manage diverse project portfolios have a significant impact on project performance in high uncertainty environments such as the consulting engineering industry. PMOs are under pressure to perform and add value in an environment where it improves efficiency and effectiveness that is difficult to measure. The PMO seems to be an unstable structure that is dynamic of nature and that is formed and restructured regularly. PMOs can have a strategic, operational or tactical approach. The mutually exclusive scopes of PMO's are applicable to the enterprise level, departmental or project-program level.

Maturity is defined as a very well developed or advanced level of development. No ISO PM certification is available yet and more than 30 PM maturity models are available to assess the current and required PM maturity of a company. From the literature it was shown that companies with more mature project integration, scope, time, cost and human resource PM knowledge areas tend to be more successful.

The internal and external environment consulting engineering companies function in is constantly changing and not two companies are the same or on the same level of experience and maturity. A generic PMO structure or project management procedure is therefore not possible.

From literature it seems that in general more mature PMOs relate to a more mature PM company, although it cannot blindly be applied across all projects. There are, as with PM maturity models, a multitude of PMO maturity models. The success of a PMO implicates its capacity to understand who its customers are, what their needs are, and how to meet those needs by creating clear and sufficient benefits and generating traceable and measurable value. Project success may therefore depend on other factors than only standardised processes implemented by a PMO.

The ability to determine the current PM maturity of a company and compare that to the ideal required maturity level can be used as the road map for the PMO to implement. It

is also evident that not all PMOs need to be at the most advanced maturity level to be successful.

Based on the summary of the literature review presented here, a PM and PMO maturity survey will be selected and used in the empirical study discussed in the next chapter to cast more light on the contribution a PMO can make in the consulting engineering industry towards successful, sustainable project delivery.

2.12 CHAPTER SUMMARY

The aim of this chapter was to highlight the dynamic environment of the consulting engineering industry, provide background to the concepts of PM, PMO, project success definition, maturity levels of project management and how these concepts are used to add value to clients and provide a sustainable competitive advantage to the company.

The primary study objective is to determine what contribution a PMO can make towards successful project delivery in a medium sized consulting engineering company. The literature study focused on the following concepts in an attempt to define and understand the concepts required to achieve the study objectives:

- Nature of consulting engineering industry.
- Value addition in the value chain.
- What constitutes competitive advantage for a company.
- Definition of PM performance and success.
- The concept of PM and the standards governing it.
- PM maturity definition and models.
- The background and concepts regarding PMOs.
- The PMO maturity definition and models available.

This chapter ended with a conclusion drawn from the literature study aimed at the objective of the study.

From the literature study conducted, a self-assessment maturity model for PM and PMO can be selected (see next chapter) and sufficient concepts were investigated to identify relevant demographic information to be requested from the respondents.

CHAPTER 3: EMPIRICAL STUDY

3.1 INTRODUCTION

The primary objective of this study was to determine the contribution a PMO can make to deliver more projects successfully and consistently in the consulting engineering industry for a medium sized company. This objective was supplemented by:

- Determining the current PM and PMO maturity levels in the selected consulting engineering company, as well as similar companies and companies related to the selected company.
- Determine what this group of respondents perceived as the required level of PM and PMO maturity levels in order to achieve more successful projects for a medium sized consulting engineering firm in South Africa.
- Determine the relationship between PM and PMO maturity.

The empirical study was conducted by selecting a questionnaire for PM maturity and another for PMO maturity. These two questionnaires were then combined with a respondent demographic questionnaire into a single large questionnaire that was distributed to the target respondents. Since one of the objectives is not just to determine the current maturity levels but also to determine what the group of respondents felt was required to deliver more projects successful, some sort of consensus had to be reach among the group of respondents. The Delphi technique was therefore used where more than one round of questionnaires were used in a structured fashion in order to achieve a consensus from a group of experts on the field of PM and PMO in the consulting engineering industry in South Africa.

The survey was distributed by means of direct e-mails to a total of 161 identified potential respondents. From the 86 responses received, the average PM and PMO required maturity levels were determined with descriptive statistics. For round 2 of the survey, the survey only asked the respondents' perception of the required PM and PMO maturity required taking into consideration the average maturity levels from the group of respondents obtained in round 1. The required maturity levels from round 1 and 2 were then evaluated to determine whether some sort of a consensus was reached, to establish if the survey was to be conducted again.

The chapter begins by giving some background on the Delphi survey method used, the population of respondents selected, how the questionnaire was developed, the process of data collection and some background on the statistical analysis techniques used.

The demographics, round 1 and round 2 survey results are then summarised and discussed followed by the results of relationship statistical analysis between the results obtained from the survey. The chapter concludes with a discussion on the interpretation of the survey results and a summary.

3.2 SURVEY METHOD: DELPHI TECHNIQUE

Due to the explorative nature of the research to determine the perceived ideal PM and PMO maturity to ensure more successful projects being delivered by consulting engineers in South Africa, the Delphi technique was selected. The Delphi technique is defined as follows (Linstone & Turoff, 1975:3):

> "Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem."

The Delphi technique started in 1950 as a spin-off from defence research. The original research study objective was to "obtain the most reliable consensus of opinion of a group of experts ... by a series of intensive questionnaires interspersed with controlled opinion feedback" (Linstone & Turoff, 1975:3). The name or brand "Delphi" can be related back to the Delphi monastery in Greece that was one of the few places on earth at the time (in the 600's) where knowledge was accumulated, ordered and stored. The Delphi oracle was consulted on long term orientated progress and reforming (Cuhls, 2010:94).

The main application of the Delphi technique is for projecting and long term forecasting, although it is not limited to forecasting only. In summary, the characteristics of the Delphi technique involve (Linstone & Turoff, 1975:4; Cuhls, 2010:97):

- Respondents provide feedback on their perceptions of the subject in an individual manner.

- The content of the survey pertains to issues on which incomplete knowledge exist and on which some form of consensus from the judgement of a panel of experts is aimed for.
- The elements of group think and group pressures are eliminated.
- The respondents act independently and give estimations.
- It is anonymous.
- The technique provides subjective judgement on a collective basis.
- More individuals can co-operate than practically possible on a face to face meeting basis.
- Individuals from a variety of geographical locations can collectively provide a culmination of isolated and individually generated ideas on a complex subject matter.
- The group consists of mainly experts based on their knowledge and experience. The group of individuals can assess the issue in a competent way.

The Delphi technique is based on structured surveys using the intuitive opinion of a panel of respondents consisting mainly of experts on the subject. The Delphi technique delivers both qualitative and quantitative results with explorative, predictive and normative elements. The Delphi technique is a two or more round survey in which the second and later rounds give feedback on the results from the previous round/s. The results from the second round are therefore influenced by the previous round feedback/opinions from colleagues (Cuhls, 2010:96).

In this study the Delphi technique was applied in two survey rounds. In round one of the survey the questionnaire sections, as shown in Appendix A to Appendix G and discussed in Section 3.4, were sent out to the respondents. In round 2 of the survey the summary of the averages obtained from the first round of the survey was sent out to the respondents to work towards a consensus among the respondents on what the ideal maturity of project management and the PMO should be in small to medium sized consulting engineering companies in South Africa.

3.3 POPULATION AND SAMPLING TYPE

The non-probabilistic sampling of respondents included:

- Incidental sampling: Selecting all the employees involved in project management at the author's company.
- Purposive sampling: Selecting all previous colleagues and clients the author worked with from a wide range of companies in the consulting engineering industry, including larger and smaller companies than the author's company and also most of the competition to the author's company. Previous lecturers of the author that are involved in project management or managing their own company projects were also contacted at three different universities. All contact information and screening for relevant experience was done using the social networking website called Linkedin for professionals.
- Snowball sampling: Some of the respondents initially contacted declined to complete the questionnaire as they did not rate themselves as knowledgeable or experts on the field of project management or PMOs. They then proposed colleagues or friends with the relevant experience to assist.
- The purpose of the study and an invitation to participate in the study was posted on a social networking website group on Linkedin: PMO Experienced (Practising Project and Program Managers). No respondents from this option was received.

These types of non-probabilistic sampling normally have a very low probability of being a representative sample depending on the selection made in the purposive sampling (Welman, Kruger & Mitchell, 2010:70). The sampling selected is applicable and useful in explorative research and where the focus is on a key theme such as project management and PMO in the consulting engineering industry. The cost and control over the sample ranges from low to reasonable (Welman *et al.*, 2010:70).

3.4 QUESTIONNAIRE COMPOSITION

The questionnaire consisted of four conceptual sections:

- Questionnaire instructions (See Appendix A).
- Respondent demographic information (See Appendix B).
- Project management maturity model questionnaire (See Appendix C and D).
- Project management office maturity model questionnaire (See Appendix E, F and G).

3.4.1 Project management maturity model (PMMM)

From the more than 30 PM maturity models available, the PM maturity model based on the nine knowledge areas defined in PMBOK®4 and referenced by numerous authors (Crawford, 2002; Mittermaier & Steyn, 2009:100) were selected to evaluate the current and required PM maturity in consulting engineering companies in South Africa. The model was selected based on the following reasons:

- The self-assessment survey is based on the nine knowledge areas of PMBOK®4, which is well known and accepted in the South African engineering and mining industry (Mittermaier & Steyn, 2009:99).
- The self-assessment survey is relatively easy to use to determine both the current and required PM maturity.

The project management maturity model (PMMM) has five distinct levels of maturity ranging from Level 1 (indicating the initial process) to Level 5 (indicating an optimised process). The PM maturity levels are cumulative of nature and a level 3 maturity therefore indicates that a specific company has achieved level 1, 2 and 3 to be classified at a Level 3 maturity. The knowledge area of project integration for example consists of project plan development, execution, change control, project information system and the project office as can be seen in Appendix D. The maturity level of the project integration management (2) is the lowest maturity level obtained from the knowledge area components as shown in Table 7 (Project plan execution: 2). Since a calculated average maturity level of 3.7 for a group of respondents indicate that the maturity level is more than 3 but not yet 4, the average values is rounded down to the closest integer value of 3. This indicates that although some of the aspects of a maturity level of 4 is visible, not all of the requirements of a level 4 maturity is achieved yet. The overall organisational PM maturity is then the lowest maturity level of the nine knowledge areas.

Table 7: Example of maturity level assignment of knowledge areas as the minimum of the knowledge area components.

Project Integration Management	**2**
Project Plan Development	3
Project Plan Execution	2
Change Control	3
Project Information System	4
Project Office	3

3.4.2 Project management office maturity model

The PMO maturity cube developed by Pinto *et al*. (2010) was selected for the following reasons:

- The self-assessment survey was developed based on the twenty-seven generic functions of a PMO obtained from a large survey.
- The model has been tested already.
- The model is a generic classification of PMOs based on the scope and approach of PMOs that have been applied in a wide range of industries, including the energy sector.

The three dimensions that comprise the PMO maturity cube are therefore scope (enterprise, departmental or program-project), approach (strategic, tactical or operational) and finally the maturity level (basic, intermediate or advanced). A separate questionnaire was used for each scope (enterprise, departmental or program/project) of PMO where the company can evaluate the current level of maturity as well as the desired PMO maturity. The three levels of maturity are expressed in the following percentage ranges (Pinto et al., 2010:14):

- Basic: 0 – 33%
- Intermediate: 34 – 66%
- Advanced: 67 – 100%

The percentage of each function of the PMO is calculated as the percentage of the selected level divided by the maximum level for a specific function possible (Pinto *et al.*, 2010:14). To illustrate how the PMO maturity is determined, arbitrary values were populated in Table 8 for the departmental scope and strategic approach section of the maturity cube. For the first line where the PMO advice to departmental senior management is evaluated the maximum possible level is 3 and a level 2 was selected. The maturity level is therefore 2 divided by 3 which equates to 66% or an intermediate maturity level. The strategic maturity level is calculated by adding all the selected values and dividing it by the summation of all the maximum levels possible per PMO function question. For the example in Table 8 the maturity level is calculated as 47% or intermediate level.

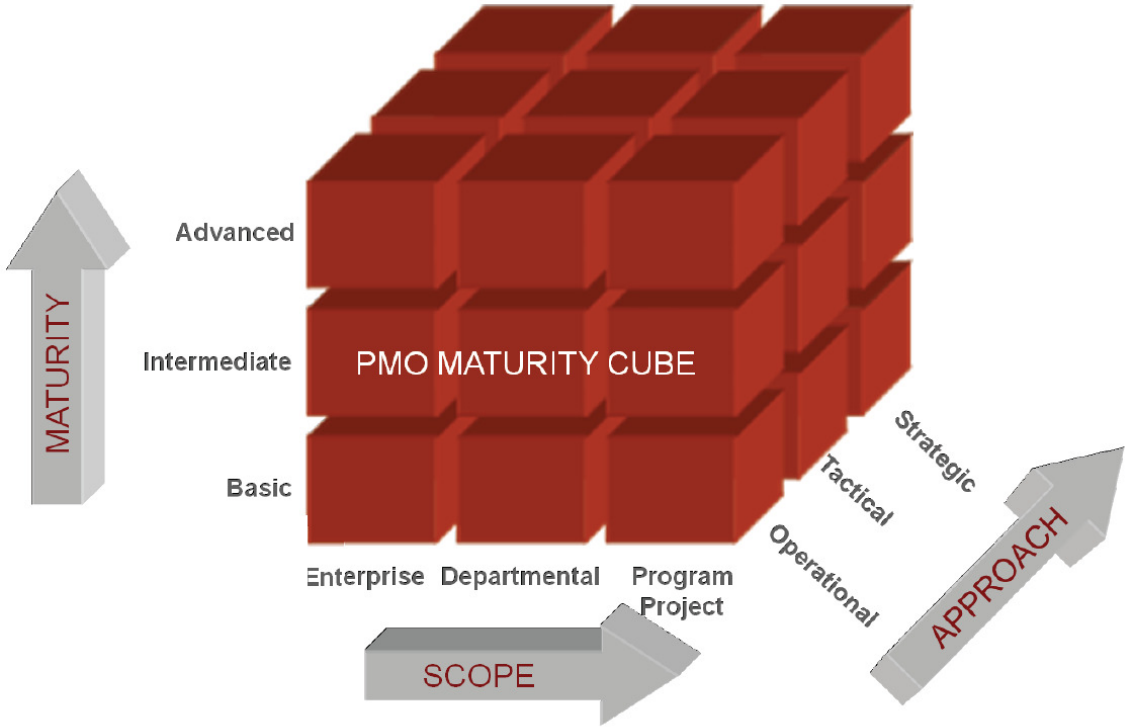


Figure 10: The Three Dimensions of the PMO Maturity Cube

Source: (Pinto et al., 2010:14).

Table 8: Example of the PMO maturity questionnaire and some post processing illustrated.

	Current/required Level					Post processing		
	0	1	2	3	4	Actual level	Max. Possible level	Maturity/ Percentage
How does the PMO provide advice to the department senior management?	0	0	1	0		2	3	66 %/Intermediate
How does the PMO coordinate and integrate the department's portfolio?	0	1	0	0		1	3	33%/Basic
How does the PMO develop and maintain a strategic framework of departmental projects and programs (Scoreboard)?	0	0	1	0		2	3	66 %/Intermediate
How does the PMO promote project management awareness in the department?	0	1	0	0		1	3	33 %/Basic
How does the PMO monitor and control its own performance?	0	1	0	0	0	1	4	25 %/Basic
How does the PMO participate in the department strategic planning process?	0	1	0	0		1	3	33 %/Basic
How does the PMO manage one or more departmental portfolios?	0	0	1	0	0	2	4	50%/Intermediate
How does the PMO identify, select and prioritise new departmental projects and programs?	0	1	0	0		1	3	33%/Basic
How does the PMO manage the benefits of the departmental projects and programs?	0	1	0			1	2	50%/Intermediate
How does the PMO map the relationships and the environment of the projects and programs in and out of the department?	0	0	1			2	2	100%/Advanced
	Strategic maturity					***14***	***30***	***47%/Intermediate***

3.5 DATA GATHERING PROCESS

The round 1 survey was created on MS Excel sheets to enable feedback to the respondents while completing the survey. Colour coded and text feedback indicated to the respondent whether a section and/or subsection was completed and/or completed correctly (Figure 11). By using MS Excel, the post processing can also be done relatively easier than retyping completed hard copies of the questionnaire (and it also minimises opportunity for mistyping). Both round 1 and round 2 questionnaires were sent out by individual e-mail to ensure the anonymity of the respondents. This method also ensures more control as to which respondents have replied and who have not. Online surveys were decided against, since there is no control over which of the respondents targeted actually completed the questionnaire. Respondents also made use of the e-mail as means of communication to highlight or explain how they experienced the questionnaire or interpreted the questions.

	Current Project Management Maturity Level						Project Management Maturity Required in Consulting Engineering Industry					
	1	2	3	4	5		1	2	3	4	5	
	Section completed						Section not complete yet					
Project Integration Management	Sub-section completed						Sub-section not complete yet					
Project Plan Development	0	1	0	0	0			0	1	0	0	
Project Plan Execution	0	0	1	0	0		0	0	0	0	0	
Change Control	0	1	0	0	0		0	1	0	0	0	
Project Information System	0	1	0	0	0		0	1	0	0	0	
Project Office	0	0	1	0	0		0	1	0	0	0	

Figure 11: Example of colour coded and text feedback on questionnaires.

3.6 STATISTICAL ANALYSIS

The data gathered were analysed with the help of statistical software packages SPSS and SAS. The Statistical Consultation Services department of the North-West University (Potchefstroom Campus) analysed the data set gathered for round 1 and 2 of the survey. In order to analyse the data, the following statistical tests were performed:

- Factor analysis to confirm that the questions are related to the factors of the existing questionnaires.
- Reliability analysis (Cronbach's alpha) was performed to determine the internal consistency or average correlation between the variables and constructs formulated from them. A larger Cronbach's alpha value relates to a higher internal consistency, and as a result indicates a more reliable construct.

- Descriptive statistics to calculate averages (measure of central tendency) and standard deviation (indicate distributions or scattering of data) values.
- Hypothesis testing: T-tests, hierarchical linear regression analysis, effect sizes and p-values.

3.6.1 Factor analysis

Both questionnaires selected have a large number of questions ralating to common factors/constructs. For example the project management maturity questionnaire determines a maturity level for the project integration management knowledge area (factor) based on the following related constructs:

- Project Plan Development.
- Project Plan Execution.
- Change Control.
- Project Information System.
- Project Office.

To determine whether the sample taken was large enough for the respective questionnaire constructs to be represented by the respective factors, a confirmatory factor analysis was performed. Factor analysis is typically used to (Williams, Brown & Onsman, 2010:2):

- Reduce the number of factors to relate and interpret.
- Provide contruct validation evidence of the scale, test or instrument used in a self reporting questionaire.

The first step in factor analysis is to test the respondent data to see whether factor analysis can be applied, using the following tests (Williams, Brown & Onsman, 2010:5):

- **Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy:** The KMO index ranges between 0 and 1 and all values larger than 0.5 is considered acceptable for factor analysis. The KMO value can be interpreted as follows (Pett, Lackey, & Sullivan, 2003:78):
    - KMO >0.9: Superb.
    - KMO>0.8: Very good.
    - KMO>0.7: Good.

    - 0.5<KMO<0.7: Acceptable to medium.
- **Bartlett's test of sphericity:** This test should be significant (p-value < 0.05) for factor analysis to be suitable and for the correlations to be sufficiently high.

The second step involves the validation of the factor extraction. Validation of factor extraction is done using the cumulative percentage of variance and Eigen value larger than one (1) rule of Kaiser-Guttman (Williams, Brown & Onsman, 2010:6). Eigen values are derived from the correlation matrix with communalities on the diagonal. If an Eigen value is smaller than one, the variance is smaller than the variance of a single factor, and therefore generally neglected. The number of Eigen values larger than one generally suggests the number of independent factors to describe the indicators. Another technique assisting the number of factor selection is the cumulative percentage a factor or number of factors contribute towards the cumulative total variance. A value larger than 50% was considered as acceptable for the cumulative percentage. The extraction method used in this study is principal axis factoring and the rotation method used is Oblimin with Kaiser normalization.

Factor loadings also gives an indication of the strength of a relationship that exist between the data and the extracted factors. The following relationships are used as guideline (Williams, Brown & Onsman, 2010:5):

- A relationship of 0.30 indicates 30% or minimal relationship between data and factors extracted,
- A relationship of 0.40 indicates an important relationship and
- A relationship of 0.50 and more indicates a practically significant relationship.

These guidelines are not definitive and are regularly determined by the context of the research.

3.6.2 Reliability analysis

Although existing questionnaires were used in this study, the different variables grouped under specific factors in the PM and PMO maturity questionnaires were still tested for reliability. In this study a Cronbach's alpha coefficient value of 0.7 or larger was regarded as an acceptable level of reliability.

3.6.3 Descriptive statistics

The primary unit of measure was the companies and not individuals, as employees of the same company have similar factors influencing their perceptions and interpretations of the survey and its topic. The individuals are therefore nested under a company in a hierarchy. Averages for the group are therefore calculated from the company averages to ensure the large number of respondents from one company and company specific factors do not skew the analysis.

3.6.4 Hypothesis testing

Paired t-tests were performed to determine if there is a statistically significant relationship (p-values) between

a) the current and required PM and PMO maturity; and
b) the current PM maturity and the different PMO scope and approach maturities.

For the purposes of this study a p-value of smaller than 0.05 was deemed statistically significant. The effect size values (d-values) calculated, measure whether the differences between any of the study element variables are of any practical significance. For the purpose of this study the following d-value interpretation was employed:

a) d values < 0.2 — No practical significant difference.
b) 0.2 <= d-values < 0.5 — Small practical significant difference.
c) 0.5 <= d-values < 0.8 — Medium practical significant difference.
d) d-values >= 0.8 — Large practical significant difference.

3.6.5 Hierarchical linear modelling

Due to the nested nature of the group of respondents (employees nested in their respective companies), hierarchical linear modelling is required instead of traditional statistical methods. Traditional statistical methods assume the respondents are unrelated/independent/uncorrelated with each other. This is true if respondents are randomly selected from a large population. Hierarchical linear modelling allows the statistical relation determination taking the interdependence of the workers related to each other by means of their respective company. This type of multi-level analysis allows the determination of variability between clusters (companies) and within a

cluster (between workers of a company) in relation to a specific output variable (Hancock & Meuller, 2010:123).

Hierarchical linear regression analysis was used to determine the relationship/ correlation between the current PM maturity and the different PMO scope and approach maturities.

For the purposes of this study the following R square value interpretation guidelines are used:

a) 0.1 <= R squared-values < 0.2 Medium statistically significant.
b) R squared-values >= 0.2 Statistically significant.

Hierarchical linear modelling was also used to determine:

a) Is there a significant difference between answers from respondents in an ISO9001 company and companies who are not ISO9001 certified?
b) Is there a significant difference between answers from respondents within a company with a PMO and those companies without a PMO?
c) Is there a significant difference between answers of respondents from M-Tech and those of the rest of the group?
d) Is there a significant difference between answers from respondents in medium sized organisations and those of the rest of the group?

3.7 RESPONSE TO SURVEY - ROUND 1 AND 2

The questionnaire for round 1 (See Appendix A to G) was distributed on 19 August 2013 via individual e-mails to 161 respondents working in consulting engineering companies or who have worked as consulting engineers. By the end of the round 1 cut off date (2 September 2013), 86 responses were received providing a response rate of 53%. Since the three PMO scopes are mutually exclusive, some of the respondents only completed the PMO scope questionnaire they had exposure to/experience in. When a respondent did not complete one of the questionnaires (see Table 9), the answers were left blank to ensure it does not influence the results. None of the questionnaires were completed incorrectly. None of the questionnaires were discarded as all response had some use in this study.

Table 9: Questionnaire completion details for round 1.

	Respondents		
Questionnaire	**Total**	**Left open**	**Incomplete**
PM maturity current	86	2	0
PM maturity required	86	1	0
Strategic PMO maturity current	86	5	0
Strategic PMO maturity required	86	5	0
Departmental PMO maturity current	86	14	0
Departmental PMO maturity required	86	13	0
Project PMO maturity current	86	12	0
Project PMO maturity required	86	12	0

The questionnaire for round 2 (See Appendix H for an example of one of the sections) was distributed on 20 September 2013 via individual e-mails to the 86 respondents that completed the first round questionnaires. By the end of the round 2 cut off date (4 October 2013) 47 responses were received providing a response rate of 55%.

The round 2 respondent questionnaire completion details are shown in Table 10. None of the questionnaires were completed incorrectly. None of the questionnaires were discarded as all response had some use in this study.

Table 10: Questionnaire completion details for round 2.

	Respondents		
Questionnaire	**Total**	**Left open**	**Incomplete**
PM maturity required	47	0	0
Strategic PMO maturity required	47	1	0
Departmental PMO maturity required	47	1	0
Project PMO maturity required	47	0	0

3.8 SURVEY DEMOGRAPHIC DISTRIBUTION

In section 2 of the maturity questionnaire the demographic information of the respondents taking part in the survey was requested (see Appendix B). The demographics included age, gender, industry sector, size of company, current position, ISO 9001 status, project management qualifications, PM experience, typical size and duration of projects, whether a PMO exists in the company and for how long and whether the respondents have completed a maturity survey for PM or PMO before. The results of the demographics of the group of respondents are presented next.

3.8.1 Respondent age group distribution

The distribution of the respondent ages for round 1 and round 2 is shown in Figure 12 and Table 11.

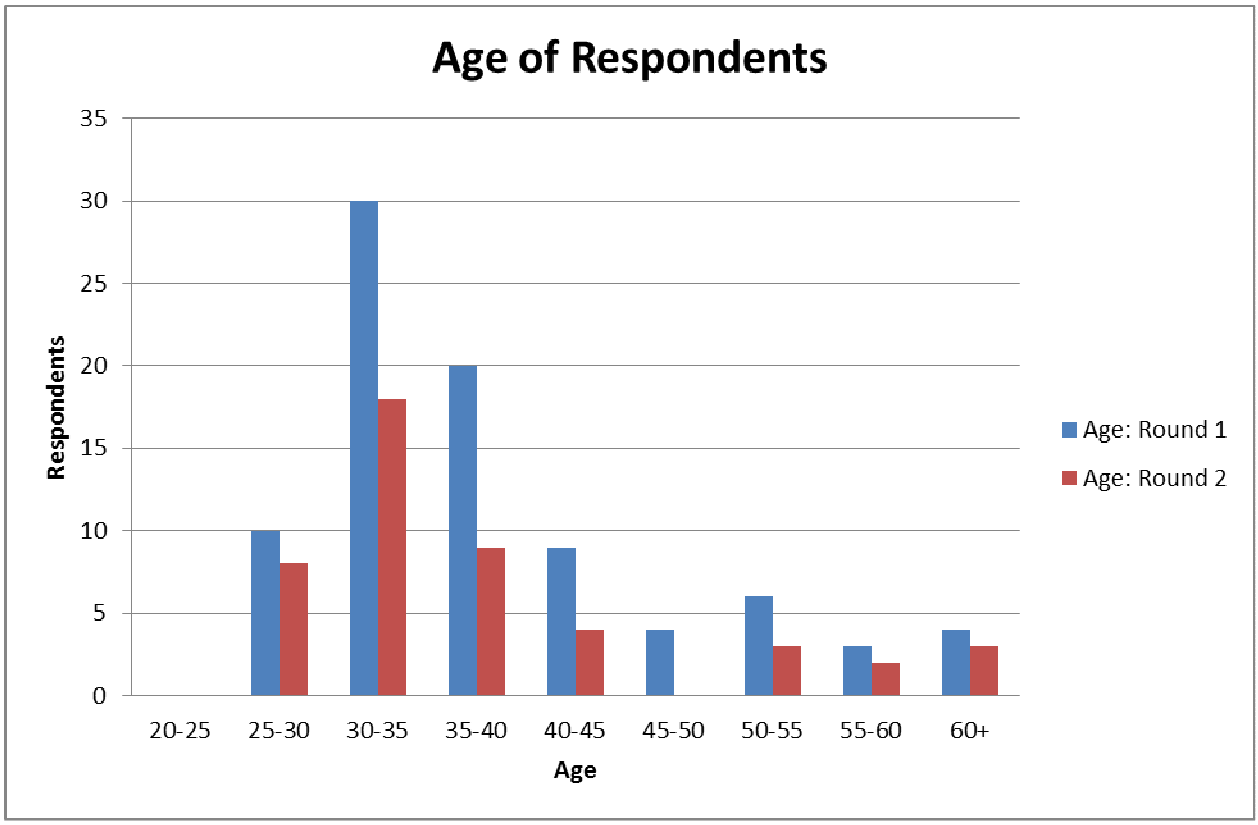


Figure 12: Age distribution of respondents for round 1 and 2.

For round 1 of the survey the largest age group (35%) of the respondents were between 30 to 35 years of age, 23% between 35 and 40 years, 10% between 40 and 45 years and 7% or less in each of the age groups 45 to 50, 50 to 55, 55 to 60 and older than 60 years. In general the age group distribution between the first and second round survey look very similar. The age group distribution indicates a mature group of respondents that have a number of years working experience.

Table 11: Age group distribution frequency percentages.

Age group	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60+
Round 1	0	12	35	23	10	5	7	3	5
Round 2	0	17	38	19	9	0	6	4	6

3.8.2 Gender distribution

For round 1 and 2 the majority of the respondents were male (89% and 91% respectively) compared to the 9% to 11% females as shown in Table 12. In the December 2012 survey of CESA the ratio of male to female employees in the consulting engineering industry was 66% male and 34% female (CESA, 2013:40). In the CESA survey a large portion of the female employees were from the administrative or support personnel and draughtsmen that do not necessarily indicate the breakdown of people with PM and PMO experience. In another study performed on operational personnel of a consulting engineering company in South Africa (Mocke, 2012:131) a male:female ratio of 83:17 was found.

Table 12: Respondent gender frequency and percentage distribution for round 1 and 2.

	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Round 1	78	91%	8	9%
Round 2	42	89%	5	11%

3.8.3 Industry sector distribution

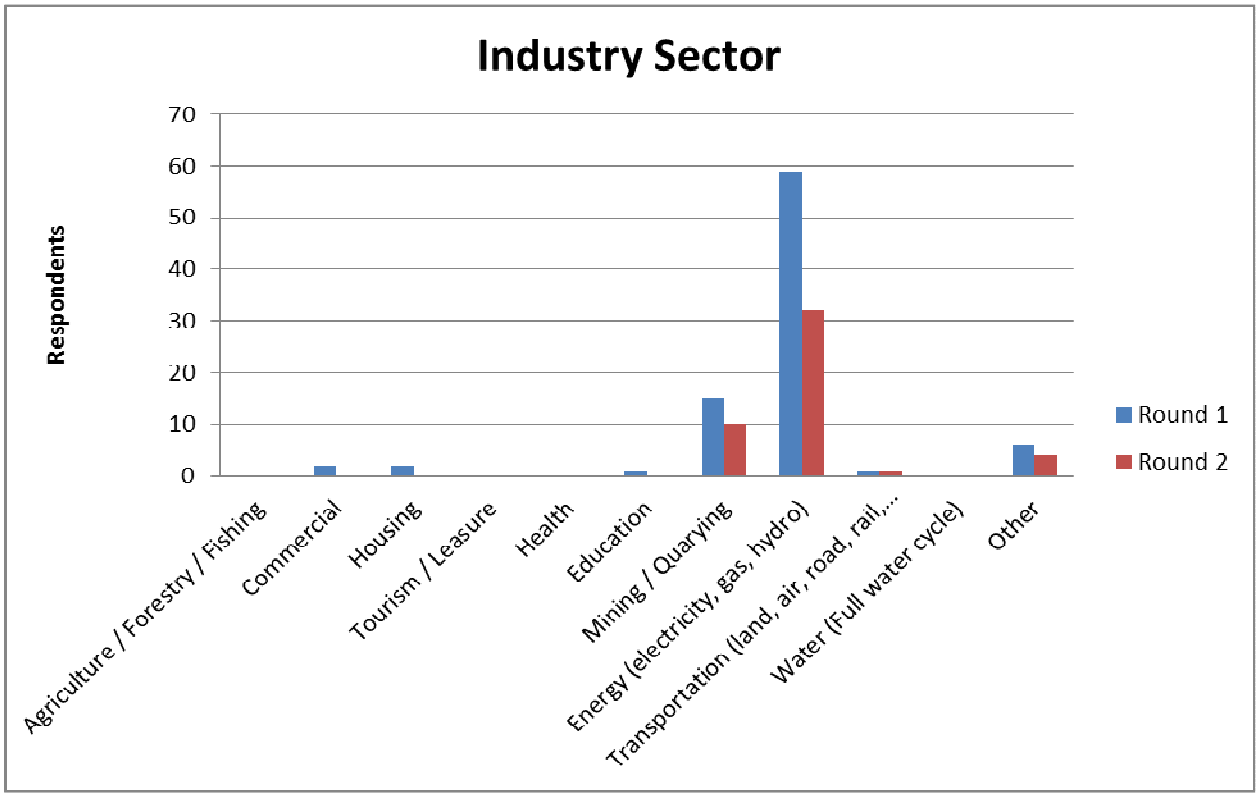


Figure 13: Industry sector distribution of respondents for round 1 and 2.

For round 1 and round 2 of the survey the respondent industry sector distribution in the consulting engineering industry is shown in Figure 13.

Comparing Figure 13 to Figure 2 points out that the distribution of respondents does not represent the consulting engineering industry of South Africa as a whole as the representation in the transport, water, commercial and housing sectors are lacking compared to the fee income distribution from industry sectors obtained in the 2012 CESA survey (CESA, 2013:19). The respondents in this survey represented the energy and mining sector in general.

3.8.4 Respondent company size distribution

The majority of the respondents (66%) were from medium sized companies (10 to 100 employees), followed by large organisations (more than 500 employees) (22%), larger organisations (between 100 to 500 employees) (8%) and only 3% from small to micro companies (less than 10 employees). The respondent company size frequency distribution is shown in Figure 14.

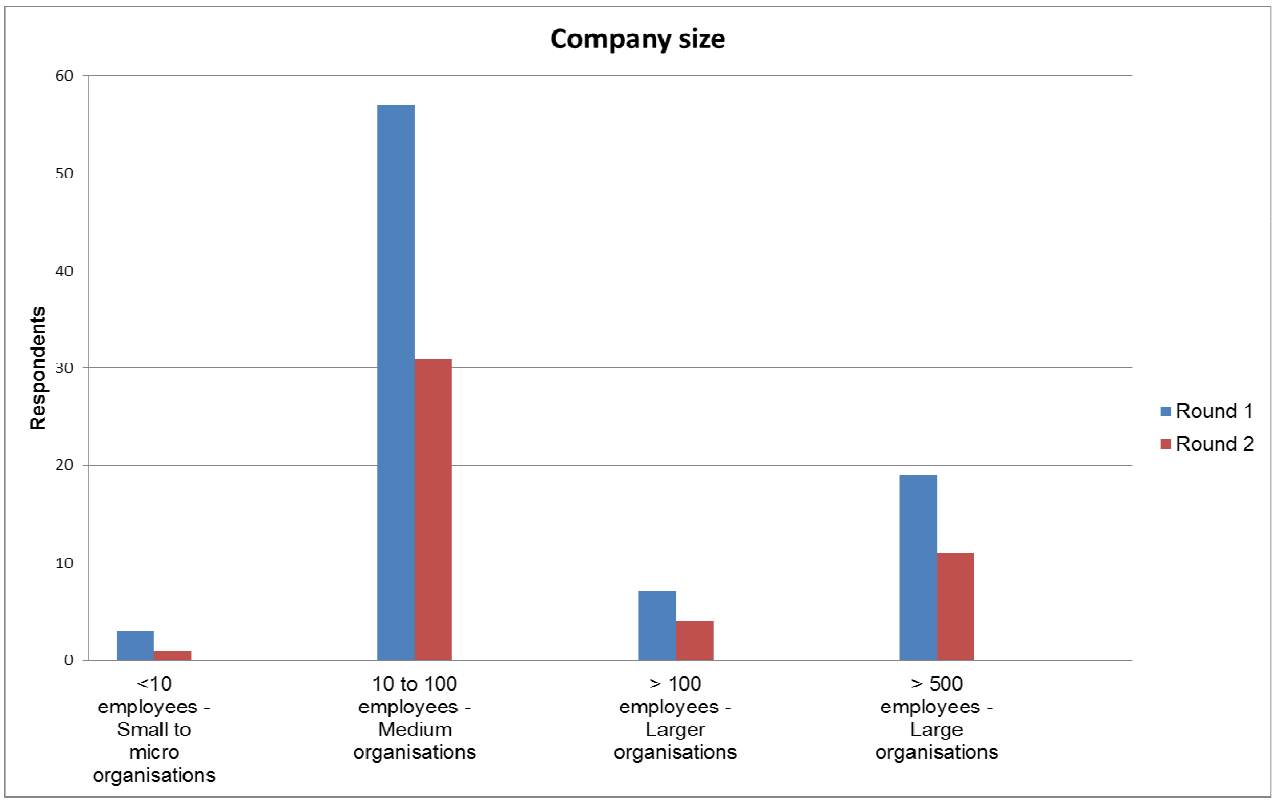


Figure 14: Company size distribution of respondents for round 1 and 2.

The distribution of respondents in terms of the companies they work for are shown in Figure 15. It is evident that the majority of the respondents are from the author's company (medium sized company) which overshadows the response from any other company in terms of respondent numbers. This can be mainly attributed to the method of respondent selection and lack of willingness of companies to participate in a long questionnaire with multiple survey rounds. Medium Organisation 8 as a company was asked to participate and it can be seen that the response this organisation, especially in round 1, was the second most after the response total from M-Tech.

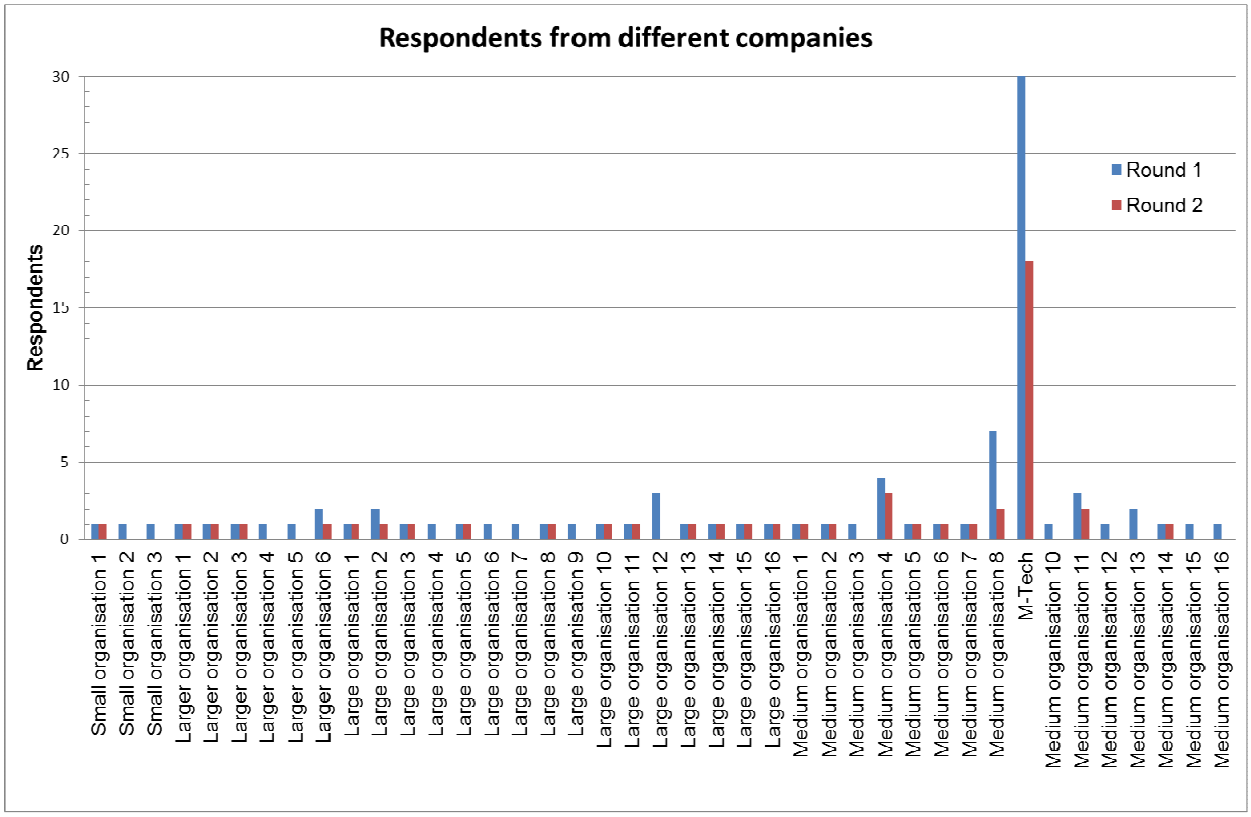


Figure 15: Respondent company representation distribution for round 1 and 2.

3.8.5 ISO 9001 quality accreditation distribution

The majority (72 – 74%) of the survey respondents work for a company that functions within an ISO 9001 accredited quality system (Table 13). Note that 6% of the respondents were not sure whether their company was ISO 9001 accredited.

Table 13: Company ISO 9001:2008 accreditation of respondent companies in round 1 and 2.

	Iso 9001 accredited		Not Accredited		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	62	72%	19	22%	5	6%
Round 2	35	74%	9	19%	3	6%

3.8.6 Respondent position distribution

The distribution of the different positions occupied by respondents are shown in Figure 16. The position distribution percentages are shown in Table 14. 15 to 19% of the respondents classified their positions as other. Since the other position category is so large, the different positions specified by the respondents are listed in Table 15.

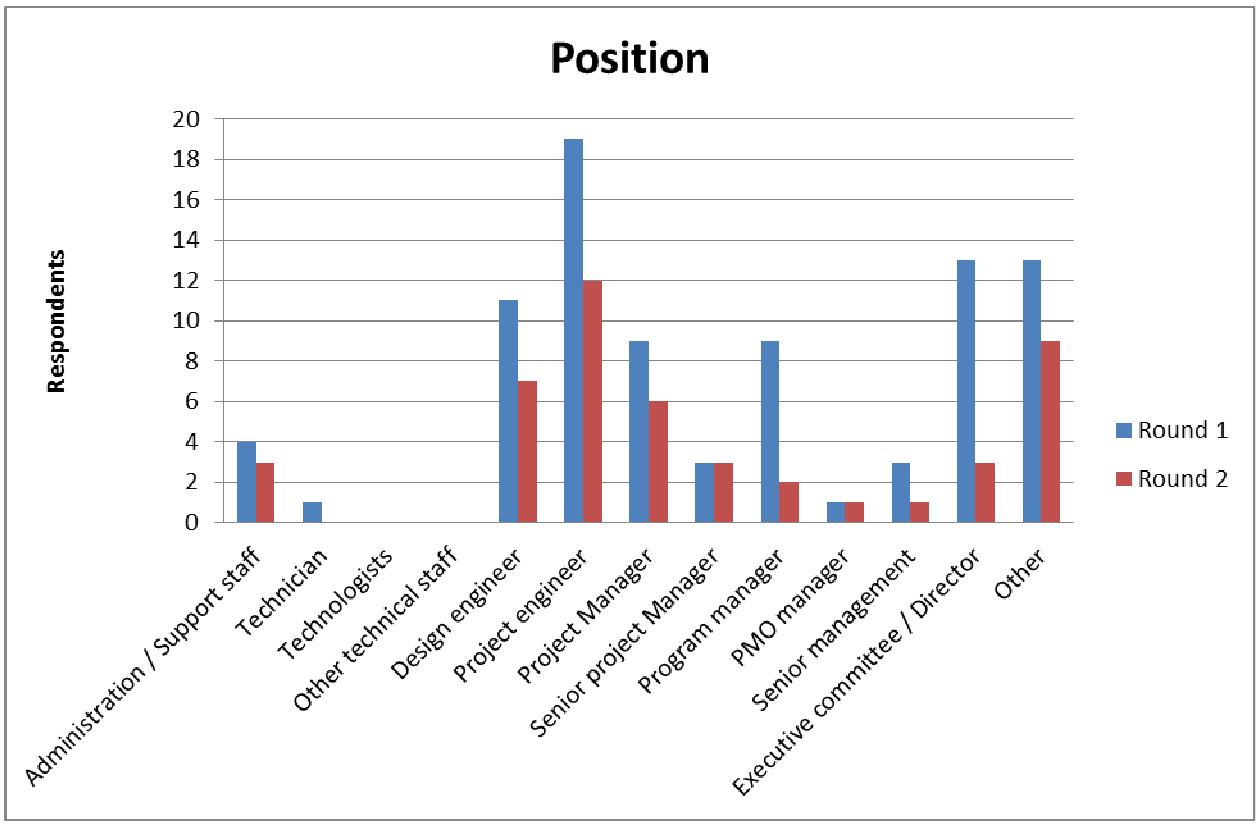


Figure 16: Respondent position distribution for round 1 and 2.

Table 14: Respondent position distribution frequency percentages.

	Adminis-tration / Support staff	Techni-cian	Technolo-gists	Other technical staff	Design engineer	Project engineer	Project Manager	Senior project Manager	Program manager	PMO manager	Senior manage-ment	Executive committee / Director	Other
Round 1	5%	1%	0%	0%	13%	22%	10%	3%	10%	1%	3%	15%	15%
Round 2	6%	0%	0%	0%	15%	26%	13%	6%	4%	2%	2%	6%	19%

The respondents with administration or support duties are all employed in management or PMO departments. From the positions listed in Table 14 and Table 15 that can be directly related to PM accounts for 29% and 32% of respondents for round 1 and round 2 respectively. The positions that can be directly related to PM and management in general accounts for 51% and 45% of respondents for round 1 and round 2 respectively. Some of the design and project engineers also function within a PM environment. The selected respondents therefore represent an experienced and relatively senior sector of the consulting engineering industry.

Table 15: Respondent position not offered as option to select from.

	Round 1	Round 2
Corporate Consultant	4	3
Senior Process Engineer	1	1
Lead Discipline Engineer	1	1
Marketing Manager	1	1
Internal Consultant	1	1
Principal	1	1
Lecturer	1	0
Senior lecturer	1	0
Site Engineer	1	0
Aftermarket Manager	1	1

3.8.7 Respondents PMO distribution

The majority (65% round 1 and 74% round 2) of the respondents taking part in the survey works for a company with a PMO. Note that 6% in round 1 and 9% in round 2 of the respondents did not know whether their company had a PMO or not (Table 16).

Table 16: Respondents with a PMO in their company.

	PMO exist		No PMO in company		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	56	65%	25	29%	5	6%
Round 2	34	72%	9	19%	4	9%

The largest category (41% round 1 and 38% round 2) of the survey PMOs have been in existence for one to two years. The second most (14% round 1 and 15% round 2) PMOs have been inexistence for three to four years, followed by five to ten years,

three to five years and lastly PMOs that have been in existence for less than a year. In a survey conducted by Hobbs *et al.* on 500 PMOs, 53% of PMOs were younger than 2 years and they found that less than 16% of PMOs were older than 5 years (Hobbs & Aubry, 2007:79). In this survey only 43% and 41% of PMO's were 2 years and less in existence (0 to 1 and 1 to 2 years) and 27% and 26% of PMO's were in existence for more than 5 years (5 to 10 years and more than 10 years) for round 1 and 2. This survey therefore has similar age distribution than the study conducted by Hobbs *et al.*

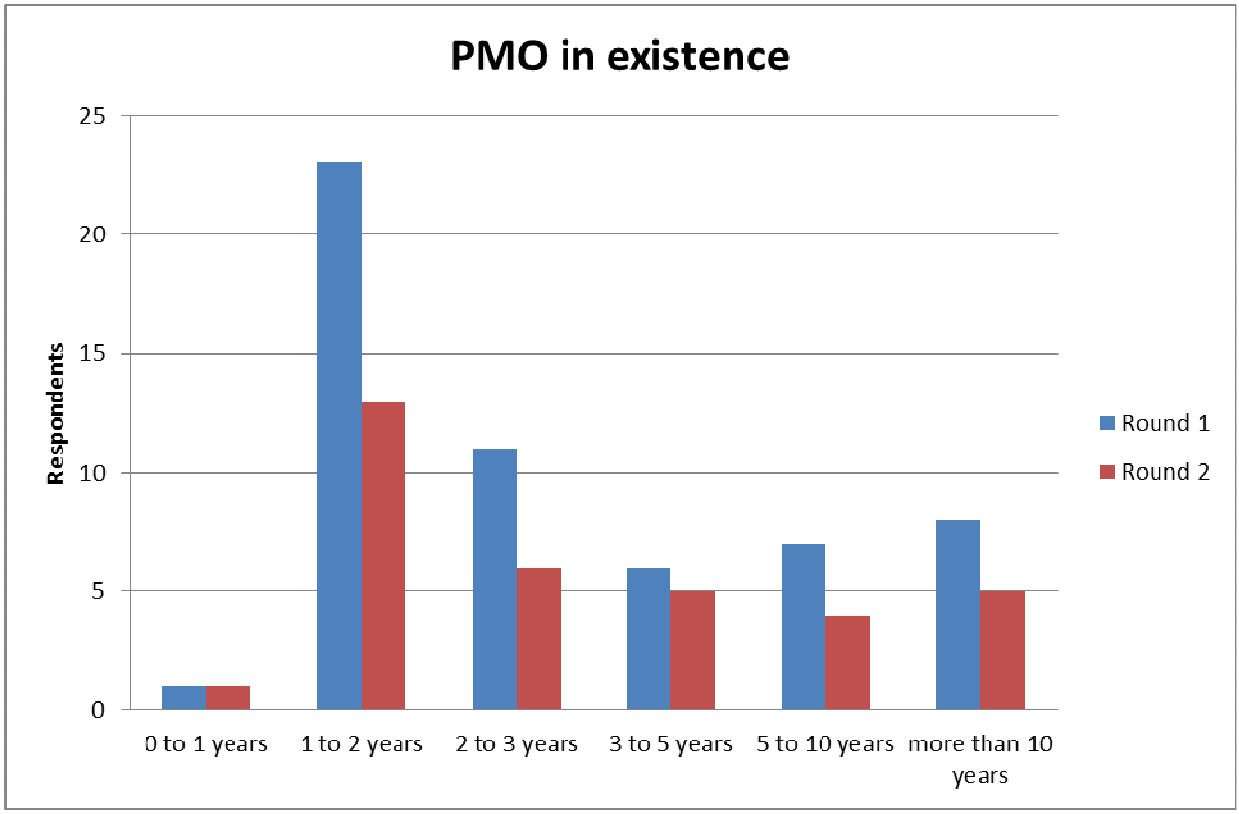


Figure 17: Respondent average age of PMO at their company for round 1 and 2.

3.8.8 Respondent PM experience distribution

The formal PM education distribution of the respondents is shown in Table 17. It is evident that the minority of respondents taking part in the survey had formal PM education (17% in round 1 and 21% in round 2).

Table 17: Respondent PM qualification distribution frequency and percentages for round 1 and 2.

	PM Certificate		No formal PM Certificate		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	15	17%	71	83%	0	0%
Round 2	10	21%	37	79%	0	0%

The different formal qualifications and certifications are shown in Figure 18. Three of the respondents hold a masters degree in project management and the rest of the respondents indicated a mixture of short course and certificates in some form of project management. Some of the respondents had formal PRINCE and PMBOK training in the PM standards.

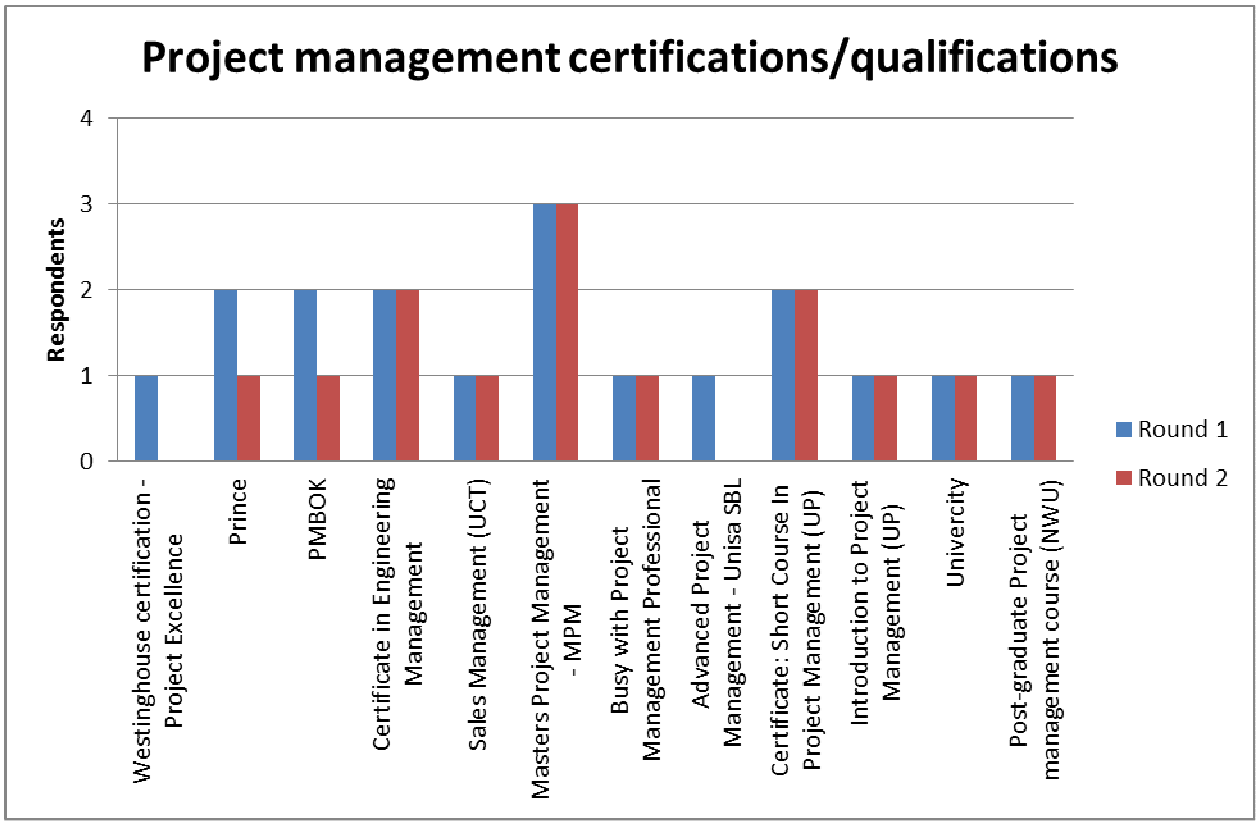


Figure 18: Respondent PM qualification/certification distribution for round 1 and 2.

The majority of the respondents had previous PM experience (83% in round 1 and 79% in round 2) as shown in Table 18. The majority of the respondents with PM experience (32% round 1 and 38% round 2) had 2 to 5 years PM experience (Table 19). This was followed by 5 to 10 years PM experience (31% round 1 and 27% round 2) and 23% of the respondents had more than 15 years PM experience in round 1. The cumulative PM experience for 5 years and longer are therefore 86% and 89% for round 1 and round 2 respectively. Although formal education in PM is relatively low for the group of respondents, the amount of experience indicates a very senior and experienced group of respondents in the PM environment within the consulting engineering industry.

Table 18: Previous respondent PM experience for round 1 and 2.

	PM Experience		No PM Experience		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	71	83%	15	17%	0	0%
Round 2	37	79%	10	21%	0	0%

Table 19: PM years experience of respondents for round 1 and 2.

			Round 1	Round 2
Experience	0 to 2 years	Frequency	10	4
		Percentage	14%	11%
	2 to 5 years	Frequency	23	14
		Percentage	32%	38%
	5 to 10 years	Frequency	22	10
		Percentage	31%	27%
	More than 15 years	Frequency	16	9
		Percentage	23%	24%

3.8.9 Respondent typical project distribution

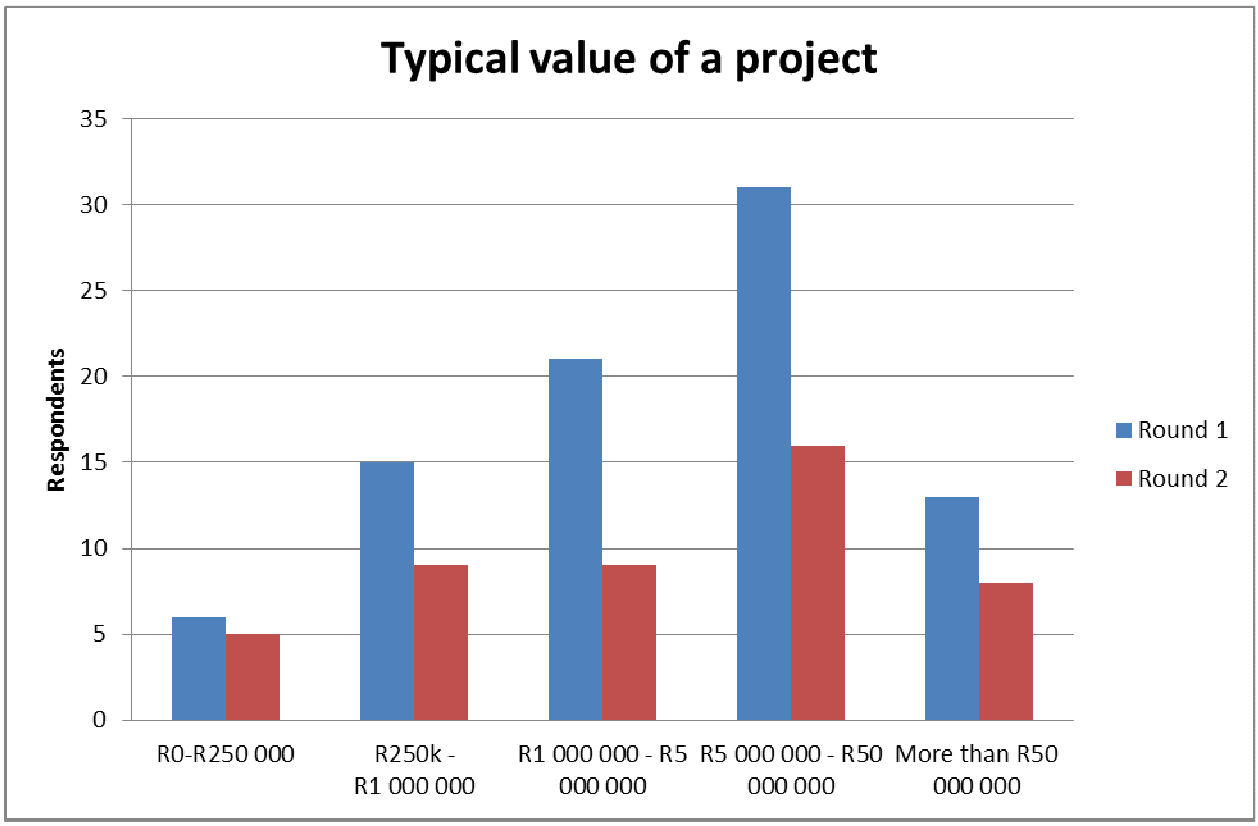


Figure 19: Typical value of a project respondent companies are involved in for round 1 and 2.

From Figure 19 it is seen that the largest category (36% round 1 and 34% round 2) of the projects handled by the surveyed companies have project values of between R5

million and R50 million. This is followed by project values of R1 million to R5 million (24% round 1 and 19% round 2), R250 000 to R1 million (17% round 1 and 19% round 2), more than R50 million (15% round 1 and 17% round 2) and lastly projects smaller than R250 000 (7% round 1 and 11% round 2).

From Figure 20 it can be seen that the largest projects completion duration category are the projects completed within one year (36% round 1 and 40% round 2). This is followed by projects being completed in one to two years (28% round 1 and 26% round 2), two to three years (17% round 1 and 15% round 2), three to five years (13% round 1 and 11% round 2) and the minority (6% in round 1 and 9% round 2) of projects are completed in more than 5 years.

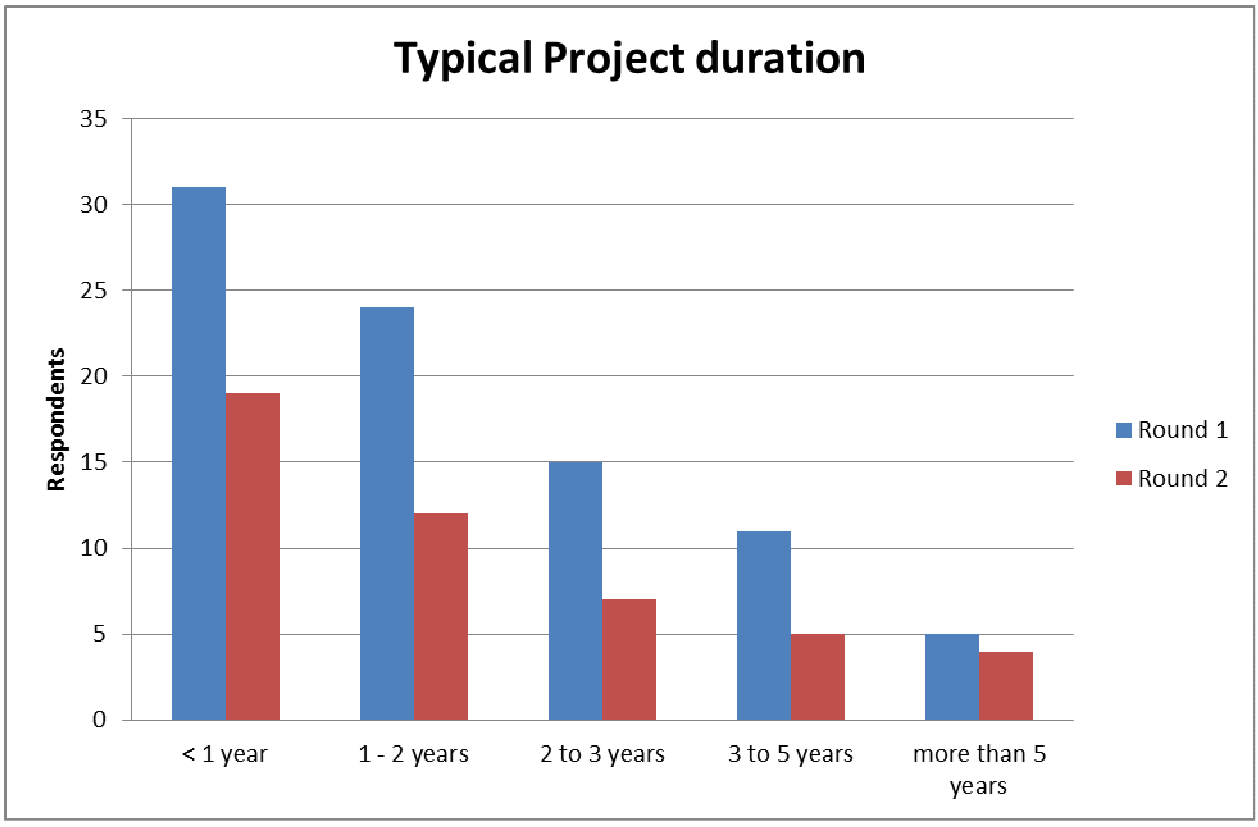


Figure 20: Typical duration of projects respondent companies are involved in for round 1 and 2.

3.8.10 Maturity assessment experience distribution

From Table 20 and Table 21 it is clear that regular self-assessment surveys of PM and PMO maturity levels are not done in the group of respondents. Less than 8% of the respondents have completed a PM maturity survey before and less than 3% have yet completed a PMO maturity survey.

Table 20: Respondent previous experience with PM maturity assessments for round 1 and 2.

	Completed PM maturity assessment before		Have not completed PM maturity assessment before		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	7	8%	79	92%	0	0%
Round 2	3	6%	44	94%	0	0%

Table 21: Respondent previous experience with PMO maturity assessments for round 1 and 2.

	Completed PMO maturity assessment before		Have not completed PMO maturity assessment before		Not Sure	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Round 1	3	3%	82	95%	1	1%
Round 2	1	2%	46	98%	0	0%

3.9 ROUND 1 PM AND PMO QUESTIONNAIRE RESULTS

3.9.1 Project management maturity level - round 1

The purpose of this questionnaire was to determine both the current and perceived required PM maturity level in the consulting engineering industry in South Africa.

Performing a factor analysis on the round 1 current and required PM maturity questionnaire confirmed that the PM maturity questionnaire variables can be represented by the nine PM knowledge areas/factors. The variables used in the factor analysis, as described in Section 3.6.1, are shown in Table 22.

For both the current and required variables:

- The sample adequacy ranges between good and very good (0.78 to 0.89).
- The correlations between variables and the factor are sufficiently high ($p < 0.05$).
- The total variance of a single factor contributes more than 75% while a contribution of only 50% is considered sufficient.
- The test reliability is acceptable as Cronbach's Alpha is well in excess of 0.7.
- All factor loadings are in excess of 0.6 and are therefor the data are represented more than 60% by the nine knowledge areas/ factors.

Table 22: Factor analysis results for round 1 current and required PM maturity.

	Current Round 1						
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity: p	Total Variance Explained: Total for 1 factor	Total Variance Explained: Total for 2 factors	Total Variance Explained: Cumulative % for 1 factor	Total Variance Explained: Cumulative % for 2 factors	Cronbach's Alpha
Project Integration Management	0.88	4.20E-58	3.83	0.38	76.52	84.04	0.92
Project Scope Management	0.89	3.93E-76	4.47	0.55	74.53	83.70	0.93
Project Time Management	0.88	1.27E-70	4.02	0.37	80.40	87.80	0.94
Project Cost Management	0.84	3.28E-62	3.76	0.52	75.13	85.51	0.92
Project Quality Management	0.85	8.22E-72	3.47	0.30	86.69	94.16	0.95
Project Human Resource Management	0.78	1.49E-42	3.04	0.53	75.91	89.20	0.89
Project Communications Management	0.84	4.65E-44	3.15	0.34	78.70	87.13	0.91
Project Risk Management	0.84	2.18E-98	4.25	0.41	84.92	93.09	0.95
Project Procurement Management	0.78	1.39E-58	3.31	0.33	82.78	90.92	0.93
	Required Round 1						
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity: p	Total Variance Explained: Total for 1 factor	Total Variance Explained: Total for 2 factors	Total Variance Explained: Cumulative % for 1 factor	Total Variance Explained: Cumulative % for 2 factors	Cronbach's Alpha
Project Integration Management	0.89	1.02E-58	3.82	0.41	76.50	84.68	0.92
Project Scope Management	0.82	1.69E-73	4.18	0.81	69.71	83.27	0.91
Project Time Management	0.88	4.32E-83	4.13	0.38	82.70	90.33	0.95
Project Cost Management	0.88	2.26E-80	4.03	0.37	80.61	88.11	0.94
Project Quality Management	0.87	1.96E-80	3.53	0.27	88.33	95.20	0.96
Project Human Resource Management	0.83	4.70E-57	3.31	0.34	82.79	91.29	0.93
Project Communications Management	0.87	1.62E-60	3.39	0.23	84.83	90.68	0.94
Project Risk Management	0.88	2.04E-121	4.53	0.17	90.52	93.99	0.97
Project Procurement Management	0.82	2.43E-80	3.52	0.25	88.10	94.36	0.95

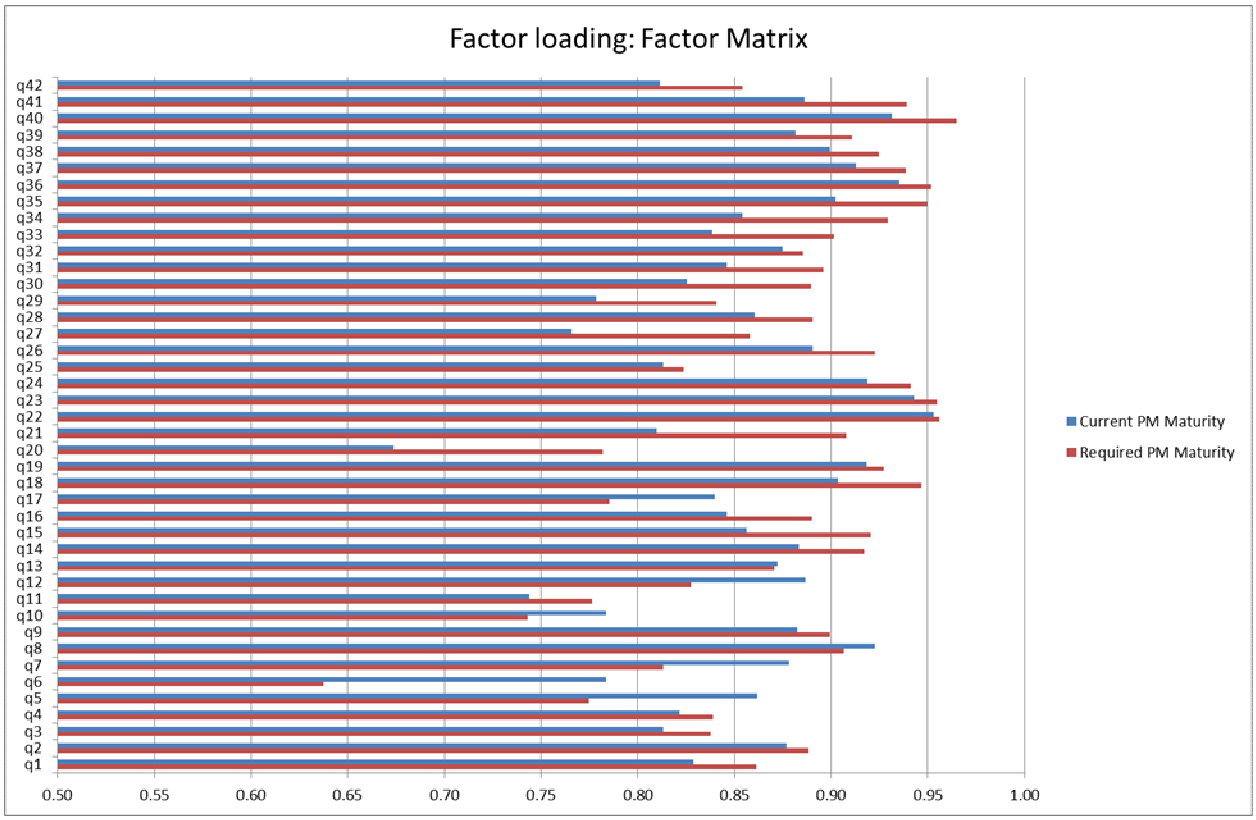


Figure 21: Factor loading results for round 1 current and required PM maturity questions.

The factor loadings for the forty two questions that results in the representative nine knowledge areas are presented graphically in Figure 21.

Based on the factor analysis results the PM maturity can effectively be represented by the nine knowledge areas of PM.

The Cronbach's alphas for this study is of similar order of magnitude than those obtained in an engineering survey to determine the relationship between PM maturity and project success (Pretorius *et al.,* 2012:8).

From the descriptive statistics the averages of the nine knowledge areas for each company and the averages of the companies were calculated and summarised in Table 24. The current and required levels of maturity indicated by the respondents are displayed. Also displayed in Table 24 is the required maturity rounded down to the closest integer value as explained in Section 3.4.1. This rounded down or converted required PM maturity level was given to the respondents as feedback from the round 1 required PM maturity questionnaire to influence the round 2 responses.

3.9.2 Project management office maturity level - round 1

The purpose of the three PMO maturity questionnaire sections were to measure the current and perceived enterprise, departmental and/or project-program PMO maturity required in the consulting engineering industry in South Africa.

Performing a factor analysis on the round 1 current and required PMO maturity questionnaire confirmed that the PMO maturity questionnaire variables can be represented by respective PMO functionalities as defined by the maturity cube model. The variables used in the factor analysis, as described in Section 3.6.1, are shown in Table 23.

For both the current and required variables:

- The sample adequacy ranges between good and superb (0.78 to 0.90).
- The correlations between variables and the factor are sufficiently high (p-value < 0.05).

- For the validation of factor extraction, the Eigen values are slightly larger than one for four factors (for both the current and required PMO maturity).
- The total variance of a single factor contributes more than 50% for all the factors.
- The test reliability is acceptable as Cronbach's Alpha is well in excess of 0.7.

Table 23: Factor analysis results for round 1 current and required PMO maturity.

	Current Round 1						
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity: p	Total Variance Explained: Total for 1 factor	Total Variance Explained: Total for 2 factors	Total Variance Explained: Cumulative % for 1 factor	Total Variance Explained: Cumulative % for 2 factors	Cronbach's Alpha
Enterprise Strategic	0.87	5.96E-73	5.71	1.04	57.11	67.47	0.91
Enterprise Tactical	0.89	8.29E-55	5.02	0.97	55.74	66.49	0.90
Enterprise Operational	0.90	8.80E-64	5.00	0.73	62.49	71.63	0.91
Departmental Strategic	0.82	2.61E-53	5.23	1.17	52.27	63.98	0.89
Departmental Tactical	0.85	8.62E-46	4.83	1.05	53.66	65.34	0.89
Departmental Operational	0.82	2.98E-35	4.17	0.91	52.08	63.48	0.86
Program/ project Strategic	0.80	1.13E-29	3.12	0.83	62.38	79.08	0.84
Program/ project Tactical	0.79	1.10E-48	4.45	1.01	55.61	68.25	0.88
Program/ project Operational	0.87	9.15E-47	4.66	0.77	58.25	67.88	0.89
	Required Round 1						
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity: p	Total Variance Explained: Total for 1 factor	Total Variance Explained: Total for 2 factors	Total Variance Explained: Cumulative % for 1 factor	Total Variance Explained: Cumulative % for 2 factors	Cronbach's Alpha
Enterprise Strategic	0.88	2.05E-80	5.94	0.83	59.43	67.78	0.92
Enterprise Tactical	0.82	5.19E-51	4.54	1.18	50.41	63.55	0.87
Enterprise Operational	0.86	1.16E-52	4.55	0.87	56.83	67.74	0.88
Departmental Strategic	0.90	3.08E-86	6.37	1.06	63.74	74.39	0.93
Departmental Tactical	0.85	1.62E-71	5.33	1.07	59.28	71.19	0.91
Departmental Operational	0.89	3.28E-68	5.33	0.71	66.69	75.54	0.93
Program/ project Strategic	0.83	1.29E-28	3.19	0.69	63.78	77.62	0.85
Program/ project Tactical	0.78	5.04E-40	4.06	1.15	50.75	65.17	0.85
Program/ project Operational	0.89	5.67E-60	4.88	0.85	60.95	71.52	0.90

Since a number of Eigen values indicate according to factor analysis guidelines that more factors are required than the nine factors of the PMO maturity cube (three scope factors and three approach factors), the factor loadings for single factor and two factor are indicated in Figure 22 and Figure 23. From the result it is generally seen that the second factor loading is smaller than 0.5 and therefor tends to be not practically significant according to the factor loading guidelines discussed in Section 3.6.1.

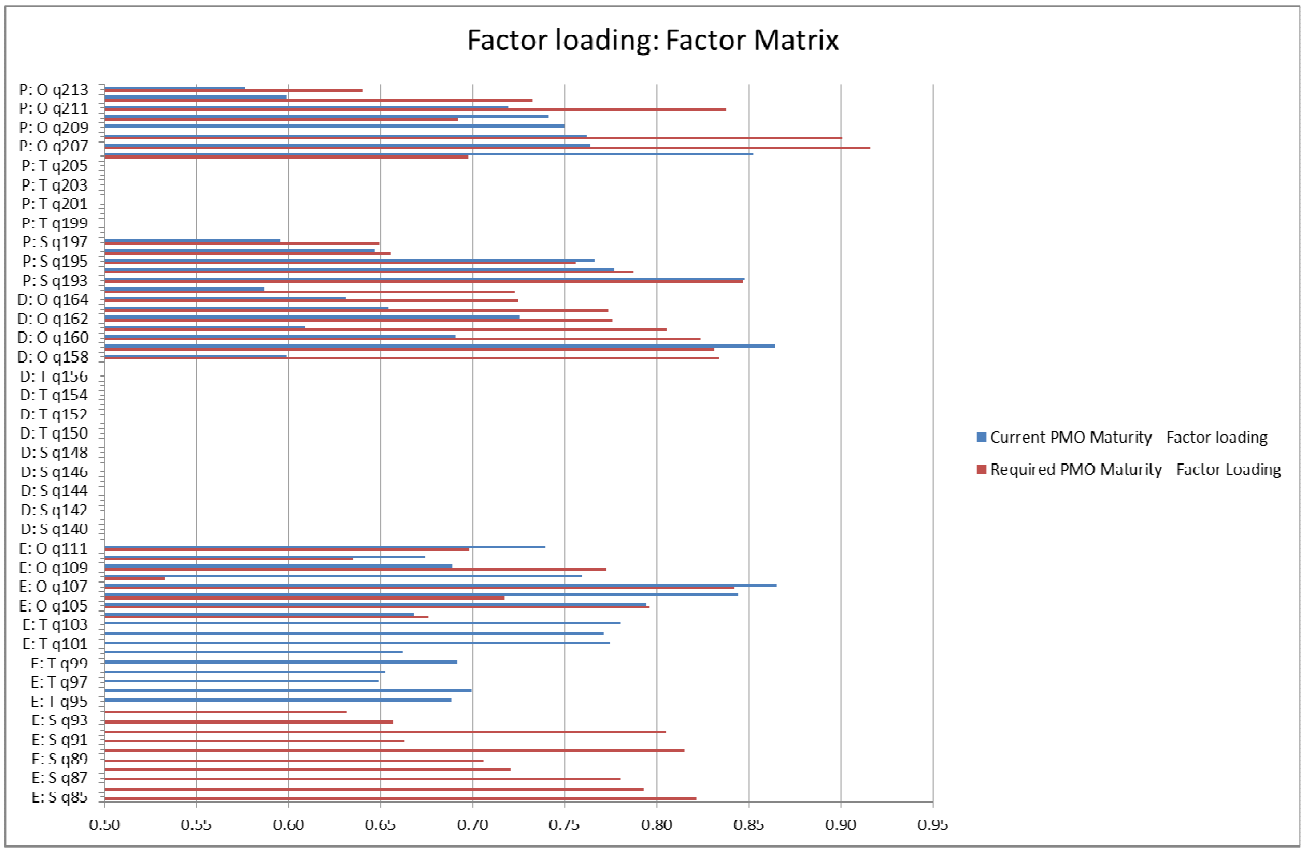


Figure 22: Factor loading results for round 1 current and required PMO maturity for single factor extraction.

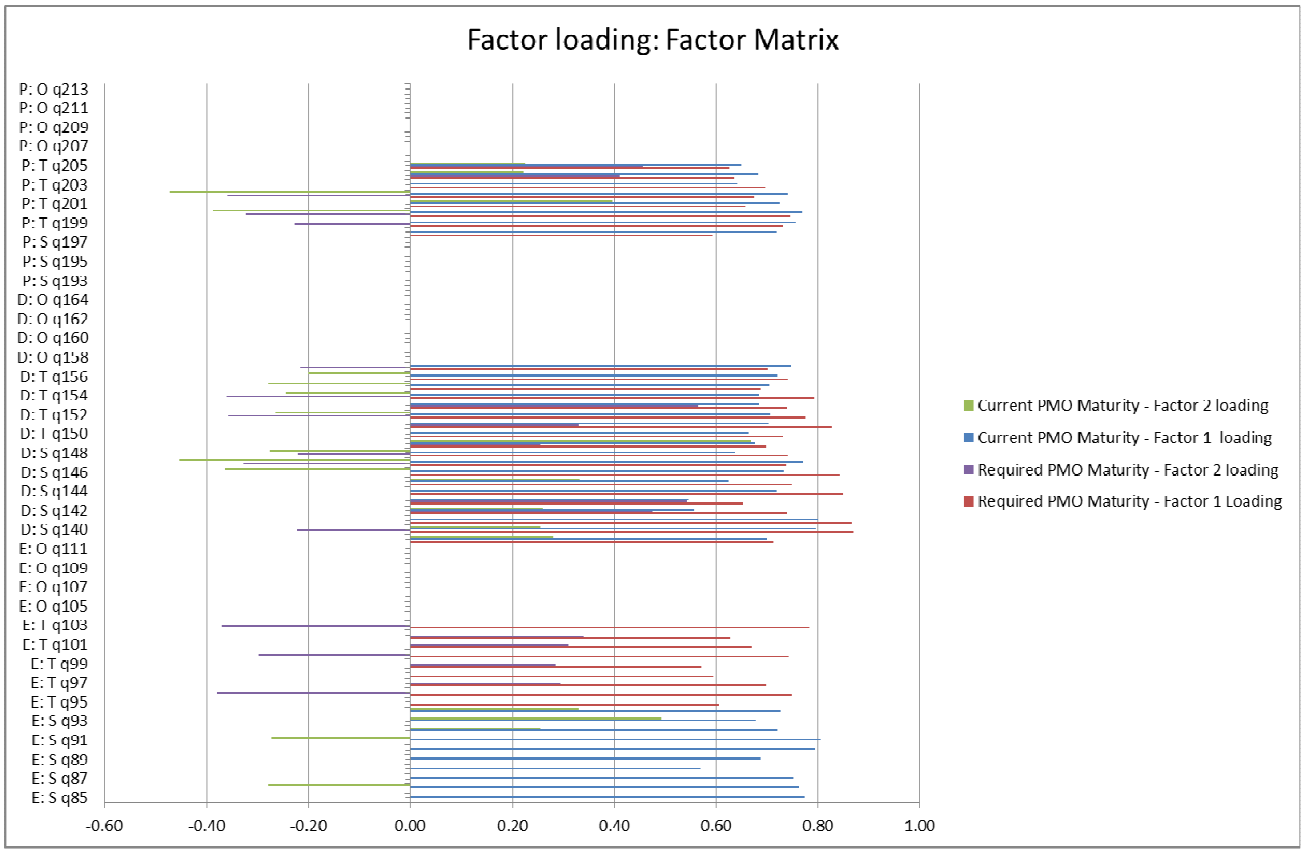


Figure 23: Factor loading results for round 1 current and required PMO maturity for two factor extraction.

Although a number of Eigen values are larger than one and the guideline of factor analysis suggest to use more than one factor when the Eigen values are larger than one, the single factors used in the questionnaire are sufficient for the following reasons:

- The PMO maturity cube survey is an existing questionnaire that have been tested on several PMO's and adjusted based on their feedback.
- The Eigen values are only slightly larger than one.
- All the single factor contributions are larger than 50%.
- The factor loading of the second factors are smaller than 50%.

Based on the factor analysis results and the explanation above, the PMO maturity can effectively be represented by the three scope factors and three approach factors for the purposes of this study.

The current and perceived PMO maturity required for enterprise, departmental and project maturity for round 1 is shown in Table 25, Table 26 and Table 27 respectively. The values in the "Current" and "Required Round 1" columns are the average values out of a total of the maximum for that specific question. For example in Table 25, for the first row the current maturity based on the average calculated of the averages for each company that participated is 1.28 out of a maximum of 3. The column "Required Round 1 converted" is an indication of the required maturity level rounded down similar to the PM maturity to the closest integer. Again for the first row of Table 25 the required average value was calculated as 2.43 out of a maximum of 3. This rounded down or converted required PMO maturity level was given to the respondents as feedback from the round 1 required PMO maturity questionnaire to influence the round 2 responses.

3.10 ROUND 2 PM AND PMO QUESTIONNAIRE RESULTS

3.10.1 Project management maturity level - round 2

The purpose of the second round of the PM maturity questionnaire is to attempt to move towards a converged perception of what the required PM maturity level of consulting engineering industry in South Africa should be.

Using descriptive statistics, the average value of the company PM maturity averages was calculated and is shown in Table 24.

In general, the average required level of PM maturity for round 2 was lower than the average required PM maturity level for round 1 (See Table 24). This indicates that the respondents definitely changed their perceived required rate of PM maturity between round 1 and round 2 of the survey, although not much in most instances.

The results in Table 24 indicate that there is a definite difference in the current and required maturity level for each of the knowledge areas and the respective knowledge area components. It furthermore indicates that for consulting engineering companies to produce more successful and consistent performance, the PM maturity needs to improve from the current maturity level to the required maturity level. In Table 24, for example, the project integration management knowledge area component of project plan development needs to increase from a structured process and standards (Level 2 maturity) to a managed process (Level 4).

The average PM maturity for the project integration management knowledge area is calculated from the lowest maturity level for the components of the knowledge area. The current level of maturity for the project integration management knowledge area is therefore at a structured process and standards (level 2 as described in Section 3.4.1). The required maturity level for project integration knowledge area is at an organisational standard and institutional process level (level 3) for both round 1 and round 2 of the survey.

Table 24: PM maturity summary for round 1 and round 2 surveys.

		Round 1			Round 2
		Current	Required	Required Converted	Required
Project Integration Management	Project Plan Development	2.82	4.01	4	4.00
	Project Plan Execution	2.75	3.96	3	3.66
	Change Control	2.61	4.02	4	3.79
	Project Information System	2.80	3.86	3	3.23
	Project Office	2.62	3.88	3	3.23
Project Scope Management	Requirements Definition (Business)	2.86	4.05	4	3.98
	Requirements Definition (Technical)	3.01	4.14	4	4.00
	Deliverables identification	3.13	4.22	4	3.98
	Scope Definition	3.08	4.14	4	4.06
	Work Breakdown Structure	2.69	4.01	4	3.72
	Scope Change Control	2.56	4.14	4	3.89
Project Time Management	Activity Definition	2.83	3.92	3	3.49
	Activity Sequencing	2.61	3.78	3	3.40
	Schedule Development	2.70	3.91	3	3.40
	Schedule Control	2.38	3.93	3	3.57
	Schedule Integration	2.35	3.91	3	3.38
Project Cost Management	Resource Planning	2.89	3.94	3	3.53
	Cost Estimating	3.00	4.06	4	3.81
	Cost Budgeting	3.04	4.07	4	3.87
	Performance Measurement	2.64	4.01	4	3.74
	Cost control	3.13	4.15	4	3.87
Project Quality Management	Quality Planning	2.73	3.89	3	3.34
	Quality Assurance	2.83	4.01	4	3.68
	Quality Control	2.85	4.01	4	3.72
	Management Oversight	2.71	3.91	3	3.36
Project Human Resource Management	Organisational Planning	2.39	3.76	3	3.28
	Staff Acquisition	2.45	3.78	3	3.21
	Team Development	2.27	3.76	3	3.17
	Professional Development	2.35	3.80	3	3.28
Project Communication Management	Planning	2.42	3.81	3	3.43
	Information Distribution	2.52	3.92	3	3.43
	Performance Reporting	2.51	3.84	3	3.32
	Issues Tracking and Management	2.45	3.85	3	3.40
Project Risk Management	Risk identification	2.55	3.93	3	3.45
	Risk Quantification	2.31	3.81	3	3.23
	Risk Response Development	2.18	3.82	3	3.15
	Risk Control	2.31	3.91	3	3.23
	Risk Documentation	2.19	3.80	3	3.04
Project Procurement Management	Procurement Planning	2.93	3.92	3	3.19
	Requisition	3.00	3.91	3	3.15
	Solicitation / Source Control	2.90	3.88	3	3.11
	Contract Management / Closure	3.00	3.94	3	3.23

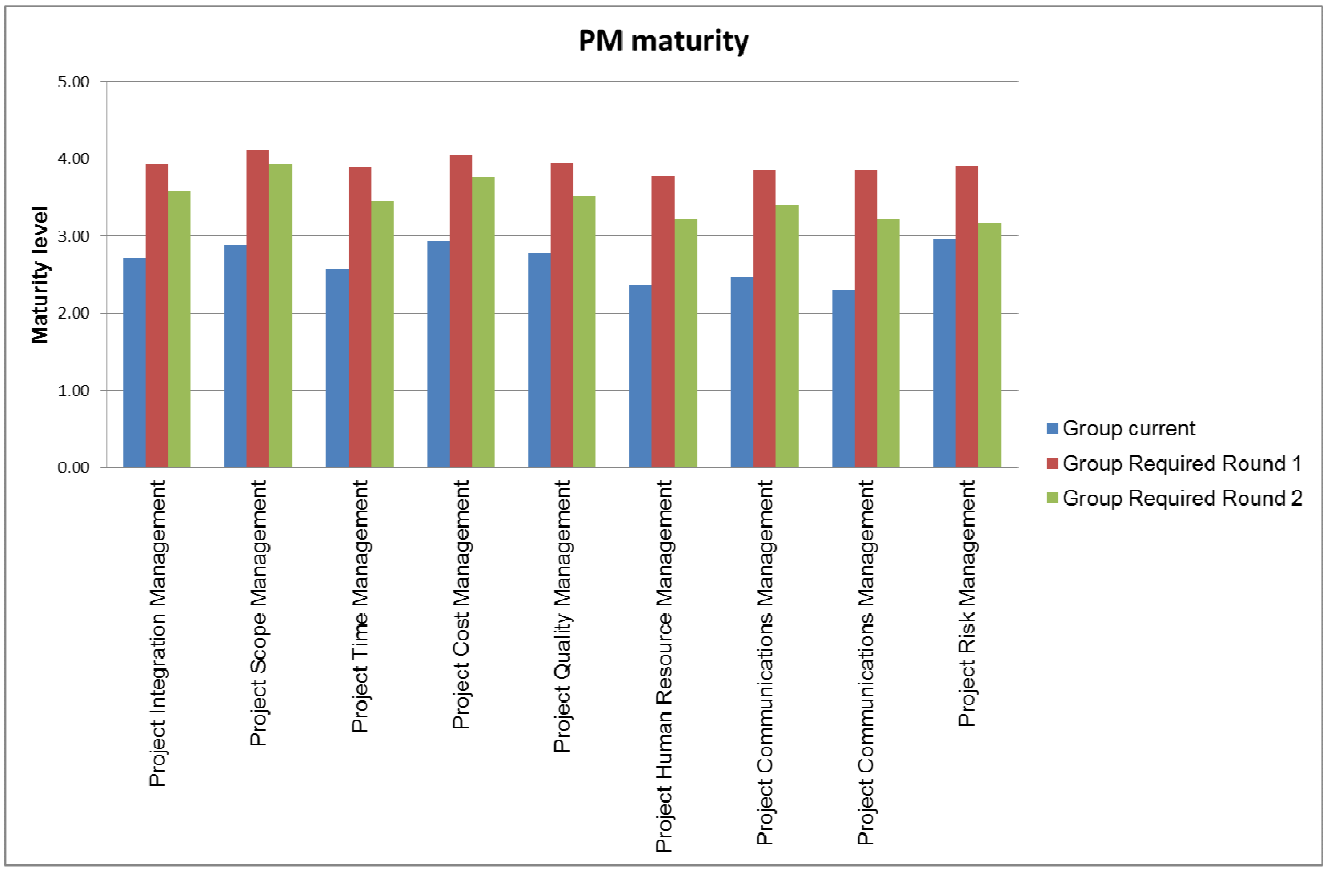


Figure 24: PM maturity summary based on the nine PM knowledge areas.

The summary of the calculated average PM maturity levels currently in the consultation engineering industry represented by the respondents and their perceived maturity levels required in the consulting engineering industry is shown in Figure 24 for each of the nine PM knowledge areas.

Based on the lowest maturity level for the nine knowledge areas (as discussed in Section 3.4.1) the current PM maturity level in the consulting engineering industry is at a level 2 (See Figure 24). A Level 2 PM maturity refers to a structured process and standards level. Although two of the knowledge areas had a required maturity level of 4 (managed process) in the round 1 survey, based on the discussion in section 3.4.1, the required maturity level to achieve more successful project delivery consistently in consulting engineering industry is at a level 3 (See Figure 24) for both round 1 and round 2 of the survey.

3.10.2 Project management office maturity level - round 2

The purpose of the second round of the PMO maturity questionnaire is to attempt to move towards a converged perception of what the required PMO maturity level of consulting engineering industry in South Africa should be.

Using descriptive statistics the average value of the company PMO maturity averages was calculated and is shown in Table 25, Table 26 and Table 27 (enterprise, departmental and program/project PMOs respectively).

The maturity percentage results in Table 25, Table 26 and Table 27 indicate that there is a definite difference in the current and required maturity levels for each of the PMO scopes. It furthermore indicates that for consulting engineering companies to produce more successful and consistent performance, the PMO maturity needs to improve from the current maturity level to the required maturity level. In Table 25, for example, the coordination and integration of organisation's portfolio PMO function needs to improve from the current basic level (32% maturity) to an intermediate level (60% maturity).

The highest current maturity level for a function of enterprise PMOs is 47% (intermediate) for the PMO to provide a set of tools for PM. The lowest current maturity level is 19% (basic) for PMO to manage the risk database. The highest required maturity for round 1 is 88% (advanced) also for the PMO to provide a set of tools for PM. The lowest required maturity for round 1 is 69% (advanced) for the PMO to develop PM skills. The highest required maturity for round 2 is 70% (advanced) for the PMO to manage one or more programs or projects. The lowest required maturity for round 2 is 52% (intermediate) for the PMO to monitor and control its own performance. The maximum and minimum values are indicated with orange and blue in the tables below.

The highest current maturity level for a function of departmental PMO's is 41% (intermediate) for the PMO to provide a set of tools for PM. The lowest current maturity level is 19% (basic) for PMO to conduct post-reviews of project management (lessons learned). The highest required maturity for round 1 is 90% (advanced) for the PMO to provide specialised services to project managers. The lowest required maturity for round 1 is 66% (intermediate) for the PMO to select, manage and evaluate project

managers. The highest required maturity for round 2 is 70% (advanced) for the PMO to provide a set of tools for PM. The lowest required maturity for round 2 is 47% (intermediate) for the PMO to select, manage and evaluate project managers.

Table 25: Enterprise PMO maturity summary for round 1 and round 2 surveys.

		Current	Required Round 1	Required Round 1 converted	Required Round 2	Current [%]	Required Round 1 [%]	Required Round 2 [%]
Strategic	How does the PMO provide advice to the senior management? (Max = 3)	1.28	2.43	2.00	1.89	43%	81%	63%
	How does the PMO coordinate and integrate the organisation's portfolio? (Max = 3)	0.95	2.37	2.00	1.80	32%	79%	60%
	How does the PMO develop and maintain a strategic framework of projects and programs (Scoreboard)? (Max = 3)	0.88	2.44	2.00	1.98	29%	81%	66%
	How does the PMO promote project management awareness in the organisation? (Max = 3)	1.14	2.52	2.00	2.00	38%	84%	67%
	How does the PMO monitor and control its own performance? (Max = 4)	0.84	2.85	2.00	2.09	21%	71%	52%
	How does the PMO participate in the strategic planning process? (Max = 3)	1.00	2.36	2.00	1.87	33%	79%	62%
	How does the PMO manage one or more Portfolios? (Max = 4)	1.44	2.96	2.00	2.17	36%	74%	54%
	How does the PMO identify, select and prioritise new projects and programs? (Max = 3)	0.80	2.19	2.00	1.78	27%	73%	59%
	How does the PMO manage the benefits of the projects and programs? (Max = 2)	0.73	1.77	1.00	1.24	36%	88%	62%
	How does the PMO map the relationships and environment of projects and programs in and out of the organisation? (Max = 2)	0.48	1.62	1.00	1.09	24%	81%	54%
Tactical	How does the PMO develop and implement the project management methodology? (Max = 4)	1.52	2.96	2.00	2.26	38%	74%	57%
	How does the PMO develop skills in project management? (Max = 4)	0.99	2.77	2.00	2.15	25%	69%	54%
	How does PMO implement and manage project information systems? (Max = 3)	1.00	2.48	2.00	1.96	33%	83%	65%
	How does PMO manage interfaces with customers? (Max = 3)	1.05	2.12	2.00	1.70	35%	71%	57%
	How does the PMO provide a set of tools for project management? (Max = 3)	1.42	2.65	2.00	2.07	47%	88%	69%
	How does the PMO allocate and share resources between projects? (Max = 3)	1.10	2.43	2.00	1.98	37%	81%	66%
	How does the PMO implement and manage the lessons learned database? (Max = 3)	0.65	2.53	2.00	1.87	22%	84%	62%
	How does the PMO implement and manage the risk database? (Max = 3)	0.56	2.56	2.00	1.80	19%	85%	60%
	How does the PMO select, manage and evaluate project managers? (Max = 3)	0.62	2.23	2.00	1.76	21%	74%	59%
Operational	How does the PMO provide specialised services for the project manager? (Max = 2)	0.79	1.77	1.00	1.30	40%	88%	65%
	How does the PMO provide information to the senior management of the status of projects that are under way? (Max = 3)	1.07	2.41	2.00	1.76	36%	80%	59%
	How does the PMO monitor and control project / program performance? (Max = 3)	0.99	2.35	2.00	1.87	33%	78%	62%
	How does the PMO provide mentoring for the project managers? (Max = 3)	0.69	2.36	2.00	1.63	23%	79%	54%
	How does the PMO manage and collect project files and documentation? (Max = 3)	1.36	2.59	2.00	1.98	45%	86%	66%
	How does the PMO manage one or more programs or projects? (Max = 3)	1.41	2.63	2.00	2.09	47%	88%	70%
	How does the PMO conduct project Audits? (Max = 3)	0.81	2.30	2.00	1.87	27%	77%	62%
	How does the PMO conduct the post-reviews of project management (Lessons learned)? (Max = 3)	0.59	2.54	2.00	1.85	20%	85%	62%

Table 26: Departmental PMO maturity summary for round 1 and round 2 surveys.

		Current	Required Round 1	Required Round 1 converted	Required Round 2	Current [%]	Required Round 1 [%]	Required Round 2 [%]
Strategic	How does the PMO provide advice to the department senior management? (Max = 3)	1.03	2.36	2.00	1.87	34%	79%	62%
	How does the PMO coordinate and integrate the department's portfolio? (Max = 3)	0.75	2.26	2.00	1.74	25%	75%	58%
	How does the PMO develop and maintain a strategic framework of departmental projects and programs (Scoreboard)? (Max = 3)	0.75	2.33	2.00	1.91	25%	78%	64%
	How does the PMO promote project management awareness in the department? (Max = 3)	0.97	2.32	2.00	1.80	32%	77%	60%
	How does the PMO monitor and control its own performance? (Max = 4)	0.76	2.86	2.00	2.13	19%	72%	53%
	How does the PMO participate in the department strategic planning process? (Max = 3)	0.90	2.25	2.00	1.83	30%	75%	61%
	How does the PMO manage one or more departmental portfolios? (Max = 4)	1.13	2.71	2.00	2.09	28%	68%	52%
	How does the PMO identify, select and prioritise new departmental projects and programs? (Max = 3)	0.68	2.12	2.00	1.74	23%	71%	58%
	How does the PMO manage the benefits of the departmental projects and programs? (Max = 2)	0.64	1.70	1.00	1.30	32%	85%	65%
	How does the PMO map the relationships and the environment of the projects and programs in and out of the department? (Max = 2)	0.42	1.51	1.00	1.11	21%	75%	55%
Tactical	How does the PMO develop and implement the department's project management methodology? (Max = 4)	1.31	2.90	2.00	2.28	33%	73%	57%
	How does the PMO develop skills in project management? (Max = 4)	0.89	2.70	2.00	2.13	22%	67%	53%
	How does the PMO implement and manage project information systems? (Max = 3)	0.94	2.34	2.00	1.96	31%	78%	65%
	How does the PMO manage interfaces with customers? (Max = 3)	0.83	2.04	2.00	1.80	28%	68%	60%
	How does the PMO provide a set of tools for project management? (Max = 3)	1.22	2.59	2.00	2.09	41%	86%	70%
	How does the PMO allocate and share resources between departmental projects? (Max = 3)	0.94	2.27	2.00	2.02	31%	76%	67%
	How does the PMO implement and manage the lessons learned database? (Max = 3)	0.68	2.37	2.00	1.96	23%	79%	65%
	How does the PMO implement and manage the risk database? (Max = 3)	0.64	2.34	2.00	1.78	21%	78%	59%
	How does the PMO select, manage and evaluate project managers? (Max = 3)	0.60	1.99	1.00	1.41	20%	66%	47%
Operational	How does the PMO provide specialised services for the Project manager? (Max = 2)	0.76	1.79	1.00	1.26	38%	90%	63%
	How does the PMO provide information to senior management of the status of projects that are under way? (Max = 3)	1.00	2.26	2.00	1.98	33%	75%	66%
	How does the PMO monitor and control project / program performance? (Max = 3)	0.82	2.29	2.00	1.89	27%	76%	63%
	How does the PMO provide mentoring for project managers? (Max = 3)	0.60	2.25	2.00	1.78	20%	75%	59%
	How does the PMO manage and collect project files and documentation? (Max = 3)	1.19	2.40	2.00	2.07	40%	80%	69%
	How does the PMO manage one or more programs or projects? (Max = 3)	1.17	2.48	2.00	2.00	39%	83%	67%
	How does the PMO conduct project audits? (Max = 3)	0.78	2.38	2.00	1.96	26%	79%	65%
	How does the PMO conduct post-reviews of project management (lessons learned)? (Max = 3)	0.56	2.41	2.00	1.98	19%	80%	66%

The highest current maturity level for a function of program/project PMO's is 46% (intermediate) for the PMO to manage and collect project/program files and documentation. The lowest current maturity level is 21% (basic) for PMO to implement and manage the risk database. The highest required maturity for round 1 is 89% (advanced) for the PMO to provide specialised services to project managers. The lowest required maturity for round 1 is 68% (advanced) for the PMO to manage interfaces with project/program's customers. The highest required maturity for round 2

is 72% (advanced) for the PMO to manage the benefits of the project/program. The lowest required maturity for round 2 is 54% (intermediate) for the PMO to map the relationship and the environment of the projects and programs in and out of the project/program.

Table 27: Program/project PMO maturity summary for round 1 and round 2 surveys.

		Current	Required Round 1	Required Round 1 converted	Required Round 2	Current [%]	Required Round 1 [%]	Required Round 2 [%]
Strategic	How does the PMO provide advice to the senior management about the project / program? (Max = 3)	1.18	2.35	2.00	1.98	39%	78%	66%
	How does the PMO develop and maintain a strategic framework of the project / program (Scoreboard)? (Max = 3)	1.00	2.49	2.00	2.09	33%	83%	70%
	How does the PMO monitor and control its own performance? (Max = 4)	0.91	2.92	2.00	2.23	23%	73%	56%
	How does the PMO manage the benefits of the project / program? (Max = 2)	0.62	1.70	1.00	1.45	31%	85%	72%
	How does the PMO map the relationship and the environment of the projects and programs in and out of the project / program? (Max = 2)	0.47	1.57	1.00	1.09	24%	78%	54%
Tactical	How does the PMO develop and implement the project management methodology? (Max = 4)	1.49	3.07	3.00	2.77	37%	77%	69%
	How does the PMO develop skills in project management for the program / project? (Max = 3)	0.84	2.32	2.00	1.96	28%	77%	65%
	How does the PMO implement and manage the project information system? (Max = 3)	0.95	2.39	2.00	1.91	32%	80%	64%
	How does the PMO manage interfaces with project's / program's customers? (Max = 3)	0.74	2.05	2.00	1.79	25%	68%	60%
	How does the PMO provide a set of tools for project management? (Max = 3)	1.30	2.59	2.00	2.11	43%	86%	70%
	How does the PMO allocate and share resources in the project / program? (Max = 3)	0.97	2.34	2.00	1.89	32%	78%	63%
	How does the PMO implement and manage the lessons learned database? (Max = 3)	0.73	2.43	2.00	1.98	24%	81%	66%
	How does the PMO implement and manage the risk database? (Max = 3)	0.62	2.39	2.00	1.79	21%	80%	60%
Operational	How does the PMO provide specialised services for the project / program manager? (Max = 2)	0.81	1.77	1.00	1.30	41%	89%	65%
	How does the PMO provide information to senior management of the status of project / program that are under way? (Max = 3)	1.05	2.24	2.00	1.96	35%	75%	65%
	How does the PMO monitor and control project / program performance? (Max = 3)	0.88	2.26	2.00	2.04	29%	75%	68%
	How does the PMO provide mentoring for the project / program manager? (Max = 3)	0.69	2.19	2.00	1.64	23%	73%	55%
	How does the PMO manage and collect project / program files and documentation? (Max = 3)	1.38	2.50	2.00	2.04	46%	83%	68%
	How does the PMO manage the program/project? (Max = 3)	1.22	2.49	2.00	2.13	41%	83%	71%
	How does the PMO conduct project / program audits? (Max = 3)	0.78	2.30	2.00	2.02	26%	77%	67%
	How does the PMO conduct post-reviews of project management (lessons learned)? (Max = 3)	0.65	2.54	2.00	2.02	22%	85%	67%

The results in Table 25, Table 26 and Table 27 indicate that there is a definite difference in the current and required maturity level for each of the PMO functionalities, scopes and approaches. It furthermore indicates that for consulting engineering companies to produce more successful and consistent performance, the PMO maturity needs to improve from the current maturity level to the required maturity level.

The average PMO maturity for a PMO approach is calculated by adding all the applicable PMO functionality values and dividing by the sum of the maximum possible values for each functionality as discussed in Section 3.4.2. The summary of the PMO maturity levels for the current and required levels for round 1 and 2 is shown in Table 28.

Table 28: PMO maturity summary based on the scope and approach PMO cube.

Current		**SCOPE**		
		Enterprise	**Departmental**	**Program / Project**
Approach	**Strategic**	Basic **31%**	Basic **25%**	Basic **29%**
	Tactical	Basic **30%**	Basic **26%**	Basic **29%**
	Operational	Intermediate **34%**	Basic **27%**	Basic **32%**
Required Round 1		**SCOPE**		
		Enterprise	**Departmental**	**Program / Project**
Approach	**Strategic**	Advanced **85%**	Advanced **81%**	Advanced **85%**
	Tactical	Advanced **83%**	Advanced **79%**	Advanced **81%**
	Operational	Advanced **85%**	Advanced **84%**	Advanced **84%**
Required Round 2		**SCOPE**		
		Enterprise	**Departmental**	**Program / Project**
Approach	**Strategic**	Intermediate **63%**	Intermediate **58%**	Intermediate **65%**
	Tactical	Intermediate **62%**	Intermediate **59%**	Intermediate **63%**
	Operational	Intermediate **62%**	Intermediate **64%**	Intermediate **63%**

From Table 28 it is seen that a small range of maturity percentages is visible across the scopes and approaches of the PMO (25% to 34% for the current maturity, 79% to 85% for required maturity round 1 and 58% to 65% for required maturity for round 2).

The current and required PMO maturity obtained in a similar study performed on a company operating in the energy sector and that have a PMO responsible for the engineering department is shown in Table 29. Both this study and the comparative study have a current departmental PMO maturity for strategic, tactical and operational that is basic. The required PMO maturity for round 2 in this study is all on an

intermediate level where the comparative study had a basic strategic maturity and advanced maturity requirement for tactical and operational as a target.

Table 29: Department PMO maturity assessment for PMO operating in energy engineering sector (Pinto *et al.*, 2010:19).

Company	Sector	Scope of the PMO			Approach of the PMO		
					Strategic assessment	Tactical assessment	Operational assessment
F	Energy	Departmental	Maturity	Current level	9% Basic	35% Basic	18% Basic
				Target level	19% Basic	68% Advanced	75% Advanced

3.11 EMPIRICAL STUDY STATISTICAL RELATIONSHIP RESULTS AND DISCUSSION

3.11.1 Assessment of degree in which a group of experts reached a consensus of opinion

The purpose of the Delphi technique was to determine the perception of experts from the consulting engineering industry on what they feel the required or target maturity should be for PM and PMO. In the first round the opinions of the experts are gathered on the perceived target. The perceived target from all the respondents is then statistically processed and the average values are given back to the respondents in round 2 to influence their answers (as provided in round 1). This process is then repeated until the group of experts reach a consensus on what the target maturity should be based on their experience.

To assess whether the maturity required have converged towards a consensus, the standard deviation of the required maturity of the group as a whole and of M-Tech have been compared between round 1 and 2 answers. If the round 2 standard deviation is smaller than the round 1 value, then the group is moving towards a consensus in the structured Delphi technique method. Thus by subtracting the standard deviation of round 2 from round 1, a positive answer would indicate that round 2 has a smaller standard deviation and therefore the results are converging.

Table 30: PM maturity standard deviation comparison between survey round 1 and round 2.

	Current		Required Round 1		Required Round 2		Required Round 1 - Round 2	
	M-Tech	Group	M-Tech	Group	M-Tech	Group	M-Tech	Group
Project Integration Management	0.90	1.05	0.90	0.80	0.7	0.8	0.24	0.04
Project Scope Management	1.0	1.1	0.8	0.8	0.6	0.6	0.26	0.20
Project Time Management	0.9	1.0	0.9	0.8	0.7	0.7	0.18	0.05
Project Cost Management	0.9	1.0	0.8	0.8	0.6	0.6	0.23	0.16
Project Quality Management	0.8	1.1	0.8	0.8	0.6	0.8	0.18	0.03
Project Human Resource	0.9	1.0	1.0	0.9	0.7	0.7	0.23	0.17
Project Communications	0.9	1.0	1.0	0.9	0.6	0.7	0.42	0.18
Project Risk Management	0.9	1.0	0.9	0.8	0.6	0.8	0.32	0.06
Project Procurement Management	0.8	1.0	0.8	1.0	0.6	0.6	0.23	0.35
PM Maturity	0.9	1.1	0.9	0.8	0.7	0.7	0.23	0.08

Table 31: PMO maturity standard deviation comparison between survey round 1 and round 2.

		M-Tech				Group			
		Strategic	Tactical	Operational	PMO maturity	Strategic	Tactical	Operational	PMO maturity
Current	Enterprise	0.31	0.28	0.31	0.30	0.33	0.31	0.34	0.32
	Departmental	0.29	0.25	0.29	0.28	0.29	0.29	0.31	0.29
	Project Program	0.31	0.27	0.28	0.29	0.31	0.30	0.31	0.31
Required Round1	Enterprise	0.33	0.28	0.30	0.31	0.28	0.26	0.26	0.27
	Departmental	0.33	0.30	0.28	0.31	0.30	0.29	0.27	0.29
	Project Program	0.32	0.26	0.29	0.29	0.27	0.26	0.27	0.27
Required Round2	Enterprise	0.24	0.23	0.24	0.24	0.26	0.25	0.27	0.26
	Departmental	0.24	0.24	0.24	0.24	0.25	0.25	0.26	0.25
	Project Program	0.24	0.26	0.24	0.25	0.26	0.25	0.25	0.26
Required Round 1 - Round 2	Enterprise	0.09	0.05	0.06	0.07	0.01	0.01	-0.01	0.00
	Departmental	0.09	0.06	0.04	0.07	0.05	0.04	0.01	0.04
	Project Program	0.08	0.00	0.05	0.04	0.01	0.01	0.02	0.01

From Table 30 and Table 31 it can be seen that all standard deviations decreased from round 1 to round 2 except two of the 24 values in the PMO maturity. These values that are negative or have not converged are close to zero. The two PMO maturity types that did not converge was the Enterprise-Operational value for the group and the Project-Tactical value for M-Tech.

In general, based on the reduction in standard deviation from round 1 to round 2, it can be deducted that the group of respondents is moving towards a consensus regarding what the required PM and PMO maturity level should be in the consulting engineering industry. For the purposes of this study round 2 was deemed sufficient and further survey rounds were not conducted.

3.11.2 Relationship assessment between average PM maturity and PMO maturity

From the average current PM and PMO maturity results obtained from the survey, the existence of the following relationships were investigated:

- Is PM average maturity related to Enterprise-Strategic PMO maturity?
- Is PM average maturity related to Enterprise-Tactical PMO maturity?
- Is PM average maturity related to Enterprise-Operational PMO maturity?
- Is PM average maturity related to Departmental-Strategic PMO maturity?
- Is PM average maturity related to Departmental-Tactical PMO maturity?
- Is PM average maturity related to Departmental-Operational PMO maturity?
- Is PM average maturity related to Project-Strategic PMO maturity?
- Is PM average maturity related to Project-Tactical PMO maturity?
- Is PM average maturity related to Project-Operational PMO maturity?

Table 32: Relationship assessment between average PM maturity and PMO maturity by evaluating the coefficient of determination.

	PM average Maturity	
	R^2 value	P value
Enterprise - Strategic	0.30	<0.0001
Enterprise - Tactical	0.29	0.0001
Enterprise - Operational	0.38	<0.0001
Departmental - Strategic	0.22	<0.0001
Departmental - Tactical	0.39	<0.0001
Departmental - Operational	0.51	<0.0001
Project/Program - Strategic	0.31	<0.0001
Project/Program - Tactical	0.46	<0.0001
Project/Program - Operational	0.46	<0.0001

Regression analysis revealed practically significant relationships between the PM maturity and the nine PMO maturity averages. From Table 32 is can be seen that for example 30% of the variation in Enterprise-Strategic PMO maturity can be explained by the variation in PM maturity, etc.

3.11.3 Significant difference assessment between current and required maturity levels

From the average current and required PM and PMO maturity results obtained from the survey round 1, it was investigated whether there was any significant difference

between the current and required maturity levels. Since the primary unit of measure is the companies, the difference in current and required maturity level will be tested for each company. Furthermore, to assess whether the current and required maturity levels are significantly different within a company, a paired t-test will be used as the two sets of data are related. The paired t-test furthermore requires that the selection of respondents should be randomly selected from a normally distributed population (Levine *et al.*, 2011:374). The paired t-test requires the calculation of standard deviations and means for each company and therefore only companies where more than one respondent took part in the survey can be tested. The companies with more than one respondent that answered the round 1 survey were tested and the results of the different PM knowledge areas and different types of PMO maturities are displayed in Table 33.

Table 33: Significant differences between current and required PM and PMO maturities.

		P- Value					Effect size				
		Medium organisation 4	M-Tech	Medium organisation 8	Large organisation 12	Medium organisation 11	Medium organisation 4	M-Tech	Medium organisation 8	Large organisation 12	Medium organisation 11
Pair 1	Project Integration Management	.01	.00	.00	.09	.06	1.84	.95	2.52	1.15	1.45
Pair 2	Project Scope Management	.05	.00	.01	.03	.18	1.52	1.22	2.59	3.61	.88
Pair 3	Project Time Management	.04	.00	.00	.07	.20	2.61	1.59	2.77	2.00	.75
Pair 4	Project Cost Management	.04	.00	.00	.19	.42	1.39	1.15	2.94	1.39	.44
Pair 5	Project Quality Management	.02	.00	.00	.21	.00	1.83	1.31	2.41	9.24	2.77
Pair 6	Project Human Resource Management	.12	.00	.00	.20	.06	.75	1.59	5.39	2.89	2.08
Pair 7	Project Communications Management	.01	.00	.00	.04	.06	1.76	1.36	5.81	1.50	1.33
Pair 8	Project Risk Management	.00	.00	.00	.01	.04	2.86	1.39	5.91	3.81	3.31
Pair 9	Project Procurement Management	.00	.01	.01	.19	.10	2.63	.89	2.96	1.73	1.32
Pair 10	Enterprise - Strategic	.00	.00	.00	.82	.19	5.15	1.71	1.83	.33	
Pair 11	Enterprise - Tactical	.00	.00	.00		.14	2.75	2.42	2.84		
Pair 12	Enterprise - Operational	.02	.00	.00		.13	2.72	2.39	2.38		
Pair 13	Departmental - Strategic	.07	.00	.00	.42	.00	2.23	1.81	4.07	11.55	2.79
Pair 14	Departmental - Tactical	.02	.00	.00		.04	3.75	3.39	3.50		2.09
Pair 15	Departmental - Operational	.02	.00	.00		.05	4.50	3.17	4.11		2.31
Pair 16	Project/Program - Strategic	.06	.00	.00	.18	.06	3.28	1.60	3.12		3.23
Pair 17	Project/Program - Tactical	.03	.00	.00	.03	.10	2.47	3.17	3.60		1.42
Pair 18	Project/Program - Operational	.03	.00	.00	.09	.09	2.73	2.85	3.84		1.26

From the results it can be seen that all p-values smaller than 0.05 indicate a significant difference between the current and required maturity levels. It is also evident that the companies with more respondents that took part in the survey, show a larger significant difference between current and required maturity levels based on the results of the t-test.

From the results it can also be seen that the effect size is medium (d-value > 0.5) to large (d-value > 0.8) in most cases of the companies suitable for the paired t-test.

3.11.4 Significant difference assessment between M-Tech and remaining group answers

From the average current PM maturity and PMO maturity results obtained from the survey, it was investigated whether there was any significant difference in the answers provided by M-Tech respondents compared the rest of the group of respondents for round 1 of the survey.

In Table 34 the mean value of each PM knowledge area and type of PMO maturity currently experienced in M-Tech and the rest of the group is displayed separately. It can be seen that there is only one p-value that is smaller than 0.05, indicating that only for the current PM knowledge area of project cost management there is a significant difference between the M-Tech and group maturity levels. Based on the results in Table 34, there does not seem to be a significant difference between the current M-Tech and the rest of the group answers for PM and PMO maturity.

Table 34: Significant maturity difference assessment between M-Tech and group answers.

Factor	M-Tech Mean	Group mean	P value	Effect size
Project Integration Management	2.56	2.83	0.25	0.26
Project Scope Management	2.85	2.97	0.57	0.13
Project Time Management	2.66	2.41	0.24	0.27
Project Cost Management	2.77	3.26	0.01	0.57
Project Quality Management	2.66	3.00	0.16	0.32
Project Human Resource Management	2.38	2.34	0.82	0.05
Project Communications Management	2.45	2.53	0.66	0.10
Project Risk Management	2.32	2.28	0.86	0.04
Project Procurement Management	2.85	3.16	0.15	0.33
Enterprise - Strategic	34%	21%	0.81	0.05
Enterprise - Tactical	33%	26%	0.18	0.31
Enterprise - Operational	35%	29%	0.23	0.28
Departmental - Strategic	26%	14%	0.96	0.01
Departmental - Tactical	30%	23%	0.14	0.37
Departmental - Operational	33%	20%	0.93	0.02
Project/Program - Strategic	28%	20%	0.76	0.07
Project/Program - Tactical	32%	29%	0.21	0.31
Project/Program - Operational	32%	25%	0.23	0.30

3.11.5 Significant difference assessment between medium sized companies and remaining group answers

From the average current PM maturity and PMO maturity results obtained from the survey, it was investigated whether there was any significant difference in the answers provided by respondents from medium sized companies (10 to 100 employees) compared to the rest of the group of respondents for round 1 of the survey.

In Table 35 the mean value of each PM knowledge area and type of PMO maturity currently experienced in medium sized companies that took part in the survey and the rest of the group is displayed separately. It can be seen that there is no p-value that is smaller than 0.05. Based on the results in Table 35, there does not seem to be a significant difference between the current medium sized companies and the rest of the group answers for PM and PMO maturity.

Table 35: Significant maturity difference assessment between medium sized companies and the rest of the group.

Factor	Medium sized company mean	Group mean	P value	Effect size
Project Integration Management	2.70	2.62	0.72	0.09
Project Scope Management	2.93	2.90	0.90	0.03
Project Time Management	2.52	2.79	0.22	0.30
Project Cost Management	3.00	2.82	0.40	0.20
Project Quality Management	2.82	2.76	0.81	0.06
Project Human Resource Management	2.36	2.44	0.70	0.09
Project Communications Management	2.45	2.58	0.54	0.15
Project Risk Management	2.20	2.58	0.08	0.43
Project Procurement Management	3.00	2.91	0.69	0.10
Enterprise - Strategic	30%	30%	1.00	0.00
Enterprise - Tactical	30%	34%	0.45	0.19
Enterprise - Operational	31%	39%	0.18	0.34
Departmental - Strategic	23%	22%	0.90	0.03
Departmental - Tactical	26%	34%	0.14	0.39
Departmental - Operational	30%	33%	0.56	0.15
Project/Program - Strategic	24%	28%	0.49	0.16
Project/Program - Tactical	29%	33%	0.46	0.19
Project/Program - Operational	28%	33%	0.38	0.23

3.11.6 Significant difference assessment between ISO 9001 companies and non-ISO 9001 answers

From the average current PM maturity and PMO maturity results obtained from the survey, it was investigated whether there was any significant difference in the answers provided by respondents from companies that work according to ISO 9001 quality standards compared to respondents in companies without ISO 9001 for round 1 of the survey.

In Table 36 the mean value of each PM knowledge area and type of PMO maturity currently experienced in companies that took part in the survey and who are working according to ISO 9001 standards, and the rest of the group is displayed separately. It can be seen that there are five of the nine PM knowledge areas and three of the nine types of PMOs with a p-value smaller than 0.05 (statistically significant). It is also seen in Table 36 that for PM maturity:

- one of the knowledge areas have a large effect size (d-value > 0.8) (for quality management);
- four of the nine PM knowledge areas have an effect size that is medium (d value > 0.5); and
- the rest all have small effect sizes (d-value > 0.2) (for time management, human resource management, communications management and risk management).

Furthermore, it is seen in Table 36 that for PMO maturity:

- three of the nine PMO types have a medium effect size (for enterprise-strategic, department-strategic and department-operational);
- four of the nine PMO types have small effect size (for enterprise-tactical, enterprise-operational, department-tactical, project-strategic); and
- the remaining two PMO types have no significant effect size (for project-tactical and project-operational).

Based on the results in Table 36, there does seem to be a significant difference between the answers for PM and PMO maturity for some of the PM knowledge areas and some of the PMO types. For the PM knowledge areas and PMO types that have a significant difference between ISO 9001 accredited companies and those without

accreditation, it is evident that the PM and PMO maturity levels are in general higher for companies working in an ISO 9001 accredited quality system environment.

Table 36: Significant maturity difference assessment between ISO 9001 companies and non-ISO 9001 companies.

Factor	ISO 9001	Not ISO 9001	P value	Effect size
Project Integration Management	2.82	2.27	.03	.58
Project Scope Management	3.05	2.49	.02	.61
Project Time Management	2.66	2.35	.19	.35
Project Cost Management	3.08	2.62	.04	.54
Project Quality Management	2.95	2.17	.00	.83
Project Human Resource Management	2.45	2.12	.14	.39
Project Communications Management	2.57	2.20	.10	.44
Project Risk Management	2.39	2.03	.13	.40
Project Procurement Management	3.08	2.62	.04	.55
Enterprise - Strategic	34%	21%	.05	.52
Enterprise - Tactical	33%	26%	.22	.34
Enterprise - Operational	35%	29%	.36	.25
Departmental - Strategic	26%	14%	.03	.56
Departmental - Tactical	30%	23%	.22	.36
Departmental - Operational	33%	20%	.03	.65
Project/Program - Strategic	28%	20%	.19	.35
Project/Program - Tactical	32%	29%	.65	.13
Project/Program - Operational	30%	29%	.77	.08

3.11.7 Significant difference assessment between companies with a PMO and those without

From the average current PM maturity and PMO maturity results obtained from the survey, it was investigated whether there was any significant difference in the answers provided by respondents from companies with a PMO compared to the respondents in companies without PMOs for round 1 of the survey.

In Table 37 Table 34the mean value of each PM knowledge area and type of PMO maturity currently experienced in companies that took part in the survey and that have a PMO, and the rest of the group is displayed separately. It can be seen that there are six of the nine PM knowledge areas and five of the nine types of PMO's with a p-value that is smaller than 0.05 (statistically significant). It is also seen in Table 37 that for PM maturity:

- one of the knowledge areas have a large effect size (d-value > 0.8) (for procurement management);
- five of the nine PM knowledge areas have an effect size that is medium (d-value > 0.5); and
- the other three have small effect sizes (d-value > 0.2) (for time management, human resource management and communications management).

Table 37: Significant current maturity difference assessment between companies with and without PMO.

Factor	PMO in company	No PMO	P value	Effect size
Project Integration Management	2.86	2.16	0.00	0.74
Project Scope Management	3.03	2.49	0.02	0.58
Project Time Management	2.69	2.34	0.11	0.39
Project Cost Management	3.13	2.61	0.01	0.61
Project Quality Management	2.99	2.31	0.01	0.69
Project Human Resource Management	2.49	2.16	0.11	0.39
Project Communications Management	2.56	2.24	0.13	0.37
Project Risk Management	2.50	1.89	0.01	0.69
Project Procurement Management	3.21	2.49	0.00	0.86
Enterprise - Strategic	34%	21%	0.04	0.50
Enterprise - Tactical	33%	26%	0.05	0.51
Enterprise - Operational	35%	29%	0.06	0.47
Departmental - Strategic	26%	14%	0.01	0.65
Departmental - Tactical	30%	23%	0.02	0.66
Departmental - Operational	33%	20%	0.00	0.85
Project/Program - Strategic	28%	20%	0.06	0.46
Project/Program - Tactical	32%	29%	0.07	0.47
Project/Program - Operational	32%	23%	0.11	0.43

Furthermore, it is also seen in Table 37 that for PMO maturity:

- one of the nine PMO types have a large effect size (for department-operational);
- four of the nine PMO types have medium effect size (for enterprise-strategic, enterprise-tactical, department-strategic and department-tactical); and
- the remaining four PMO types have a small effect size.

Based on the results in Table 37, there does seem to be a significant difference between the answers for PM and PMO maturity for most of the PM knowledge areas and almost half of the PMO types. For the PM knowledge areas and PMO types that

have a significant difference between companies with and without a PMO, it is evident that the maturity levels are in general higher for companies with a PMO.

3.11.8 Ranking of PMO functionalities

In the international study conducted by Hobbs and Aubry (2007:82) of 500 PMOs, 27 PMO functionalities were ranked according to their importance. The PMO functionalities were also ranked according to the current PMO functionality maturity levels obtained in round 1. The rankings obtained from Hobbs and Aubry (2007:82) are compared with this study's current PMO maturity rankings in Table 38.

Table 38: Ranking of PMO functionalities by Hobbs and Aubry (2007:82) compared to survey current maturity status ranking.

PMO functionalities	Hobbs & Aubry		Enterprise	Departmental	Project - program
Report project status to upper management	83%	1	11	6	7
Develop and impliment a standard methodology	76%	2	6	7	6
Monitor and control project performance	65%	3	15	15	12
Develop competency of personnel, including training	65%	4	20	21	13
Impliment and operate a project information system	60%	5	14	11	10
Provide advice to upper management	60%	6	4	5	5
Coordinate between projects	59%	7	16	17	
Develop and maintain a project scoreboard	58%	8	17	18	8
Promote project management within organisation	55%	9	7	8	
Monitor and control performance of PMO	50%	10	24	26	19
Participate in strategic planning	49%	11	13	12	
Provide mentoring for project managers	49%	12	22	25	18
Manage one or more portfolios	49%	13	10	13	
Identify, select and prioritise new projects	48%	14	19	19	
Manage archives of project documentation	48%	15	3	2	1
Manage one or more programs	48%	16	2	3	4
Conduct project audits	45%	17	18	16	14
Manage customer interfaces	45%	18	12	14	15
Provide a set of tools without an effort to standardize	42%	19	1	1	2
Execute specialized tasks for project managers	42%	20	5	4	3
Allocate resources between projects	40%	21	8	10	9
Conduct post project reviews	38%	22	26	27	20
Impliment and manage database of lessons learned	34%	23	23	20	16
Impliment and manage risk database	29%	24	27	22	21
Benefits management	28%	25	9	9	11
Networking and environmental scanning	25%	26	21	23	17
Recruit, select, evaluate and determine salaries for project managers	22%	27	25	24	

From the current survey rankings it is evident that the following three PMO functionalities are ranked highest using the average of the enterprise, departmental and project-program rankings:

1. Provide a set of tools without an effort to standardise.
2. Manage archives or project documentation.

3. Manage one or more programs.

All three these PMO functionalities are ranked in the bottom half of the Hobbs and Aubry (2007:82) survey.

The rankings obtained from Hobbs and Aubry (2007:82) are compared with this study's required PMO maturity rankings in Table 39.

Table 39: Ranking of PMO functionalities by Hobbs and Aubry (2007:82) compared to survey required maturity status ranking.

PMO functionalities	Hobbs & Aubry		Enterprise	Departmental	Project - program
Report project status to upper management	83%	1	20	5	13
Develop and impliment a standard methodology	76%	2	22	22	5
Monitor and control project performance	65%	3	11	12	7
Develop competency of personnel, including training	65%	4	26	25	12
Impliment and operate a project information system	60%	5	7	7	15
Provide advice to upper management	60%	6	9	14	10
Coordinate between projects	59%	7	16	20	
Develop and maintain a project scoreboard	58%	8	5	11	4
Promote project management within organisation	55%	9	3	17	
Monitor and control performance of PMO	50%	10	27	24	19
Participate in strategic planning	49%	11	13	15	
Provide mentoring for project managers	49%	12	23	19	20
Manage one or more portfolios	49%	13	24	26	
Identify, select and prioritise new projects	48%	14	18	21	
Manage archives of project documentation	48%	15	4	2	6
Manage one or more programs	48%	16	1	4	2
Conduct project audits	45%	17	12	9	8
Manage customer interfaces	45%	18	21	16	17
Provide a set of tools without an effort to standardize	42%	19	2	1	3
Execute specialized tasks for project managers	42%	20	8	13	14
Allocate resources between projects	40%	21	6	3	16
Conduct post project reviews	38%	22	15	6	9
Impliment and manage database of lessons learned	34%	23	10	8	11
Impliment and manage risk database	29%	24	17	18	18
Benefits management	28%	25	14	10	1
Networking and environmental scanning	25%	26	25	23	21
Recruit, select, evaluate and determine salaries for project managers	22%	27	19	27	

From the required survey rankings it is evident that the following three PMO functionalities are ranked highest using the average of the enterprise, departmental and project-program rankings:

1. Provide a set of tools without an effort to standardise.
2. Manage one or more programs.
3. Manage archives or project documentation.

All three these PMO functionalities are ranked in the bottom half of the Hobbs and Aubry (2007:82) survey.

Furthermore, it is also evident in Table 38 and Table 39 that the ranking of the functions differ depending on the scope of the PMO. The PMO functions ranked according to the average ranking of the required maturity level of enterprise, departmental and program-project PMOs are listed in Table 40.

Table 40: Ranking of PMO functions by Hobbs and Aubry (2007:82) compared to survey average required maturity status ranking.

PMO functionalities	Hobbs & Aubry Percentages	Hobbs & Aubry rankings	Average required rankings	Average required percentages
Provide a set of tools without an effort to standardize	42%	19	1	70%
Manage one or more programs	48%	16	2	69%
Manage archives of project documentation	48%	15	3	68%
Develop and maintain a project scoreboard	58%	8	4	66%
Allocate resources between projects	40%	21	5	65%
Benefits management	28%	25	6	67%
Impliment and operate a project information system	60%	5	7	65%
Conduct project audits	45%	17	8	65%
Impliment and manage database of lessons learned	34%	23	9	64%
Monitor and control project performance	65%	3	10	64%
Promote project management within organisation	55%	9	11	63%
Conduct post project reviews	38%	22	12	65%
Provide advice to upper management	60%	6	13	64%
Execute specialized tasks for project managers	42%	20	14	64%
Report project status to upper management	83%	1	15	63%
Participate in strategic planning	49%	11	16	62%
Develop and impliment a standard methodology	76%	2	17	61%
Impliment and manage risk database	29%	24	18	60%
Coordinate between projects	59%	7	19	59%
Manage customer interfaces	45%	18	20	59%
Identify, select and prioritise new projects	48%	14	21	59%
Provide mentoring for project managers	49%	12	22	56%
Develop competency of personnel, including training	65%	4	23	57%
Networking and environmental scanning	25%	26	24	55%
Recruit, select, evaluate and determine salaries for project managers	22%	27	25	53%
Monitor and control performance of PMO	50%	10	26	54%
Manage one or more portfolios	49%	13	27	53%

The fact that reporting to management is the number one ranked function of the PMO in the Hobbs and Aubry (2007:82) survey and ranked much lower in this survey, may be attributed to the fact that in medium size organisations the PMO, PM and executive managers are involved with day-to-day operations to such an extent that dedicated reporting to management is not always perceived as important as it happens naturally in medium sized companies. Furthermore, it may also be that the important functions

for the PMO's in the Hobbs and Aubry (2007:82) survey were not representative of medium sized companies investigated in this study.

3.12 CHAPTER SUMMARY

The primary objective of this study was to determine the contribution that a PMO can make to deliver more projects that are consistently successful for a medium sized company in the consulting engineering industry in South Africa. This objective was supplemented by:

- Determining the current PM and PMO maturity levels.
- Determine what the selected group of respondents perceived as the required level of PM and PMO maturity levels in order to achieve more successful projects.
- Determine the relationship between PM and PMO maturity.

An empirical study was conducted by selecting a questionnaire for PM maturity and another for PMO maturity. These two questionnaires were then combined with a respondent demographic questionnaire into a single large questionnaire that was distributed to a total of 161 respondents in the first round of the survey. A response rate of 53% for the first survey round was achieved. From the 86 responses received in round 1, the average PM and PMO required maturity levels were determined with descriptive statistics. For round 2 of the survey, the survey only asked the respondents' perception of the required PM and PMO maturity required taking into consideration the average maturity levels from the group of respondents obtained in round 1. A response rate of 55% for the second survey round was achieved. The required maturity levels from round 1 and 2 were then evaluated in terms of whether some sort of a consensus was reached, to determine if the survey was to be conducted again. Sufficient consensus was achieved for the purposes of this study.

The majority of respondents (86%) had project management experience of more than 5 years, were in the mining and energy sectors (86% of respondents) of the consulting engineering industry, the majority (70%) worked within an ISO 9001 quality accredited company and worked within a medium sized company (66% of respondents).

The PM maturity questionnaire selected was confirmed (using a factor analysis) to effectively assess the PM maturity based on the nine PMBOK® knowledge areas. From the survey the current PM maturity was in general assessed to be on a structured process and standards level (level 2 out of a possible 5) by calculating the average of the average maturity level per company involved in the survey. The primary survey unit of measurement was the companies and not the individuals for the assessment of the PM and PMO maturities. The required PM maturity level was assessed to be on an organisational standard and institutional process level (level 3 out of a possible 5). None of the nine knowledge areas had a different maturity level than the average values calculated for the current and required PM maturity levels.

The PMO maturity questionnaire selected was confirmed (using a factor analysis) to effectively assess the PMO maturity for the three different scopes and approaches. From the survey the current PMO maturity level was assessed to be on a basic level, except for the enterprise-operational PMO that was on an intermediate level (34%). The required PMO maturity level was assessed to be on an intermediate level for all types of PMOs.

In terms of relationships there was a statistically significant relationship witnessed between the different types of PMO maturities and the average PM maturity. A statistically significant difference was witnessed between the current and required maturity levels. No significant difference between the M-Tech respondents and medium sized company respondents and the remaining group of respondents were witnessed. There were some evidence that ISO 9001 accredited companies showed a significant correlation with PM and PMO maturity levels. A larger number of PM and PMO maturity levels showed a statistically significant relationship with a company employing a PMO compared to the ISO 9001 relationship with PM and PMO maturity. The ranking of the PMO functionalities were determined and compared to an international study performed.

In the next chapter some conclusions will be discussed based on the findings obtained in this chapter.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

The aim of this study was to investigate the relationship between the project management (PM) maturity of a company and the possible contribution of an applicable project management office (PMO) towards repeated successful and sustainable project delivery in medium sized consulting engineering firms.

The background to this study, general objectives, research methodology and chapter layout was presented in chapter 1. Chapter 2 started off with a literature study of the main research elements and obtaining conclusions and results from similar empirical studies. Chapter 2 finished with a conclusion being drawn from the literature study relating to the study primary objective.

Chapter 3 provided a more complete discussion of the Delphi survey method used, the survey population and applicable information regarding the interpretation of the two existing maturity models selected. The interpretation of the empirical survey started with a brief discussion of the statistical methods used, followed by the discussion and interpretation of the empirical survey results.

In this final chapter the conclusion of the empirical study is discussed, starting with the suitability of the respondents to be considered as experts in terms of the Delphi survey method used. The results and conclusions regarding the current and required PM and PMO maturity levels obtained in the survey are then discussed. This is followed by an evaluation of this study according to the primary and secondary objectives defined in chapter 1, the limitations of the study and recommendations for future research.

The conclusion of the empirical study is presented next.

4.2 CONCLUSIONS OF THE EMPIRICAL STUDY

4.2.1 Respondent demographics

The demographic information collected in the survey included age, gender, industry sector, size of company, respondent current position, ISO 9001 status, project management (PM) qualifications, PM experience, typical size and duration of projects, whether a project management office (PMO) exists in the company and for how long, and whether the respondents have completed a maturity survey for PM or PMO before. From the descriptive statistics performed on the survey demographic results the following was determined:

- 30% of respondents are between the age of 30 to 35 years, 23% between the age of 35 and 40 years and 30% of respondents are older than 40 years. The age group distribution indicate a relative mature group of respondents that have a number of years working experience.
- The majority (91%) of the respondents are male, similar to the male-female ratio found in other studies performed and therefore seems to be an indicative representation of gender distribution in the engineering fraternity in South Africa.
- The respondents originated from 41 engineering companies in South Africa.
- The respondents in this survey work mainly in the mining and energy sector (86% of respondents).
- The majority of the respondents (66%) were from medium sized companies (i.e. consisting of 10 to 100 employees).
- More than half (51%) of the respondent positions can be directly related to PM and management in general.
- The majority of respondents (72%) work in a company that is ISO 9001 accredited.
- Only 17% of respondents has obtained formal PM certification or education.
- The majority (83%) of respondents has had previous project experience with 86% of the respondents with PM experience having more than 5 years PM experience.
- For the majority (60%) of respondents, projects ranged between R1M and R50M.
- Project completion period for the majority (64% of respondents) is within 2 years.

- The majority (65%) of the respondents taking part in the survey works for a company with a PMO.
- The most PMOs (55% of respondents) have been in existence for 1 to 3 years and only 26% have existed for more than 5 years. This is a similar PMO age distribution as was found in a large survey conducted internationally.
- Very few of the respondents have taken part in previous PM (8% of respondents) and PMO (3% of respondents) maturity surveys.

Taking the above into consideration it is safe to conclude that the group of respondents, from both M-Tech Industrial (the author's company) and other participating companies, can be considered as suitable "experts" in terms of PM and PMOs of medium sized consulting engineering companies operating in the energy and mining sector.

Since the respondents can in general be considered as experts, the Delphi sampling technique could be used to determine the PM and PMO maturity levels required to deliver more projects successfully and consistently based on the respondents' experience and perception of the maturity levels required.

4.2.2 PM maturity

The primary objective of the study was to determine the contribution of PMOs to successful project delivery using PM maturity as departure point.

The empirical results show that there is a definite difference in the current and required maturity levels for each of the identified knowledge areas and the respective knowledge area components. As a rule, a positive difference (current maturity is smaller than the required PM maturity) was observed. In terms of the calculated Cronbach's alpha, the internal consistency or average correlation between the variables and constructs or factors in the PM maturity questionnaire was found to be very reliable. It was furthermore indicated that for consulting engineering companies to produce more successful and consistent performance, the PM maturity needs to improve from the current maturity level to the required maturity level defined by the group of respondents. Based on the results and descriptive statistical analysis, the current PM maturity level in the consulting engineering industry is at a structured

process and standards level (level 2). The required maturity level from the survey was determined to be at an organisational standards and institutionalised process level (level 3) to achieve more successful project delivery consistently.

4.2.3 PMO maturity

One of the secondary objectives was to determine the current PMO maturity level and also the required PMO level which would ensure more consistent successful project delivery.

From the survey results it was indicated that there is a definite difference in the current and required maturity levels for each of the PMO scopes (enterprise, departmental and program-projects) and approaches (strategic, tactical and operational). As a rule, a positive difference (current maturity is smaller than the required PMO maturity) was observed. In terms of the calculated Cronbach's alpha, the internal consistency or average correlation between the variables and constructs or factors in the PMO maturity questionnaire was found to be very reliable. It was furthermore indicated that for consulting engineering companies to produce more successful and consistent performance, the PMO maturity needs to improve from the current maturity level to the required maturity level defined by the group of respondents.

Table 41: Current and required PMO maturity results of the survey.

Current		**SCOPE**		
		Enterprise	**Departmental**	**Program / Project**
Approach	**Strategic**	Basic **31%**	Basic **25%**	Basic **29%**
	Tactical	Basic **30%**	Basic **26%**	Basic **29%**
	Operational	Intermediate **34%**	Basic **27%**	Basic **32%**
Required Round 2		**SCOPE**		
		Enterprise	**Departmental**	**Program / Project**
Approach	**Strategic**	Intermediate **63%**	Intermediate **58%**	Intermediate **65%**
	Tactical	Intermediate **62%**	Intermediate **59%**	Intermediate **63%**
	Operational	Intermediate **62%**	Intermediate **64%**	Intermediate **63%**

From the empirical results it was seen that a small range of maturity percentages is seen across the scopes and approaches of the PMO [25% to 34% (basic to intermediate) for the current maturity and 58% to 65% (intermediate) for required PMO maturity] as shown in Table 41. The PMO required maturity level (58% to 65%) was very close to the starting limit of the advanced level (starting at 67%) indicating that a high intermediate maturity level is required.

4.2.4 Statistical relationships

From the statistical analysis assessments, the following statistical relationship results were found:

a) In general the standard deviation for round 2 of the survey decreased from round 1 and can be considered a sufficient indication that the group reached a consensus on the required PM and PMO maturity to contribute towards successful project delivery in the medium size consulting engineering industry.
b) A practically significant relationship exists between the average PM maturity and the nine types of PMO maturities when scope (enterprise, departmental and project-program) and approach (strategic, tactical and operational) combinations are considered.
c) A statistically significant difference exists between the current and required PM (for all nine knowledge areas) and PMO (for all the nine types of PMOs for all scope and approach combinations) maturity levels.
d) In general the maturity answers of the M-Tech respondents and those of the rest of the group of respondents showed no significant difference, except for the cost management PM knowledge area maturity.
e) In general the maturity answers of medium sized companies (10 to 100 employees) and those of the rest of the group of respondents showed no significant difference.
f) There does seem to be a significant difference between the answers for PM and PMO maturity (for 5 of the 9 knowledge areas) and some of the PMO types (3 of the nine combinations). For the PM knowledge areas and PMO types that have a significant difference between ISO 9001 accredited companies and those without accreditation, it is evident that the PM and PMO maturity levels are in general higher for companies working in an ISO 9001 accredited quality system.

g) There does seem to be a significant difference between the answers for PM and PMO maturity for most of the PM knowledge areas (6 of the 9 knowledge areas) and almost half of the PMO types (5 of the 9 combinations). For the PM knowledge areas and PMO types that have a significant difference between companies with and without a PMO, it is evident that the maturity levels are in general higher for companies with a PMO.

4.2.5 PMO function ranking

The 27 PMO functions, defined in a large survey of 500 PMO managers in Canada, USA and Europe (Hobbs & Aubry, 2007:82) which was included as part of the PMO maturity questionnaire, were ranked as functions of current and required PMO maturity levels. These functionalities were ranked in another survey (Hobbs & Aubry, 2007:82) and compared to the current survey rankings. In this survey it was seen that the top three functionalities according to the current and required PMO maturity levels were defined as follows:

- Provide a set of tools without an effort to standardise.
- Manage archives or project documentation.
- Manage one or more programs.

All three these PMO functionalities are ranked in the bottom half of the Hobbs and Aubry (2007:82) survey indicating that the PMO maturity for the current group of respondents in the consulting engineering industry differs from the PM survey conducted by Hobbs and Aubry. One possible explanation is that one cannot deduct PMO functionality ranking from the PMO maturity questionnaire, although the visual comparison of the PMO function ranking in this study also show good correlation with the Hobbs and Aubry survey on some of the other functions. Furthermore, the Hobbs & Aubry survey conducted in a wide range of industries and did not focus specifically on the consulting engineering industry amongst medium sized companies.

4.3 EVALUATION OF THIS STUDY

4.3.1 Secondary objective

The secondary objectives, as defined in chapter 1, are as follows:

a) Investigate the concepts of project management, project management maturity, project management office and successful project delivery from the literature.
b) Make use of a literature review to relate the concepts mentioned above to the consulting engineering industry.
c) Conceptualise the typical maturity level of a PMO based on structure, responsibility and function for medium sized organisations from the literature review.
d) Select a project management maturity measurement questionnaire from literature to measure the current level of project management maturity as well as the required level of project management maturity to deliver projects successfully in a medium sized consulting engineering company.
e) Select a project management office maturity measurement questionnaire from literature to measure the current level of PMO maturity as well as the required level of PMO maturity to deliver projects successfully in a in a medium sized consulting engineering company.
f) Identify one or more consulting engineering firm/s that are willing to participate in this study and gather information of the study elements by using the selected PM and PMO maturity questionnaires.
g) Determine if there is a relation between the level of PMO and PM maturity for medium sized consulting engineering organisations from both the literature and empirical study.

The secondary objectives a) to c) were achieved in the literature review (chapter 2) where the background, application and relations of different PM and PMO concepts were investigated and identified from open literature. Secondary objectives d) and e) were achieved with the selection of existing and standardised PM and PMO maturity models. Furthermore, the required level of PM and PMO maturity for medium sized consulting engineering companies were measured using the Delphi sampling method used typically for the determination of long term, future orientated concepts from a panel of experts. Secondary objective f) was achieved when the author's company was selected for the survey and 40 other companies of similar type and in the same industry sector contributed to the survey. The additional respondents were essential to determine a wider perception of what the required PM and PMO maturity should be to contribute towards successful project delivery. The inclusion of inputs from multiple

companies ensures that the survey results and conclusions are not just applicable to or representative of the author's company.

The last secondary objective was achieved in chapter 3 where statistical analysis was used to determine the relationship between PM and PMO maturity for medium sized companies. The relationship was determined with hierarchical linear modelling where the relationship within a company was taken into account and then the relationship amongst the respondent companies was also taken into account. The summary of the relationships is provided in section 3.12.

4.3.2 Primary objective

The primary objective as defined in chapter 1 was as follows:

a) Assess and identify how a PMO, for a medium sized consulting engineering company in South Africa (as selected by the researcher), can contribute to successful project delivery using project management maturity as starting point.

The primary objective was achieved in a multi round survey of respondents from 41 consulting engineering companies and engineering departments in large companies in the mining and energy sector. The majority of these companies were medium sized companies. The respondents defined the current PM and PMO maturity and also provided their view/perception of the required PM and PMO maturity to contribute to successful project delivery in medium sized consulting engineering companies. From the literature review and the survey results the following conclusions can be made:

- The literature showed that more mature project integration, scope, time, cost and human resource PM knowledge areas tend to deliver more successful projects. Project success, however, does not only depend on standardised procedures and standards implemented by a PMO.
- There are only a few PM standards in industry that can be applied generically to almost all projects from engineering to IT. However, there are a variety of opinions on and proposed standards for the centralised PMO. This seems to be attributed to the PMO being known as a dynamic (almost fragile) entity that evolves with the specific company it functions within and adapts to the company's needs. PMOs seem to differ based on each PMO specific scope.

- The success of a PMO depends on its ability to sense and adjust to its external and internal environment and according to its defined scope. The scope of a PMO therefore is specific to the company it is affiliated with and, as was seen from literature and comparing PMO maturity surveys to this study, the PMO maturity required varies between different companies and industries.
- The ranking of the functions of PMOs also differed between this study and another international survey conducted. This indicated that the variations in PMO scope and goals result in changes to the PMO structure and maturity level required.
- From the current survey, it is evident that a definite relationship between all the PMO maturity combinations/types and the nine PM knowledge areas exist.
- It was apparent from the literature and the survey that the maximum PM and PMO maturity levels are not always required to be able to deliver projects successfully.
- The contribution of the PMO to successful project delivery is highlighted by the differences between the objectives of a project manager and a PMO as follows (PMI, 2013:12):
    - The project manager focuses on the project objective where the PMO focuses on company, portfolio or programme scope changes that may improve the ability to reach the business objectives.
    - The project manager focuses on controlling the resources best to achieve the project objectives, whereas the PMO manages the optimal utilisation of shared resources across all projects. The PMO will therefore contribute by reducing the possible loss of revenue if work demand is such that more than the available resources are required and some resources can effectively be drawn temporarily from other projects with spare capacity or that is ahead of schedule.
    - The project manager manages the project constraints (time, cost, quality, etc.), whereas the PMO manages procedures, standards, business risks, metrics and interdependencies for the organisation as a whole.
- The PMO can contribute typically to assess the current and required PM maturity of a company, and develop an action plan to close any gaps identified.
- From the relationship analysis performed in this study it was seen that in general a company with a PMO with an average maturity ranging from basic to

intermediate (25% to 34%) tends to have more PM maturity. From the literature it was shown that increased PM maturity contributes to more successful projects being delivered.

- From the literature it was seen that successful project delivery differs for each project. However, based on the definition of success, a project can only be considered to be successful if the project target is achieved. Therefore a PMO defining the standardisation and procedures that assist and guide project managers to define the project target and consistently and systematically measure and adjust the project targets, will contribute towards successful project delivery.

The contribution the PMO can make towards the successful project delivery can be summarised/concluded from the literature and empirical study as follows:

- Continuous improvement of PM by implementing and communicating process improvements and customisations based on lessons learned to avoid previous mistakes and build on previous successes.
- PMO should be actively aware of changing needs within the company as well as the environment the company functions in to ensure that the PMO is aware of the company needs and adapts accordingly.
- Depending on the scope of the PMO (either enterprise, departmental or program-project), the PMO needs to work out a plan on how to reach an intermediate level of maturity for a PMO in terms of strategic, tactical and operational approach. For the enterprise-strategic approach, for example, and using the PMO maturity cube model on an intermediate level, the PMO should aim to fulfil the following functions:
    - PMO should be able to answer frequently asked questions by top management on its position on issues relating to making strategic decisions, although this process is not formally established (level 2 out of 3 in the questionnaire in Appendix E).
    - Identify and track interdependencies between the projects and programs of the organization, informing and triggering the managers of projects/ programs and stakeholders in case of need, rebalancing, and other changes (level 2 out of 3 in the questionnaire in Appendix E).

- Provide information on projects and programs of the organization (with analysis of the results expected of business and dependencies between projects and programs, risk and maturity of the portfolio) in a scoreboard, but this is not often used by senior management to support decision making (level 2 out of 3 in the questionnaire in Appendix E).
- Take actions to raise awareness of PM at all levels of the organization, including senior management. The PMO develops and publishes policies and guidelines for the management of projects in the organization (level 2 out of 3 in the questionnaire in Appendix E).
- Formally ask its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers (between a level 2 and 3 out of 4 in the questionnaire in Appendix E).
- Informally and regularly participate in the strategic planning process of the organization (level 2 out of 3 in the questionnaire in Appendix E).
- Maintain a list of active projects and portfolios, prioritize them throughout the organization, and establish formal processes, acting as facilitator in the definition (identification, categorization, evaluation, selection), development (prioritize, balance and commitment) and implementation (monitoring, review and change management) of the portfolio if required (between a level 2 and 3 out of 4 in the questionnaire in Appendix E).
- Identify, select and prioritize new projects and programs throughout the organization based on criteria, but without a clear and precise relationship between the strategic goals and the existing portfolio (level 2 out of 3 in the questionnaire in Appendix E).
- Monitor the achievement of expected benefits for each project/program of the organization only during its execution, evaluating the results and comparing them with the original strategic goals of the project/program (level 1 out of 2 in the questionnaire in Appendix E).
- Identify the stakeholders of the organization's portfolio and take actions to develop a strategy for stakeholder management (level 1 out of 2 in the questionnaire in Appendix E).

- The functions listed above are applicable for an enterprise-strategic PMO on an intermediate maturity level (63% according to survey findings summarised in

Table 41). By systematically using the required maturity levels summarised in Table 41, the PMO in the consulting engineering industry can identify what functions it needs to fulfil to reach the required maturity level.

- For a start the PMO can only focus on the top three functions of a PMO identified in the survey that relate to:
    - Providing a set of tools without an effort to standardise.
    - Managing one or more programs.
    - Managing archives or project documentation.

The 27 functions of a PMO all contribute towards assisting and enabling better PM, since PM is defined as making use of skill, knowledge, tools and procedures to achieve project goals. In the process the PMO contributes towards delivering more successful projects.

4.4 LIMITATIONS OF THIS STUDY

During the study the following limitations were identified:

- The PM maturity survey employed in the study made use of PMBOK®4 and not the more recent PMBOK®5 where 10 instead of 9 knowledge areas are defined.
- For the majority of the companies only a single resource participated in the survey. For a better representation of each company, more respondents from other companies would have allowed more statistical analysis to be done. Another option would have been to contact only the PMO managers of companies and request them to sample within their own companies. Then the results from the PMO managers in consultation with their company resources could be compared and used in the statistical analysis.
- The combination of the PM and PMO questionnaires made the questionnaire extremely long. This may have lead to some respondents not completing the survey or not applying the attention to the survey it required.
- The selection method of the respondents is not probabilistic of nature and therefore does not provide a representative distribution from the medium sized consulting engineering companies in South Africa. This study and the resulting conclusions are therefore only applicable to medium sized consulting

engineering companies in the mining and energy sector, similar to the author's company.

4.5 RECOMMENDATIONS FOR FUTURE RESEARCH

This study presented explorative research regarding the contribution a PMO can make towards the consistent successful project delivery in medium sized consulting engineering companies in South Africa.

The concepts of PM, PMO, maturity models for PM and PMOs and the concept of successful project delivery was investigated in the literature study and explored further in the empirical study and analysis. From the literature study, the survey results and the limitations identified, the following recommendations for future research are made to add to the current knowledge regarding the contribution a PMO can make towards successful project delivery in the consulting engineering industry:

- Obtain a more probabilistic sample of the medium size consulting engineering industry. This would shed light on whether companies in the transport and water sectors for example have the same opinion of the required PM and PMO maturity as obtained in this study for consulting engineers. Furthermore, expand this study to be representative of the complete consulting engineering industry of SA instead of mostly the mining and energy sector.
- Investigate possible reasons why a highest level maturity for PM and PMO is not required. This may be due to constraints such as the cost involved, lack of resources, lack of PM and PMO knowledge and education, being impractical or even as simple as being unnecessary to pursue the highest level of maturity to achieve the goal of consulting engineering companies.
- Another suggestion is to split this questionnaire into a separate PM maturity questionnaire and another for PMO maturity and identify the link between the two questionnaires and project success as defined by the respondents in two different studies, still aiming at the consulting engineering companies in SA.
- Investigate whether the existence of any PMO in a company will automatically result in improved PM maturity or if it will also be influenced by:
    - the size of the company (number of employees);
    - the average PMO age;

    - the industry sector involved;
    - the size of the PMO (number of PMO employees);
    - size and duration of projects managed; or
    - some other factor not identified in this study.
- Identify the PMO function ranking in the consulting engineering industry in SA and try to identify if the function ranking can be related to the current PMO maturity of the respondents by using the PMO maturity cube model used in this study.
- Investigate if there is a minimum consulting engineering company size that still justifies the existence of a PMO. Furthermore, this study can investigate whether some of the PMO functions are then adopted by senior and executive members of such smaller companies where a separate PMO department is not justified.

4.6 CHAPTER SUMMARY

In this concluding chapter of the study the interpretation of the literature study and the empirical study is made and summarised.

The demographic information of the respondents indicated that the survey respondents may be considered experts to such an extent that they can provide the required PM and PMO maturity levels based on their experience and exposure to medium sized consulting engineering projects, PM and PMO's. It was seen that the respondents' experience corresponded very close to the profile found in similar or related studies.

From the literature it was seen that consulting engineering companies operate in a dynamic environment managing a variety of projects in varying stages of a project lifecycle simultaneously. Project teams therefore do not have the time or the requirement/scope to transfer their knowledge gained and experience to other resources on other project teams except for the small range of influence within the new project team formed.

Project management (PM) makes use of expertise, knowledge, tools and processes to achieve the project goals. From literature it was seen that PM is based on a number of knowledge areas that contributes to a project to be delivered successfully. Each

project is unique and the knowledge area maturity required normally differ between projects. Respondents in the empirical study for medium consulting engineering companies reached consensus that the maturity of PM should increase one level to ensure that more projects are delivered successfully and consistently.

The PMO is a central business unit that, depending on its scope, has the goal to improve the effective delivery of a project or all projects executed by a company. The approach of a PMO can be strategic, tactical and/or operational of nature. From the literature it was seen that a PMO is dynamic and evolves with the company it functions in. For a PMO to be successful, it needs to adapt according to the continuously changing company needs and environment. From the empirical study it was also seen that the PMO level needs to increase a fraction in order to achieve consistent and successful project delivery. A definite relation between the PM maturity and the PMO maturity was confirmed both in the literature and the empirical study.

The PMO contribution towards improved successful project delivery can be summarised as follows:

- PMO should be agile and adaptable based on the needs of the company and environment.
- The PMO systematically and continuously:
    - improves the skills required of project managers;
    - transfers the applicable knowledge from previous lessons learned;
    - creates, maintains and educates project teams on the tools needed to manage a project; and
    - standardises and improves the PM procedures to enable the team to effectively reach each project's and collaboratively the company goals. This is done base on lessons learned and best practice in industry.
- To be effective in delivering successful projects, the PMO should determine the current PM maturity of the company and what is required for typical projects the company or industry is involved in, and then manage the gap identified.
- The existence of a PMO that is as mature as required by the nature of the projects executed by the company will automatically improve the general PM maturity. This should generally have a knock-on effect of more consistent and successful project delivery.

Although some limitations of the study and further research suggestions were made, the study was deemed successful as the aim of the study (primary and secondary objectives) was achieved through a literature study, empirical study and statistical analysis of the survey results.

This study and this chapter is concluded by confirming that all the primary and secondary objectives were achieved, identifying some of the study limitations and suggesting future research concepts.

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APPENDIX A:

ROUND 1 QUESTIONNAIRE SECTION 1 - QUESTIONNAIRE INSTRUCTIONS

The project management maturity and project management office maturity questionnaire made use of the following instructions page to instruct the respondents on how to complete the different sections of the questionnaire.

The contribution of the Project Management Office (PMO) to project delivery in the consulting engineering industry

Thank you for taking the time to participate in this survey. This page contains all the instructions on how to complete the survey as well as additional information.
Even though the survey contains personal questions, the answers will not be disclosed at any time to any respondents. The information is merely to determine a spread of the respondents.

Why should you complete the Survey?
You are not only assisting me to complete my degree, you will also be part of the group of experts that will be setting the benchmark for project management and project management office (PMO) maturity required in the consulting engineering industry.

The research is done in two rounds of the same survey. In the first survey round the current maturity of project management and the project management office is evaluated as well as the required maturity to complete more projects successfully consistently in the consulting engineering industry. After the first survey round you will receive the results from the current level of maturity in the consulting engineering industry. (No company or personal information will be disclosed, only the average results)

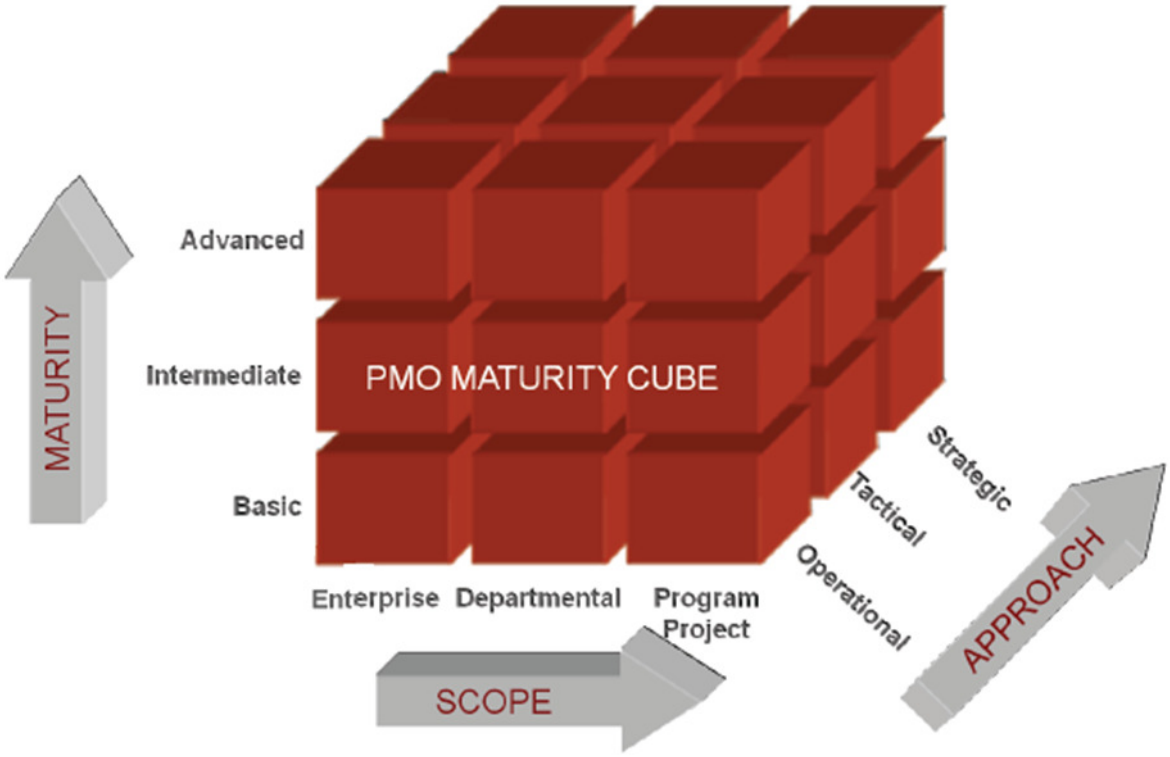
In the second survey round the required maturity of project management and project management office will be re-evaluated with respondents given the results of the group of respondents' perception of the required maturity from the first survey round. After the second survey round you will receive, what the group of experts believe to be, the required level of project management and PMO maturity in the consulting engineering industry to be competitive and deliver more successful projects. This information can then be used to benchmark your organisation and to determine in which areas change needs to take place.

How much of your time will this take?
The first survey round will take approximately 30 to 45 minutes, depending on your previous experience with maturity models and the Project Management Body of Knowledge (PMBOK® 4). The second survey round should take approximately 15minutes.

Background
To stay competitive in today's market, companies need to systematically measure, monitor and continuously improve their service delivery. The consulting engineering industry is defined as a professional service that provides independent expertise in engineering, science and related areas to governments, industries, developers and construction firms. The nature of the consulting engineering industry requires of firms to execute multiple projects at different stages of completion simultaneously in a dynamically changing environment. Project management is an integrated part of consulting engineering companies that typically manage a whole portfolio of projects simultaneously.

Project Management Maturity
Maturity is generally defined as a very advanced or developed form or state. Organisational maturity evaluation models have the objective to provide a structured systematic approach based on industry best practise to guide the maturity process and continuous improvement. The Project Management maturity in this questionnaire will be assessed at the hand of the nine PMBOK® knowledge areas as summarised in Section/Tab 3. PMMM.

Project Management Office (PMO) maturity
The PMO is typically a centralised division that implements project management (PM) procedures and provides support in the form of applying PM tools and techniques effectively. The project management office is also known by the name program management office, project office, program office, project support office, etc. The development of different levels/maturity of Project Management Office (PMO) is intended to follow an incremental evolution from a low level to an advanced level model.



In this specific questionnaire for each scope, the model identifies which services are offered under each different approach and will determine the level of sophistication/maturity of their implementation. For the approach the following definitions apply:
Strategic: Deliver service that are related to organisation strategy such as how to manage a portfolio of projects and programs, decision making information provision to top management, monitor and implement strategy, prioritise projects, etc.
Tactical/directional: Supply service for a group of projects or individuals such as cultivating a project management methodology, developing project management tools, offering training for managers and teams, etc.
Operational/support: Provides service to a project or individual such as supporting project planning and control, coaching/mentoring, managing a strategic project, recovering a troubled project, etc.

The scope of a PMO is summarised on three levels determined by how far reaching the PMO actions are within the organisation:
Project/program: Covers only one project or program within the organisation.
Departmental: Covers only part or area of the organisation.
Enterprise/Corporate: Covers the organisation as a whole.

How to complete the survey?

This survey consists of 5 sections/tabs:
1) Survey instructions - This section is where you are currently reading the guidelines on how to complete the survey.

2) Respondent information - This sections contains a number of general questions regarding the respondent. This information is required to be able to determin the distribution of respondents that participated in the survey. None of this information disclosed on this page will be disclosed to the other respondents or organisations.

3) PM solutions' Project Management Maturity Model

4) The project management maturity model questions are based on the nine knowledge areas of the PMBOK® 4. Each of the nine knowledge areas has been divided into key components for which a level of maturity (Level 1 to 5) must be assigned. Before a knowledge area is completed, refer to section 4 to determine what is required to be classified as a certain level of maturity. Example: To be rated as a level 3 for key component Scope definition under the knowledge are Project Scope Management, the organisation must fulfil all the requirements of level 1, 2 and 3.

Both the current state of project management maturity for your organisation as well as what you consider to be the ideal level of maturity for the consultation engineering industry to deliver successful, sustainable projects should be rated.

5) PMO maturity questionnaire. Each of the three questionnaires (enterprise, departmental, and program-project) is divided into three parts: assessment of strategic services, assessment of tactical services, and assessment of operational services. The 27 typical functions of a PMO is evaluated from both a scope and approach perspective in these questionnaires. When completing the questionnaire, participants provide information about their current level of maturity in each service provided for that particular scope. The target level of maturity required for the PMO in the consulting engineering industry to provide consistent and successful project delivery is also evaluated. Please note that not all questions in the PMO maturity model offer the option of a level 4.

APPENDIX B:

ROUND 1 QUESTIONNAIRE SECTION 2 - RESPONDENT DEMOGRAPHIC INFORMATION

The contribution of the Project Management Office (PMO) to project delivery in the consulting engineering industry

Age	
Sex	
Majority of projects performed in which industry	
If "Other" please specify	
Number of people employed in company	
Is your company ISO 9001:2008 accredited	
Current position	
If "Other" please specify	
Do you have a project management certificate?	
If yes please specify	
Do you have any project management experience?	
If "Yes" please indicate number of years experience.	
Indicate the average size of the projects executed by the organisation.	
Indicate average duration of projects organisation were involved in.	
Does your company have a Project Management Office?	
If "Yes" please indicate number of years PMO have been active.	
Have you previously completed a project management maturity assessment?	
Have you previously completed a project PMO maturity assessment?	

APPENDIX C:

ROUND 1 QUESTIONNAIRE SECTION 3 - PROJECT MANAGEMENT MATURITY MODEL (PMMM) KEY

PM Solutions
The Project Management Experts®

Project Management Maturity Model

Levels of Project Management Maturity	Level 1 Initial Process	Level 2 Structured Process and Standards	Level 3 Organizational Standards and Institutionalized Process	Level 4 Managed Process	Level 5 Optimized Process
Project Integration Management	No established practices, standards, or Project Office. Work performed in ad hoc fashion.	Basic, documented processes for project planning and reporting. Management only involved on high-visibility projects.	Project integration efforts institutionalized with procedures and standards. Project Office beginning to integrate project data.	Processes/standards utilized by all projects and integrated with other corporate processes/systems. Decisions based on performance metrics.	Project integration improvement procedures utilized. Lessons learned regularly examined and used to improve documented processes.
Project Scope Management	General statement of business requirements. Little/no scope management or documentation. Management aware of key milestones only.	Basic scope management process in place. Scope management techniques regularly applied on larger, more visible projects.	Full project management process documented and utilized by most projects. Stakeholders actively participating in scope decisions.	Project management processes used on all projects. Projects managed and evaluated in light of other projects.	Effectiveness and efficiency metrics drive project scope decisions by appropriate levels of management. Focus on high utilization of value.
Project Time Management	No established planning or scheduling standards. Lack of documentation makes it difficult to achieve repeatable project success.	Basic processes exist but not required for planning and scheduling. Standard scheduling approaches utilized for large, visible projects.	Time management processes documented and utilized by most projects. Organization wide integration includes inter-project dependencies.	Time management utilizes historical data to forecast future performance. Management decisions based on efficiency and effectiveness metrics.	Improvement procedures utilized for time management processes. Lessons learned are examined and used to improve documented processes.
Project Cost Management	No established practices or standards. Cost process documentation is ad hoc and individual project teams follow informal practices.	Processes exist for cost estimating, reporting, and performance measurement. Cost management processes are used for large, visible projects.	Cost processes are organizational standard and utilized by most projects. Costs are fully integrated into project office resource library.	Cost planning and tracking integrated with Project Office, financial, and human resources systems. Standards tied to corporate processes.	Lessons learned improve documented processes. Management actively uses efficiency and effectiveness metrics for decision-making.
Project Quality Management	No established project quality practices or standards. Management is considering how they should define "quality."	Basic organizational project quality policy has been adopted. Management encourages quality policy application on large, visible projects.	Quality process is well documented and an organizational standard. Management involved in quality oversight for most projects.	All projects required to use quality planning standard processes. The Project Office coordinates quality standards and assurance.	The quality process includes guidelines for feeding improvements back into the process. Metrics are key to product quality decisions.
Project Human Resource Management	No repeatable process applied to planning and staffing projects. Project teams are ad hoc. Human resource time and cost is not measured.	Repeatable process in place that defines how to plan and manage the human resources. Resource tracking for highly visible projects only.	Most projects follow established resource management process. Professional development program establishes project management career path.	Resource forecasts used for project planning and prioritization. Project team performance measured and integrated with career development.	Process engages teams to document project lessons learned. Improvements are incorporated into human resources management process.
Project Communications Management	There is an ad hoc communications process in place whereby projects are expected to provide informal status to management.	Basic process is established. Large, highly visible projects follow the process and provide progress reporting for triple constraints.	Active involvement by management for project performance reviews. Most projects are executing a formal project communications plan.	Communications management plan is required for all projects. Communications plans are integrated into corporate communications structure.	An improvement process is in place to continuously improve project communications management. Lessons learned are captured and incorporated.
Project Risk Management	No established practices or standards in place. Documentation is minimal and results are not shared. Risk response is reactive.	Processes are documented and utilized for large projects. Management consistently involved with risks on large, visible projects.	Risk management processes are utilized for most projects. Metrics are used to support risk decisions at the project and the program levels.	Management is actively engaged in organization-wide risk management. Risk systems are fully integrated with time, cost, and resource systems.	Improvement processes are utilized to ensure projects are continually measured and managed against value-based performance metrics.
Project Procurement/ Vendor Management	No project procurement process in place. Methods are ad hoc. Contracts managed at a final delivery level.	Basic process documented for procurement of goods and services. Procurement process mostly utilized by large or highly visible projects.	Process an organizational standard and used by most projects. Project team and purchasing department integrated in the procurement process.	Make/buy decisions are made with an organizational perspective. Vendor is integrated into the organization's project management mechanisms.	Procurement process reviewed periodically. On-going process improvements focus on procurement efficiency and effective metrics.

APPENDIX D:

ROUND 1 QUESTIONNAIRE SECTION 4 - PROJECT MANAGEMENT MATURITY MODEL (PMMM)

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

	Current Project Management Maturity Level					Project Management Maturity Required in Consulting Engineering Industry				
	1	2	3	4	5	1	2	3	4	5
	Section not complete yet					Section not complete yet				
Project Integration Management	Sub-section not complete yet					Sub-section not complete yet				
Project Plan Development	0	0	0	0	0	0	0	0	0	0
Project Plan Execution	0	0	0	0	0	0	0	0	0	0
Change Control	0	0	0	0	0	0	0	0	0	0
Project Information System	0	0	0	0	0	0	0	0	0	0
Project Office	0	0	0	0	0	0	0	0	0	0
Project Scope Management	Sub-section not complete yet					Sub-section not complete yet				
Requirements Definition (Business)	0	0	0	0	0	0	0	0	0	0
Requirements Definition (Technical)	0	0	0	0	0	0	0	0	0	0
Deliverables identification	0	0	0	0	0	0	0	0	0	0
Scope Definition	0	0	0	0	0	0	0	0	0	0
Work Breakdown Structure	0	0	0	0	0	0	0	0	0	0
Scope Change Control	0	0	0	0	0	0	0	0	0	0
Project Time Management	Sub-section not complete yet					Sub-section not complete yet				
Activity Definition	0	0	0	0	0	0	0	0	0	0
Activity Sequencing	0	0	0	0	0	0	0	0	0	0
Schedule Development	0	0	0	0	0	0	0	0	0	0
Schedule Control	0	0	0	0	0	0	0	0	0	0
Schedule Integration	0	0	0	0	0	0	0	0	0	0
Project Cost Management	Sub-section not complete yet					Sub-section not complete yet				
Resource Planning	0	0	0	0	0	0	0	0	0	0
Cost Estimating	0	0	0	0	0	0	0	0	0	0
Cost Budgeting	0	0	0	0	0	0	0	0	0	0
Performance Measurement	0	0	0	0	0	0	0	0	0	0
Cost control	0	0	0	0	0	0	0	0	0	0

Project Quality Management	Sub-section not complete yet						Sub-section not complete yet				
Quality Planning	0	0	0	0	0		0	0	0	0	0
Quality Assurance	0	0	0	0	0		0	0	0	0	0
Quality Control	0	0	0	0	0		0	0	0	0	0
Management Oversight	0	0	0	0	0		0	0	0	0	0
Project Human Resource Management	Sub-section not complete yet						Sub-section not complete yet				
Organisational Planning	0	0	0	0	0		0	0	0	0	0
Staff Acquisition	0	0	0	0	0		0	0	0	0	0
Team Development	0	0	0	0	0		0	0	0	0	0
Professional Development	0	0	0	0	0		0	0	0	0	0
Project Communications Management	Sub-section not complete yet						Sub-section not complete yet				
Planning	0	0	0	0	0		0	0	0	0	0
Information Distribution	0	0	0	0	0		0	0	0	0	0
Performance Reporting	0	0	0	0	0		0	0	0	0	0
Issues Tracking and Management	0	0	0	0	0		0	0	0	0	0
Project Risk Management	Sub-section not complete yet						Sub-section not complete yet				
Risk identification	0	0	0	0	0		0	0	0	0	0
Risk Quantification	0	0	0	0	0		0	0	0	0	0
Risk Response Development	0	0	0	0	0		0	0	0	0	0
Risk Control	0	0	0	0	0		0	0	0	0	0
Risk Documentation	0	0	0	0	0		0	0	0	0	0
Project Procurement Management	Sub-section not complete yet						Sub-section not complete yet				
Procurement Planning	0	0	0	0	0		0	0	0	0	0
Requisition	0	0	0	0	0		0	0	0	0	0
Solicitation/Source Control	0	0	0	0	0		0	0	0	0	0
Contract Management/Closure	0	0	0	0	0		0	0	0	0	0

APPENDIX E:

ROUND 1 QUESTIONNAIRE SECTION 5 - PROJECT MANAGEMENT OFFICE MATURITY MODEL FOR ENTERPRISE SCOPE

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
Strategic	**How does the PMO provide advice to the senior management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO is asked by top management to give its position on issues relating to making strategic decision once in a while. Level 2 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision, however, its involvement is not formally established. Level 3 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision and its involvement is formally established.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO coordinate and integrate the organisation's portfolio?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies interdependencies between the projects and programs of the organization, but it does not keep track of the changes in interdependencies. Level 2 - The PMO identifies and tracks interdependencies between the projects and programs of the organization, informing and triggering the managers of project /programs and stakeholders in case of need, rebalancing, and other changes. Level 3 - The PMO identifies and tracks interdependencies between the projects and programs of the organization, acting proactively to ensure the realization of the portfolio and providing preventive and corrective actions as required.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO develop and maintain a strategic framework of projects and programs (Scoreboard)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides information on projects and programs of the organization, but these are limited to a view on each individual project, with no analysis of the results expected of business and dependencies between projects and programs, risk and deadlines of the portfolio. Level 2 - The PMO provides information on projects and programs of the organization (with analysis of the results expected of business and dependencies between projects and programs, risk and maturity of the portfolio) in a scoreboard, but this is not often used by senior management to support decision making. Level 3 - The PMO provides information on projects and programs of the organization (with analysis of the results expected of business and dependencies between projects and programs, risk and maturity of the portfolio) in a scoreboard, but this is regularly used by senior management to support decision making.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO promote project management awareness in the organisation?** Level 0 - The PMO does not perform this function. Level 1 - The PMO raises awareness of Project Management to the intermediate level of organization, including mid-level managers. Level 2 - The PMO takes actions to raise awareness of Project Management at all levels of the organization, including senior management. The PMO develops and publishes policies and guidelines for the management of projects in the organization.	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	Level 3 - The PMO establishes and implements a structured plan to promote Project Management at all levels of the organization. The PMO reviews and improves policies and guidelines for project management in the organization.											
Strategic	**How does the PMO monitor and control its own performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO informally asks its customers to feedback on its performance. Level 2 - The PMO formally ask its customers for feedback on its performance. Level 3 - The PMO formally asks its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. Level 4 - The PMO formally ask its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. In addition, the PMO shares goals with its customers and structures itself to promote continuous improvement and increases in its maturity, assessing the need for removal, maintenance, or creation of new services.	0	0	0	0	0		0	0	0	0	0
Strategic	**How does the PMO participate in the strategic planning process?** Level 0 - The PMO does not perform this function. Level 1 - The PMO informally and occasionally participates in the strategic planning process of the organization. Level 2 - The PMO informally and regularly participates in the strategic planning process of the organization. Level 3 - The PMO formally and regularly participates in the strategic planning process of the organization.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO manage one or more Portfolios?** Level 0 - The PMO does not perform this function. Level 1 - The PMO maintains a list of active projects throughout the organization. Level 2 - The PMO maintains a list of active projects and programs throughout the organization and establishes their prioritization but does not follow a structured portfolio management process. Level 3 - The PMO maintains a list of active projects and portfolios, prioritizes them throughout the organization, and establishes formal processes, acting as facilitator in the definition (identification, categorization, evaluation, selection), development (prioritize, balance and commitment) and implementation (monitoring, review and change management) of the portfolio. Level 4 - The PMO maintains a list of active projects and portfolios, prioritizes them throughout the organization, and establishes formal processes, acting as facilitator in the definition (identification, categorization, evaluation, selection), development (prioritize, balance, and commitment) and implementation (monitoring, review, and change management) of the portfolio. The PMO uses an integrated system to automate the organization's portfolio management process.	0	0	0	0	0		0	0	0	0	0
Strategic	**How does the PMO identify, select and prioritise new projects and programs?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies, selects, and prioritizes new projects and programs throughout the organization without defined criteria and without a relationship between strategic goals and the existing portfolio. Level 2 - The PMO identifies, selects and prioritizes new projects and programs throughout the organization based on criteria, but without a clear and precise relationship between the strategic goals and the existing portfolio.	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	Level 3 - The PMO provides the entire organization with a formal process of identification, selection and prioritization of new projects and programs based on categories and pre-established criteria.											
Strategic	**How does the PMO manage the benefits of the projects and programs?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors the achievement of expected benefits for each project/program of the organization only during its execution, evaluating the results comparing them with the original strategic goals of the project/program. Level 2 - The PMO monitors the achievement of expected benefits for each project/program of the organization during its execution and after closure evaluating the results and comparing them with the original strategic goals of the project/program.	0	0	0				0	0	0		
Strategic	**How does the PMO map the relationships and environment of projects and programs in and out of the organisation?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies the stakeholders of the organization's portfolio and takes actions to develop a strategy for stakeholder management. Level 2 - The PMO identifies the stakeholders of the organization's portfolio, analyzes their expectations, establishes a strategy to manage relationships and proactively works to implement it. Besides, the PMO looks for benchmarking in project management with other organizations.	0	0	0				0	0	0		
Tactical	**How does the PMO develop and implement the project management methodology?** Level 0 - The PMO does not perform this function. Level 1 - The PMO has developed a basic methodology for the organization, but it is not used consistently on all projects. Level 2 - The PMO has developed a standard methodology for the organization, aligning possible existing methodologies in different areas, and the methodology used in most projects in the organization. Level 3 - The PMO has developed a standard methodology for the organization, and it is used by all projects as it is mandatory unless a specific waiver is requested and approved. Level 4 - The PMO has developed and improved the standard methodology for the organization focusing on best practices and continuous improvement.	0	0	0	0	0		0	0	0	0	0
Tactical	**How does the PMO develop skills in project management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO responds reactively to the organization's project management training needs. Level 2 - The PMO proposes project management training for the entire organization. Level 3 - The PMO establishes a plan for developing skills in project management throughout the organization, including training, certification, and graduate courses. Level 4 - The PMO establishes a specific career path in project management for the entire organization, supported by a plan for corporate development of project management knowledge, skills, and competencies, which includes training, certification and graduate courses.	0	0	0	0	0		0	0	0	0	0
Tactical	**How does PMO implement and manage project information systems?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides a project management information system for use throughout the organization, focusing on monitoring and control, which is used by managers of project /programs and stakeholders in	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	most projects/programs of the organization, but this system does not use an integrated database. Level 2 - The PMO provides a project management information system for use throughout the organization, focusing on monitoring and control, which is used by managers of projects/programs and stakeholders in most projects/programs of the organization with an integrated database. Level 3 - The PMO provides a project management information system for use throughout the organization, focusing on monitoring and control, which is effectively used by managers of projects /programs and stakeholders in all projects/programs of the organization with an integrated database.											
Tactical	**How does PMO manage interfaces with customers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors the progress of projects and programs of the organization but is not involved with customer relationship management. Level 2 - The PMO evaluates customer satisfaction, but does not directly interface with the customers of the organization's projects and programs. Level 3 - The PMO is responsible for customer relationship management of all the organization's projects and programs.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO provide a set of tools for project management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides tools for use in the organization but they are not standardized and integrated. Level 2 - The PMO provides tools, available for all organization, that are standardized and integrated to existing processes and methodologies, but the tools are not used in most cases to their fullest extent. Level 3 - The PMO provides tools, available for all organization, that are standardized and integrated to existing processes and methodologies, and the tools are fully used on most projects and programs.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO allocate and share resources between projects?** Level 0 - The PMO does not perform this function. Level 1 - PMO operates in a reactive form in allocating and sharing resources between projects throughout the organization. Level 2 - The PMO recognizes the importance of a resource pool, but lacks authority to allocate or share resources between projects in the organization. Level 3 - The PMO has established a resource pool and has the authority to allocate and share resources between projects in the organization.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the lessons learned database?** Level 0 - The PMO does not perform this function. Level 1 - The PMO stores the lessons learned from projects but does so in an unstructured way. Level 2 - The PMO consolidates the lessons learned from projects of the organization and has set up a database for them. Level 3 - In addition, the PMO implements and disseminates a system with a single point of entry to retrieve lessons learned from projects throughout the organization.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the risk database?** Level 0 - The PMO does not perform this function. Level 1 - The PMO has set up a risk database. Level 2 - The PMO uses a risk breakdown structure and consolidates the risks managed in each project in the organization using a risk database. Level 3 - In addition, the PMO is able to use the lessons learned	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	database to access risks from other projects in the organization.											
Tactical	**How does the PMO select, manage and evaluate project managers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO recruits, selects, evaluates, and determines salaries of project managers as requested. Level 2 - The PMO establishes criteria for use in the entire organization for recruiting, selecting, and evaluating project managers. Level 3 - In addition, the PMO establishes a career path for project managers and determines the salary structure at each level.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide specialised services for the project manager?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides the project managers with basic project management support such as: preparing documentation, preparing of schedules, and facilitating meetings. Level 2 - The PMO provides project managers advanced services and support such as: risk analysis, development and management of contracts, and project recovery.	0	0	0				0	0	0		
Operational	**How does the PMO provide information to the senior management of the status of projects that are under way?** Level 0 - The PMO does not perform this function. Level 1 - The PMO collects status information, prepares reports and distributes them to senior management/sponsors but is not responsible for analysis nor does it take corrective action based on data in the reports. Level 2 - The PMO receives status information, analyzes it and provides reports to senior management/sponsors and informs them if there are specific problems in which their assistance is needed. Level 3 - The PMO receives status information, analyzes it, and provides reports to senior management/sponsors of the organization, informs them if there are problems and assists them in resolving problems as requested.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO monitor and control project/program performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors and controls the project/program performance considering time, cost, quality and customer satisfaction, and provides follow-up reports without analysis upon request. Level 2 - The PMO monitors and controls the performance of projects/programs considering time, cost, quality, and customer satisfaction and analyzes the available data. Level 3 - The PMO monitors and controls the performance of projects/programs considering time, cost, quality and customer satisfaction, analyzes data, and takes preventive and corrective actions working proactively with project/ program managers and senior management.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide mentoring for the project managers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides mentoring throughout the organization when requested. The mentoring involves supporting project planning and control and transferring technical knowledge to the project manager or to his or her team. Level 2 - The PMO identifies needs and proactively provides mentoring throughout the organization. The mentoring involves supporting project planning and control, to transfer technical knowledge to the project manager or to his or her team. Level 3 - The PMO identifies needs and proactively provides mentoring throughout the organization. The mentoring involves supporting project	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Enterprise

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	planning and control, transferring technical knowledge to the project manager or his or her team, and assisting them with the development or enhancement of interpersonal skills.											
Operational	**How does the PMO manage and collect project files and documentation?** Level 0 - The PMO does not perform this function. Level 1 - The PMO captures and stores documents for projects across the organization, without specific analysis and information retrieval; few people use available data. Level 2 - The PMO captures and stores documents for projects across the organization, without specific analysis and information retrieval but provides guidance to individuals who wish to use these documents. Level 3 - The PMO has a structured process with the goal of capturing and storing documents for projects across the organization, analyzing the quality of documentation and providing mechanisms for users to locate needed information.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO manage one or more programs or projects?** Level 0 - The PMO does not perform this function. Level 1 - The PMO assists managers on occasion but does not have a methodology in place or tools to use. Level 2 - The PMO provides assistance to project/program managers whenever requested but does not have a methodology in place or tools to use. Level 3 - The PMO provides assistance to project/program managers with a standard methodology and tools for their use.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO conduct project Audits?** Level 0 - The PMO does not perform this function. Level 1 - The PMO performs audits upon request or if there is a major problem identified by senior managers who requests feedback. Level 2 - The PMO acts proactively throughout the organization, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes there is significant resistance from project managers when an audit is under way. Level 3 - The PMO acts proactively throughout the organization, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes that there is some resistance, but most people recognize the value of the audit work.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO conduct the post-reviews of project management (Lessons learned)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO facilitates the process of capturing lessons learned, as it is directly involved in project meetings and events. Level 2 - The PMO facilitates the process, analyzes, consolidates and submits proposals for continuous improvement on projects. Level 3 - In addition, the PMO provides a process to reuse the lessons learned in future projects across the organization.	0	0	0				0	0	0		

APPENDIX F:

ROUND 1 QUESTIONNAIRE SECTION 5 - PROJECT MANAGEMENT OFFICE MATURITY MODEL FOR DEPARTMENTAL SCOPE

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
Strategic	**How does the PMO provide advice to the department senior management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO is asked by top management to give its position on issues relating to making strategic decision once in a while. Level 2 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision, however, its involvement is not formally established. Level 3 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision and its involvement is formally established.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO coordinate and integrate the department's portfolio?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies interdependencies between the projects and programs of the department, but it does not keep track of the changes in interdependencies. Level 2 - The PMO identifies and tracks interdependencies between the projects and programs of the department, informing and triggering the managers of projects/programs and stakeholders in case of need, rebalancing, and other changes. Level 3 - The PMO identifies and tracks interdependencies between the projects and programs of the department, acting proactively to ensure the realization of the portfolio and providing preventive and corrective actions as required.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO develop and maintain a strategic framework of departmental projects and programs (Scoreboard)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides information on projects and programs of the department, but these are limited to a view on each individual project, with no analysis of the results expected of business and dependencies between projects and programs, risk, and deadlines of the portfolio. Level 2 - The PMO provides information on projects and programs of the department (with analysis of the results expected of business and dependencies between projects and programs, risk and maturity of the portfolio) in a scoreboard, but this is not often used by senior management to support decision making. Level 3 - The PMO provides information on projects and programs of the department (with analysis of the results expected of business and dependencies between projects and programs, risk and maturity of the portfolio) in a scoreboard, but this is regularly used by senior management to support decision making.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO promote project management awareness in the department?** Level 0 - The PMO does not perform this function. Level 1 - The PMO raises awareness of project management to the intermediate level of the department including mid-level managers. Level 2 - The PMO takes actions to raise awareness of project	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	management at all levels of the department, including senior management. The PMO develops and publishes policies and guidelines for the management of projects in the department. Level 3 - The PMO establishes and implements a structured plan to promote project management at all levels of the department. The PMO reviews and improves policies and guidelines for project management in the department.											
Strategic	**How does the PMO monitor and control its own performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO informally asks its customers to feedback on its performance. Level 2 - The PMO formally ask its customers for feedback on its performance. Level 3 - The PMO formally asks its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. Level 4 - The PMO formally ask its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. In addition, the PMO shares goals with its customers and structures itself to promote continuous improvement and increases in its maturity, assessing the need for removal, maintenance, or creation of new services.	0	0	0	0	0		0	0	0	0	0
Strategic	**How does the PMO participate in the department strategic planning process?** Level 0 - The PMO does not perform this function. Level 1 - The PMO informally and occasionally participates in the strategic planning process of the department. Level 2 - The PMO informally and regularly participates in the strategic planning process of the department. Level 3 - The PMO formally and regularly participates in the strategic planning process of the department.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO manage one or more departmental portfolios?** Level 0 - The PMO does not perform this function. Level 1 - The PMO maintains a list of active projects throughout the department. Level 2 - The PMO maintains a list of active projects and programs throughout the department and establishes their prioritization but does not follow a structured portfolio management process. Level 3 - The PMO maintains a list of active projects and portfolios, prioritizes them throughout the department and establishes formal processes, acting as facilitator in the definition (identification, categorization, evaluation, selection), development (prioritize, balance, and commitment) and implementation (monitoring, review, and change management) of the portfolio. Level 4 - The PMO maintains a list of active projects and portfolios, prioritizes them throughout the department, and establishes formal processes, acting as facilitator in the definition (identification, categorization, evaluation, selection), development (prioritize, balance and commitment) and implementation (monitoring, review and change management) of the portfolio. The PMO uses an integrated system to automate the department's portfolio management process.	0	0	0	0	0		0	0	0	0	0
Strategic	**How does the PMO identify, select and prioritise new departmental projects and programs?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies, selects, and prioritizes new projects and programs throughout the department without defined criteria and without a relationship between strategic department goals and the	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	existing portfolio. Level 2 - The PMO identifies, selects and prioritizes new projects and programs throughout the department based on criteria, but without a clear and precise relationship between the strategic department goals and the existing portfolio. Level 3 - The PMO provides the department with a formal process of identification, selection and prioritization of new departmental projects and programs based on categories and pre-established criteria.											
Strategic	**How does the PMO manage the benefits of the departmental projects and programs?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors the achievement of expected benefits for each project/program of the department only during its execution, evaluating the results comparing them with the original strategic goals of the project/ program. Level 2 - The PMO monitors the achievement of expected benefits for each project/program of the department during its execution and after closure evaluating the results and comparing them with the original strategic goals of the project/program.	0	0	0				0	0	0		
Strategic	**How does the PMO map the relationships and the environment of the projects and programs in and out of the department?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies the stakeholders of the department's portfolio and takes actions to develop a strategy for stakeholder management. Level 2 - The PMO identifies the stakeholders of the department's portfolio, analyzes their expectations, establishes a strategy to manage relationships and proactively works to implement it. Besides, the PMO looks for benchmarking in project management with other organizations.	0	0	0				0	0	0		
Tactical	**How does the PMO develop and implement the department's project management methodology?** Level 0 - The PMO does not perform this function. Level 1 - The PMO has developed a basic methodology for the department, but it is not used consistently on all projects. Level 2 - The PMO has developed a standard methodology for the department, aligning possible existing methodologies in different areas, and the methodology used in most projects in the department. Level 3 - The PMO has developed a standard methodology for the department, and it is used by all projects as it is mandatory unless a specific waiver is requested and approved. Level 4 - The PMO has developed and improved the standard methodology for the department focusing on best practices and continuous improvement.	0	0	0	0	0		0	0	0	0	0
Tactical	**How does the PMO develop skills in project management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO responds reactively to the department's project management training needs. Level 2 - The PMO proposes project management training for the department. Level 3 - The PMO establishes a plan for developing skills in project management throughout the department, including training, certification and graduate courses. Level 4 - The PMO establishes a specific career path in project management for the department, supported by a plan for corporate development of project management knowledge, skills, and competencies, which includes training, certification and graduate courses.	0	0	0	0	0		0	0	0	0	0

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
Tactical	**How does the PMO implement and manage project information systems?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides a project management information system for use throughout the department, focusing on monitoring and control, which is used by managers of projects/programs and stakeholders in most projects/programs of the department, but this system does not use an integrated database. Level 2 - The PMO provides a project management information system for use throughout the department, focusing on monitoring and control, which is used by managers of projects/programs and stakeholders in most projects/programs of the department with an integrated database. Level 3 - The PMO provides a project management information system for use throughout the department, focusing on monitoring and control, which is effectively used by managers of projects /programs and stakeholders in all projects/programs of the department with an integrated database.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO manage interfaces with customers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors the progress of projects and programs of the department but is not involved with customer relationship management. Level 2 - The PMO evaluates customer satisfaction, but does not directly interface with the customers of the department's projects and programs. Level 3 - The PMO is responsible for customer relationship management of all the department's projects and programs.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO provide a set of tools for project management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides tools for use in the department but they are not standardized and integrated. Level 2 - The PMO provides tools, available for department, that are standardized and integrated to existing processes and methodologies, but the tools are not used in most cases to their fullest extent. Level 3 - The PMO provides tools, available for department, that are standardized and integrated to existing processes and methodologies, and the tools are fully used on most projects and programs.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO allocate and share resources between departmental projects?** Level 0 - The PMO does not perform this function. Level 1 - PMO operates in a reactive form in allocating and sharing resources between projects throughout the department. Level 2 - The PMO recognizes the importance of a resource pool, but lacks authority to allocate or share resources between projects in the department. Level 3 - The PMO has established a resource pool and has the authority to allocate and share resources between projects in the department.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the lessons learned database?** Level 0 - The PMO does not perform this function. Level 1 - The PMO stores the lessons learned from projects but does so in an unstructured way. Level 2 - The PMO consolidates the lessons learned from projects of the department and has set up a database for them. Level 3 - In addition, the PMO implements and disseminates a system with a single point of entry to retrieve lessons learned from projects throughout the department.	0	0	0	0			0	0	0	0	
ac ti	**How does the PMO implement and manage the risk database?**	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	Level 0 - The PMO does not perform this function. Level 1 - The PMO has set up a risk database. Level 2 - The PMO uses a risk breakdown structure and consolidates the risks managed in each project in the department using a risk database. Level 3 - In addition, the PMO is able to use the lessons learned database to access risks from other projects in the department.											
Tactical	**How does the PMO select, manage and evaluate project managers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO recruits, selects, evaluates, and determines salaries of project managers as requested. Level 2 - The PMO establishes criteria for use in the entire organization for recruiting, selecting, and evaluating Project Managers. Level 3 - In addition, the PMO establishes a career path for project managers and determines the salary structure at each level.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide specialised services for the Project manager?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides the project managers with basic project management support such as: preparing documentation, preparing of schedules, and facilitating meetings. Level 2 - The PMO provides project managers advanced services and support such as: risk analysis, development and management of contracts, and project recovery.	0	0	0				0	0	0		
Operational	**How does the PMO provide information to senior management of the status of projects that are under way?** Level 0 - The PMO does not perform this function. Level 1 - The PMO collects status information, prepares reports and distributes them to senior management/sponsors but is not responsible for analysis nor does it take corrective action based on data in the reports. Level 2 - The PMO receives status information, analyzes it and provides reports to senior management/sponsors and informs them if there are specific problems in which their assistance is needed. Level 3 - The PMO receives status information, analyzes it, and provides reports to senior management/sponsors of the organization, informs them if there are problems and assists them in resolving problems as requested.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO monitor and control project/program performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors and controls the project/program performance considering time, cost, quality and customer satisfaction, and provides follow-up reports without analysis upon request. Level 2 - The PMO monitors and controls the performance of projects/programs considering time, cost, quality and customer satisfaction and analyzes the available data. Level 3 - The PMO monitors and controls the performance of projects/programs considering time, cost, quality and customer satisfaction, analyzes data, and takes preventive and corrective actions working proactively with project/program managers and senior management.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide mentoring for project managers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides mentoring throughout the department when requested. The mentoring involves supporting project planning and control and transferring technical knowledge to the project manager	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Departmental

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	or to his or her team. Level 2 - The PMO identifies needs and proactively provides mentoring throughout the department. The mentoring involves supporting project planning and control, to transfer technical knowledge to the project manager or to his or her team. Level 3 - The PMO identifies needs and proactively provides mentoring throughout the department. The mentoring involves supporting project planning and control, transferring technical knowledge to the project manager or his or her team, and assisting them with the development or enhancement of interpersonal skills.											
Operational	**How does the PMO manage and collect project files and documentation?** Level 0 - The PMO does not perform this function. Level 1 - The PMO captures and stores documents for projects across the department, without specific analysis and information retrieval; few people use available data. Level 2 - The PMO captures and stores documents for projects across the department, without specific analysis and information retrieval but provides guidance to individuals who wish to use these documents. Level 3 - The PMO has a structured process with the goal of capturing and storing documents for projects across the department, analyzing the quality of documentation and providing mechanisms for users to locate needed information.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO manage one or more programs or projects?** Level 0 - The PMO does not perform this function. Level 1 - The PMO assists managers on occasion but does not have a methodology in place or tools to use. Level 2 - The PMO provides assistance to project/program managers whenever requested but does not have a methodology in place or tools to use. Level 3 - The PMO provides assistance to project/program managers with a standard methodology and tools for their use.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO conduct project audits?** Level 0 - The PMO does not perform this function. Level 1 - The PMO performs audits upon request or if there is a major problem identified by senior managers who requests feedback. Level 2 - The PMO acts proactively throughout the department, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes there is significant resistance from project managers when an audit is under way. Level 3 - The PMO acts proactively throughout the department, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes that there is some resistance, but most people recognize the value of the audit work.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO conduct post-reviews of project management (lessons learned)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO facilitates the process of capturing lessons learned, as it is directly involved in project meetings and events. Level 2 - The PMO facilitates the process, analyzes, consolidates and submits proposals for continuous improvement on projects. Level 3 - In addition, the PMO provides a process to reuse the lessons learned in future projects across the department.	0	0	0	0			0	0	0	0	

APPENDIX G:

ROUND 1 QUESTIONNAIRE SECTION 5 - PROJECT MANAGEMENT OFFICE MATURITY MODEL FOR PROGRAM/PROJECT SCOPE

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Program/Project

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
Strategic	**How does the PMO provide advice to the senior management about the project/program?** Level 0 - The PMO does not perform this function. Level 1 - The PMO is asked by top management to give its position on issues relating to making strategic decision once in a while. Level 2 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision, however, its involvement is not formally established. Level 3 - The PMO is frequently asked by top management to give its position on issues relating to making strategic decision and its involvement is formally established.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO develop and maintain a strategic framework of the project/program (Scoreboard)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides information on the project/program, but these are limited to a view on the project/program status, with no analysis of the results expected of business. Level 2 - The PMO provides information on the project/program with analysis of the results expected of business in a scoreboard, but this is not often used by senior management to support decision making. Level 3 - The PMO provides information on the project/program with analysis of the results expected of business in a scoreboard, but this is regularly used by senior management to support decision making.	0	0	0	0			0	0	0	0	
Strategic	**How does the PMO monitor and control its own performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO informally asks its customers to feedback on its performance. Level 2 - The PMO formally ask its customers for feedback on its performance. Level 3 - The PMO formally asks its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. Level 4 - The PMO formally ask its customers to gain feedback on its performance and to obtain performance indicators for the processes under its responsibility, continually demonstrating its performance to its customers. In addition, the PMO shares goals with its customers and structures itself to promote continuous improvement and increases in its maturity, assessing the need for removal, maintenance, or creation of new services.	0	0	0	0	0		0	0	0	0	0
Strategic	**How does the PMO manage the benefits of the project/program?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors the achievement of expected benefits for the project/program only during its execution, evaluating the results comparing them with the original strategic goals of the project/program. Level 2 - The PMO monitors the achievement of expected benefits for the project/program during its execution and after closure evaluating the results and comparing them with the original strategic goals of the	0	0	0				0	0	0		

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Program/Project

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	project/program.											
Strategic	**How does the PMO map the relationship and the environment of the projects and programs in and out of the project/program?** Level 0 - The PMO does not perform this function. Level 1 - The PMO identifies the stakeholders of the project /program and takes actions to develop a strategy for stakeholder management. Level 2 - The PMO identifies the stakeholders of the project /program, analyzes their expectations, establishes a strategy to manage relationships and proactively works to implement it. Besides, the PMO looks for benchmarking in project management with other organizations.	0	0	0				0	0	0		
Tactical	**How does the PMO develop and implement the project management methodology?** Level 0 - The PMO does not perform this function. Level 1 - The PMO has developed a basic methodology for the project/program, but it is not used consistently. Level 2 - The PMO has developed a standard methodology for the project/program, and it is used in most of the time. Level 3 - The PMO has developed a standard methodology for the project/ program, and it is mandatory unless a specific waiver is requested and approved. Level 4 - The PMO has developed and improved the standard methodology for the project focusing on best practices and continuous improvement.	0	0	0	0	0		0	0	0	0	0
Tactical	**How does the PMO develop skills in project management for the program/project?** Level 0 - The PMO does not perform this function. Level 1 - The PMO responds reactively to the project management training needs. Level 2 - The PMO proposes project management training for the project/ program. Level 3 - The PMO establishes a plan for developing skills in project management throughout the project/program.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the project information system?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides a project management information system for use throughout the project/program, focusing on monitoring and control, which is used by the project/program management and stakeholders in most of the time, but this system does not use an integrated database. Level 2 - The PMO provides a project management information system for use throughout the project /program, focusing on monitoring and control, which is used by the project/program manager and stakeholders in most of the time with an integrated database Level 3 - The PMO provides a project management information system for use throughout the project /program, focusing on monitoring and control, which is effectively used by project /program managers and stakeholders all the time with an integrated database.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO manage interfaces with project's/program's customers?** Level 0 - The PMO does not perform this function. Level 1 - The PMO eventually monitors the customer satisfaction but is not involved formally with customer relationship management. Level 2 - The PMO evaluates customer satisfaction, but does not directly interface with the customers of the project/program. Level 3 - The PMO is responsible for customer relationship management of the project/program.	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Program/Project

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
Tactical	**How does the PMO provide a set of tools for project management?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides tools for use in the project/program but they are not standardized and integrated. Level 2 - The PMO provides tools, available for the project/program, that are standardized and integrated to existing processes and methodologies, but the tools are not used in their fullest extent Level 3 - The PMO provides tools, available for the project/program, that are standardized and integrated to existing processes and methodologies, and the tools are fully used on the project/program.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO allocate and share resources in the project/program?** Level 0 - The PMO does not perform this function. Level 1 - PMO operates in a reactive form in allocating resources in the project/ program. Level 2 - The PMO recognizes the importance of a resource pool, but lacks authority to allocate resources project/program. Level 3 - The PMO has established a resource pool and has the authority to allocate resources in the project/program.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the lessons learned database?** Level 0 - The PMO does not perform this function. Level 1 - The PMO stores the lessons learned from the project/program but does so in an unstructured way. Level 2 - The PMO consolidates the lessons learned from the project/program and has set up a database for them. Level 3 - In addition, the PMO implements and disseminates a system with a single point of entry to retrieve lessons learned from the project/program.	0	0	0	0			0	0	0	0	
Tactical	**How does the PMO implement and manage the risk database?** Level 0 - The PMO does not perform this function. Level 1 - The PMO has set up a risk database. Level 2 - The PMO uses a risk breakdown structure and consolidates the risks managed in the project/program using a risk database. Level 3 - In addition, the PMO is able to use the lessons learned database to access risks from the project/program.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide specialised services for the project/program manager?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides the project/program manager with basic project management support such as: preparing documentation, preparing of schedules, and facilitating meetings. Level 2 - The PMO provides project/program manager advanced services and support such as: risk analysis, development and management of contracts, and project recovery.	0	0	0				0	0	0		
Operational	**How does the PMO provide information to senior management of the status of project/program that are under way?** Level 0 - The PMO does not perform this function. Level 1 - The PMO collects status information, prepares reports and distributes them to senior management/sponsors but is not responsible for analysis nor does it take corrective action based on data in the reports. Level 2 - The PMO receives status information, analyzes it and provides reports to senior management/sponsors and informs them if there are specific problems in which their assistance is needed. Level 3 - The PMO receives status information, analyzes it, and provides reports to senior management/sponsors, informs them if there are	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Program/Project

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	problems and assists them in resolving problems as requested.											
Operational	**How does the PMO monitor and control project/program performance?** Level 0 - The PMO does not perform this function. Level 1 - The PMO monitors and controls the project/program performance considering time, cost, quality, and customer satisfaction, and provides follow-up reports without analysis upon request. Level 2 - The PMO monitors and controls the project/program performance considering time, cost, quality, and customer satisfaction and analyzes the available data. Level 3 - The PMO monitors and controls the project/program performance considering time, cost, quality and customer satisfaction, analyzes data, and takes preventive and corrective actions working proactively with the project/program manager and senior management.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO provide mentoring for the project/program manager?** Level 0 - The PMO does not perform this function. Level 1 - The PMO provides mentoring when requested. The mentoring involves supporting project planning and control and transferring technical knowledge to the project manager or to his or her team. Level 2 - The PMO identifies needs and proactively provides mentoring. The mentoring involves supporting project planning and control, to transfer technical knowledge to the project manager or to his or her team. Level 3 - The PMO identifies needs and proactively provides mentoring. The mentoring involves supporting project planning and control, transferring technical knowledge to the project manager or his or her team, and assisting them with the development or enhancement of interpersonal skills.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO manage and collect project/program files and documentation?** Level 0 - The PMO does not perform this function. Level 1 - The PMO captures and stores documents for the project/program, without specific analysis and information retrieval; few people use available data. Level 2 - The PMO captures and stores documents for the project /program, without specific analysis and information retrieval but provides guidance to individuals who wish to use these documents. Level 3 - The PMO has a structured process with the goal of capturing and storing documents for the project/program, analyzing the quality of documentation and providing mechanisms for users to locate needed information.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO manage the program/project?** Level 0 - The PMO does not perform this function. Level 1 - The PMO assists the project/program manager on occasion but does not have a methodology in place or tools to use. Level 2 - The PMO provides assistance to project/program manager whenever requested but does not have a methodology in place or tools to use. Level 3 - The PMO provides assistance to project/program manager with a standard methodology and tools for their use.	0	0	0	0			0	0	0	0	
Operational	**How does the PMO conduct project/program audits?** Level 0 - The PMO does not perform this function. Level 1 - The PMO performs audits upon request or if there is a major problem identified by senior managers who requests feedback. Level 2 - The PMO acts proactively, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes there is significant resistance when an audit	0	0	0	0			0	0	0	0	

Mark your selected level with a one (1) and leave the rest zeros (0) per key project area

Scope: Program/Project

		Current PMO maturity level						Required PMO maturity level				
		Section not complete yet						Section not complete yet				
		0	1	2	3	4		0	1	2	3	4
	is under way. Level 3 - The PMO acts proactively, following established audit procedures for projects. In addition, the audit results are used to provide feedback. The PMO realizes that there is some resistance, but most people recognize the value of the audit work.											
Operational	**How does the PMO conduct post-reviews of project management (lessons learned)?** Level 0 - The PMO does not perform this function. Level 1 - The PMO facilitates the process of capturing lessons learned, as it is directly involved in project/program meetings and events. Level 2 - The PMO facilitates the process, analyzes, consolidates, and submits proposals for continuous improvement on the project/program. Level 3 - In addition, the PMO provides a process to reuse the lessons learned in future projects/programs.	0	0	0	0			0	0	0	0	

APPENDIX H:

ROUND 2 QUESTIONNAIRE SECTION 3 - PROJECT MANAGEMENT

MATURITY REQUIRED

Project Management Maturity Required in Consulting Engineering Industry						*Round 1 Survey results*
	1	2	3	4	5	
	Section not complete yet					
Project Integration Management	Sub-section not complete yet					
Project Plan Development	0	0	0	0	0	4
Project Plan Execution	0	0	0	0	0	3
Change Control	0	0	0	0	0	4
Project Information System	0	0	0	0	0	3
Project Office	0	0	0	0	0	3
Project Scope Management	Sub-section not complete yet					
Requirements Definition (Business)	0	0	0	0	0	4
Requirements Definition (Technical)	0	0	0	0	0	4
Deliverables identification	0	0	0	0	0	4
Scope Definition	0	0	0	0	0	4
Work Breakdown Structure	0	0	0	0	0	4
Scope Change Control	0	0	0	0	0	4
Project Time Management	Sub-section not complete yet					
Activity Definition	0	0	0	0	0	3
Activity Sequencing	0	0	0	0	0	3
Schedule Development	0	0	0	0	0	3
Schedule Control	0	0	0	0	0	3
Schedule Integration	0	0	0	0	0	3
Project Cost Management	Sub-section not complete yet					
Resource Planning	0	0	0	0	0	3
Cost Estimating	0	0	0	0	0	4
Cost Budgeting	0	0	0	0	0	4
Performance Measurement	0	0	0	0	0	4
Cost control	0	0	0	0	0	4

Project Quality Management	Sub-section not complete yet					
Quality Planning	0	0	0	0	0	3
Quality Assurance	0	0	0	0	0	4
Quality Control	0	0	0	0	0	4
Management Oversight	0	0	0	0	0	3
Project Human Resource Management	Sub-section not complete yet					
Organisational Planning	0	0	0	0	0	3
Staff Acquisition	0	0	0	0	0	3
Team Development	0	0	0	0	0	3
Professional Development	0	0	0	0	0	3
Project Communications Management	Sub-section not complete yet					
Planning	0	0	0	0	0	3
Information Distribution	0	0	0	0	0	3
Performance Reporting	0	0	0	0	0	3
Issues Tracking and Management	0	0	0	0	0	3
Project Risk Management	Sub-section not complete yet					
Risk identification	0	0	0	0	0	3
Risk Quantification	0	0	0	0	0	3
Risk Response Development	0	0	0	0	0	3
Risk Control	0	0	0	0	0	3
Risk Documentation	0	0	0	0	0	3
Project Procurement Management	Sub-section not complete yet					
Procurement Planning	0	0	0	0	0	3
Requisition	0	0	0	0	0	3
Solicitation / Source Control	0	0	0	0	0	3
Contract Management / Closure	0	0	0	0	0	3