

Evaluating the effect of delivery of government projects in the Northern Cape

by

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ABSTRACT

The construction industry is a major player in the economy, generating both employment and wealth. However, many projects experience extensive delays and thereby exceed initial time and cost estimates. This study's aim was to determine the causes of delays in project delivery in the Northern Cape, South Africa. One of the major challenges facing the Government today is the delivery of all construction and maintenance projects on time, within budget, and in accordance with the desired scope.

The prevailing conditions that could exert an influence on project delivery are political, economic, and physical factors, as well as level of technological development, management style and construction techniques. Factors that negatively influence project delivery in the Northern Cape include geography, society and regulations, amongst others. Factors causing construction delays in projects differ from country to country, and due to different prevailing conditions every project is different, every organization is different, and so are business operating environments.

The data that was collected during the survey was captured and analysed by the Statistical Consultation Services of the North-West University. Descriptive statistics (means and standard deviations) were used to analyse the data. The sample population consisted of client department officials, community members, contractors and/or service providers, and NDPW officials with different fields of specialty, such as occupational health and safety, employment equity, project managers, works managers, generalists and team leaders or overseers, who were available and willing to participate during the week of sampling.

This research may have opened the doors for researchers to explore the project management practices in the public sector of any other government departments in South Africa in order to validate the study. Researchers can also do research on strategies for management.

Key terms: Construction, department, Government, management, projects.

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DEFINITION OF ABBREVIATIONS

AGSA	Auditor General South Africa
BBBEE	Broad Based Black Economic Empowerment
BE	Built Environment
BEE	Black Economic Empowerment
CBE	Council for the Built environment
CIDB	Construction Industry Development Board
DCS	Department of Correctional Services
DOA	Department of Agriculture
DOHA	Department of Home Affairs
DOJCD	Department of Justice & Constitutional Development
DME	Department of Minerals & Energy
DTI	Department of Trade of Industry
ECSA	Engineering Council of South Africa
EIA	Environmental Impact Assessment
EPWP	Expanded Public Works Programme
GCIS	Government Communications and Information System
GDP	Gross Domestic Product
GIAMA	Government Immovable Asset Management Act
ICD	Independent Complaints Directorate

IDIP	Infrastructure Development Improvement Plan
IDT	Independent Development Trust
KAM	Key Accounts Management
MFMA	Municipal Finance Management Act
MTEE	Medium Term Expenditure Estimates
MTEF	Medium Term Expenditure Framework
NC	Northern Cape
NDP	National Development Plan
NDPW	National Department of Public Works
NWU	North West University
PFMA	Public Finance Management Act
PI	Procurement Instruction
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMP	Project Management Profession
PPPFA	Preferential Procurement Policy Framework Act
QS	Quantity Surveyor
RBAC	Regional Bid Adjudication Committee
RBEC	Regional Bid Evaluation Committee

RBSC	Regional Bid Specification Committee
SABS	South African Bureau of Standards
SACAP	South African Council for the Architectural Profession
SACLAP	South African Council for the Landscape Architectural Profession
SACPCMP	South African Council for Project and Construction Management Professions
SACPVP	South African Council for the Property Valuers Profession
SACQS	South African Council for the Quantity Surveying Profession
SANAS	South African National Accreditation System
SANDF	South African Defence Force
SAPS	South African Police Services
SARB	South African Reserve Bank
SASSA	South African Social Security Agency
SCM	Supply Chain Management
SMME	Small Medium Micro Enterprise
SSA	Statistics South Africa
WBS	Work Breakdown Structure

CHAPTER 1

NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

The National Department of Public Works (NDPW) plays a crucial role in facilitating delivery by other national government departments and institutions, by providing the necessary accommodation and managing the largest property portfolio in South Africa. It is a diverse property portfolio, with the responsibility, for instance for buildings/facilities such as Parliament, the Union Buildings, the Palace of Justice, all magistrates' courts, police stations, prisons and defence force facilities.

As the key provider of accommodation for government departments, the National Department of Public Works (NDPW) plays a critical role in providing an enabling environment for the effective implementation of social and economic development. Its mandate is governed largely by the Government's Immovable Asset Management Act of 2007 (GIAMA). This is a functional continuation of the department's pre-1994 role which was to deliver government infrastructure through public works programmes, accompanied by job-creation mechanisms.

According to the Constitution of the Republic of South Africa, in 1996 (Act No 108 of 1996), the President allocated a functional mandate to the Department of Public Works which is confirmed through the annual Appropriation Act. The State Land Disposal Act (Act No 48 of 1961) furthermore mandates the Minister of Public Works to carry out certain functions. From the above legislation, the department's mandate is to be the custodian and manager of all of the National Government's fixed assets, for which legislation does not make another department or institution responsible. This includes the determination of accommodation requirements, rendering expertly built environment services to client departments, the acquisition, maintenance as well as the disposal of such assets.

Construction plays a vital role in South Africa's economic and social development, it provides the physical infrastructure and backbone for economic activity and it is also a

large-scale provider of employment. The legacy of Apartheid has, however, left the South African construction industry with a number of development and transformation challenges. These include improving the effectiveness of public sector spending on physical infrastructure development and maintenance; improving labour absorption, labour relations and job stability; accelerating sustainable transformation through access to opportunity, finance and training; reducing the impact of HIV and AIDS in construction; and ensuring international competitiveness.

In 1997 the Government published the Green Paper on "Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry", paving the way for the establishment of The Construction Industry Development Board (CIDB). The CIDB Act (Act 38 of 2000) was passed in October 2000, establishing the CIDB mandate to lead stakeholders in construction development. The CIDB Act 38 of 2000 mandates the board to establish a stakeholder forum to inform the board on matters that affect the construction industry. The stakeholder forum is comprised of individuals with relevant industry experience, expertise or skills. The members are selected through a public nomination process. The board is required to convene a meeting of the Minister of Public Works and the stakeholder forum at least once a year.

The Construction Industry Development Board's focus is on sustainable growth, capacity development and empowerment; improved industry performance and best practice; a transformed industry underpinned by consistent and ethical procurement practices; and enhanced value to clients and society

The aim of this study was to explore the issues and difficulties that departments encounter during the process of managing government projects. This study focussed on the Government's projects that were initiated in the Northern Cape Province. This is essential because it identifies the causes for projects' failure, which may benefit similar projects in the future. This study therefore reported on the findings regarding the application of project management on government projects in the Northern Cape Province and made recommendations to redress construction inefficiencies in the Northern Cape Province.

1.2 PROBLEM STATEMENT

The NDPW faces challenges and constraints in the management and delivery of government projects in the Northern Cape Province. One of the major challenges facing the Government today is the delivery of all construction and maintenance projects on time, within budget, and in accordance with the desired scope and quality. Among the many challenges facing government infrastructure service delivery programmes, the most critical and hence the basis of the problem statement, are the following (AGSA, 2013):

- Defaulting contractor/service providers;
- Under and/or over expenditure on infrastructure budgets;
- Poor application of project management principles;
- Inability to attract and retain skilled and qualified staff; and
- Infrastructure backlogs that constrains economic growth.

The findings listed above indicate that the monitoring of projects is not in all instances of the desired standard. Given the fact that the NDPW mainly acts as an implementing agent on these infrastructure projects, service delivery is negatively affected across government should such projects not be executed in accordance with specifications and predetermined timelines.

According to the Auditor General South Africa (AGSA) Report, 2013 - for a sector to deliver on its mandate, it needs to use an efficient and effective project management system to manage the budget allocation on its projects, by completing projects on time, within the budget, and according to the specifications, quality and needs of client departments. During the Auditor General's Report on the audit outcomes of the Department of Public Works, the following findings were noted on the project management of infrastructure projects (AGSA Report, 2013):

- Inadequate management information exists for evaluating and monitoring projects to identify, avoid and address delays and/or overspending on projects;

- Non-compliance with Supply Chain Management (SCM) legislation in the appointment of contractors;
- Project managers are not registered with the South African Council for Project and Construction Management Professions (SACPCMP);
- Adequate action is not taken against non-performing contractors;
- A high number of variation orders change the scope of projects resulting in potential fruitless and wasteful expenditure; and
- Construction contractors do not provide for penalties for late completion or penalties are waived without valid reasons.

In order to get to the root causes of the problems experienced in the delivery of government infrastructure in the Northern Cape Province, it is necessary to do research on capital projects above R10 million (this was identified as the cut-off point) managed by NDPW as listed below in Table 1.1.

TABLE 1.1 Northern Cape Projects

Project Location	Project Sponsor	Project Description	Project Amount
Kimberley	Department of Correctional Services	New medium security prison for 3000 inmates	R825 822 667
Keimoes	South African Police Services	Construction of new police station with single quarters	R61 685 377
Violsdrift, Border Post	National Department of Public Works	Construction of border control	R54 993 641
Kimberley, Galeshewe	Justice and Constitutional Development	Construction of magistrate court	R49 126 180
Violsdrift	Department of Defence	Construction of 34 married units	R45 197 550
Kimberley, Galeshewe	South African Police Services	Construction of community safety centre	R35 755 247

Kakamas, Augrabies	South African Police Services	Construction of community safety centre	R20 365 271
Lohatla	Department of Defence	Construction of a 30-bed sick bay	R18,780,155
Upington	Justice and Constitutional Development	Construction of magistrate offices	R18,113,610
De Aar	South African Police Services	Construction of new police station, mortuary and single quarters	R13,241,494
Kimberley	Department of Defence	Refurbishment of old sleeping facilities	R11,232,492

(Source: NDPW Registry, 2014)

The above-mentioned projects were managed by NDPW in the Northern Cape Province between 1995 and 2014. None of these capital projects was completed within the agreed schedule, within budget and according to the specifications and needs of the client departments, as the project sponsors. Many of the challenges came to the attention of the DPW in the form of criticisms from the client community and departmental contractors. These are important projects as they have an impact on the social and socio-economic conditions of the people in the Northern Cape.

1.3 RESEARCH OBJECTIVES

The primary research objectives are to evaluate the effect of delivery of government projects in the Northern Cape; to determine the root causes of government's project failures, managed by NDPW in the Northern Cape Province; and why government's projects are not completed within the agreed schedule, within budget and according to the specifications and needs of the client departments (project sponsors). In order to realize the primary objectives, the following secondary objectives must be met:

- To determine governance issues that led to the unsuccessful completion of capital projects;

- To evaluate and analyse the project failures and operational deficiencies within Northern Cape Province;
- To determine possible procurement and contracting options that will maximize value-for-money deals with capacity constraints and ensure long-term sustainability; and
- To make recommendations on how to resolve the prevailing failures, operational deficiencies and governance Issues.

1.4 THE SCOPE OF THE STUDY

To investigate the capital projects in the public sector worth more than R10 million and explore the issues that hinder the successful implementation of these schemes. This study focussed on projects that were managed and controlled by NDPW in the Northern Cape Province between 1995 and 2014. In order to get to the root causes of the problems experienced in the delivery of government projects in the Northern Cape Province, it was necessary to do research on current and previous projects, processes and operating behaviours of subjects. This study evaluated and analysed the project failures and operational deficiencies.

1.5 RESEARCH METHODOLOGY

The research methodology includes a variety of qualitative and quantitative methods, descriptions of the measuring instruments that were used and the research procedure that was employed.

1.5.1 Literature review

A literature study was performed in an attempt to uncover some of the key issues surrounding the objectives of this study. The purpose of conducting a review of the literature is to identify the issues that have already been researched on the topic, and to determine the need for the study by identifying gaps that exist in the literature. In phase one a comprehensive literature review is given on the topic, covering the following:

- The role of the construction sector in the South African context governance;
- Project management in the public sector;

- The South African Council for Project and Construction Management Professions (SACPCMP);
- Public sector budget and tender processes;
- Supply chain management;
- Public sector project managers; and
- The Project Management Body of Knowledge (PMBOK) principles.

This dissertation was based on the knowledge acquired through the study of textbooks, accredited journals and other acceptable scientific sources (Google scholar, e-Books, J-tutor, and various databases form the University’s library). The research methods were divided into two main types, namely quantitative and qualitative. The table below highlights some of the characteristics of these two methods.

TABLE 1.2: Quantitative and Qualitative Methods

Quantitative Methods	Qualitative Methods
<ul style="list-style-type: none"> • Pre-determined; • Instrument based questions; • Performance data and attitude data; • Observational data and census data; • Statistical analysis; and • Statistical interpretations. 	<ul style="list-style-type: none"> • Emerging methods; • Open-ended questions; • Interview data and observation data; • Document data and audio-visual data; • Text and image analysis; and • Themes and patterns interpretations.

(Source: Creswell, 2009:145)

The main objective of this review, besides underlining previous research, is to create a theoretical base for the completion of the survey questionnaire.

1.5.2 Empirical investigation

The empirical study consists of establishing the research design, participants, measuring instruments and statistical analysis. This was performed through the analysis

of quantitative and qualitative data. A structured questionnaire, comprising of both open- and closed-ended questions was compiled by the researcher in line with the objectives of the research; with particular focus on the questions' content in terms of non-ambiguity, relevance, general validity and interpretation. Convenience sampling was employed, during which 120 participants were selected at the convenience of the researcher. A convenience sample is made up of people who are easy to reach. Consider the following example - the NDPW office was chosen because it is a convenient site from which to solicit survey participants - this would constitute a convenience sample.

1.5.2.1 Research design

Descriptive research was used in this study and defined as a description, recording, analysis and interpretation of the presented data. This type of research is the most commonly used. The basic reason for carrying out descriptive research is to identify the cause of something that is happening (DJS Research online, 2010). There are three main research approaches, namely quantitative, qualitative and the mixed method approach, which combines the two. These refer to the way in which data is collected and analysed, as well as the type of generalizations that might be derived from it. Quantitative research seeks to quantify data and generalize the results from the predetermined sample to the target population. It also aims to measure the incidence of various views and opinions in a given sample (Balnaves & Caputi, 2001).

Qualitative research seeks to gain a complete understanding of commonly held reasons and motivations, while it also attempts to develop insights into the setting of a problem or concept, the generation of ideas or hypothesis, and to unearth the prevalent or commonly held thoughts and opinions (Goertz & Mahoney, 2012).

The mixed research method is a study design with both philosophical assumptions and empirical methods of inquiry. It involves philosophical assumptions that direct the collection and analysis of data, which incorporates both the qualitative and quantitative approaches in the research process. This is based on the central premise that the combination of both qualitative and quantitative approaches provides a better

understanding of the research problem, compared to a single approach (Creswell, & Clark, 2011). During this research a mixed research methodology was followed.

There are two types of data, namely primary data and secondary data (Funsho, 2012). Primary data is the information that is collected first-hand from the original source for the purpose of making statistical inferences, while secondary data is the information collected by the method of abstraction. This is used to make statistical inferences by using the primary data already collected (Funsho, 2012). Primary data is obtained for use in the research at hand, while secondary data is information gathered for another purpose, but can still be useful.

1.5.2.2 Target population

In order to collect the appropriate data needed for the research, the researcher collected information by handing out survey questionnaires to the project stakeholders of NDPW, client department officials, community members and contractors and/or service providers in the Northern Cape Province:

- Officials from NDPW;
- Client departments;
- Community members; and
- Contractors and/or service providers.

The researcher used simple random sampling in providing the questionnaires to the clients departments, community members and contractor/service providers. Simple random sampling is the most basic form of sampling. Every member of the population has an equal chance of being selected. The entire population of interest could be selected for the survey, but only a few are chosen at random. The researcher collected information by giving survey questionnaires to the following officials of NDPW:

- Project managers;
- Works managers;
- Supply chain management (SCM) officials;

- Regional bid specification committee (RBSC) members;
- Regional bid evaluation committee (RBEC) members; and
- Regional bid adjudication committee (RBAC) members.

In the case of this study, the researcher chose the selected sections to answer the questionnaires. From each section the researcher chose the respondents randomly. The data from the randomly selected respondents was used by the researcher to calculate the results of this study. The size of the sample was 200.

Participation in the questionnaires was anonymous and voluntary. Participants were free to withdraw at any point during the research process. They were assured that their names will not be revealed in the research reports emanating from the project. They were also guaranteed that there would be no negative consequences for those participating in the research process.

1.5.2.3 Measuring instrument

Any measuring instrument can be misused - regardless of its fairness, lack of bias or measuring adequacy. It is therefore imperative to ask whether a measuring instrument can be fairly and appropriately used as an aid in the decision-making process. To make proper use of a measuring instrument, the administrator should have a complete understanding of the instrument. A pilot study was conducted with the assistance of senior project managers to fine tune the self-administered questionnaire.

One of the critical aspects of evaluation and appraisal of the reported study was to consider the quality of the research instrument. According to Parahoo (2006), in quantitative studies reliability and validity are two of the most important concepts used by the researcher to evaluate the quality of the research carried out. Reliability and validity in research refer specifically to the measurement of data, as these will be used to answer the research questions. In most cases, the instrument that measures the variable is the central issues in determining the reliability and validity of the data. Whatever data collection method is used, the intent must be accuracy. The results of

the research depend on the consistency, stability and repeatability of the data collection instrument, or in other words, its reliability.

The data was collected by using a questionnaire. The advantages of a questionnaire are that data recording is objective, anonymity is easy to accomplish and the method is adaptable to most research situations. The questionnaire contained both closed- and open-ended questions. The official NDPW records of past events, written or printed, were used in the investigation. The advantage of using records of past events is the low cost involved, since the data already exists.

1.5.2.4 Statistical analysis

The data received from the completed questionnaires was captured and analysed by using a statistical software program, with the assistance of the Statistical Consulting Services of the North-West University (NWU).

1.5.2.5 Avoidance of bias

Reporting bias refers to systematic differences between reported and unreported findings. Within a published report, those analyses with statistically significant differences between intervention groups, are more likely to be reported than non-significant differences. This sort of 'within-study publication bias' is usually known as outcome reporting bias or selective reporting bias, and may be one of the most substantial biases affecting results from individual studies (Chan, 2005).

The most important lesson to be learned is to retain a sense of perspective, if a thorough job of investigating each and every problem from its root cause is to be done. Only then will the researcher be able to understand the true significance of recent news in the media and newspapers, and will thus be able to act accordingly. The researcher should also rely on facts and data, rather than coming to conclusions based on a gut feeling.

1.5.2.6 Ethics

The true purpose of the study was revealed in the cover letter that was sent out with the questionnaire. The researcher informed the participants of the purpose and nature of the study, as well as the data collection methods and the extent of the research prior to commencement. Furthermore, the researcher explained to the candidates their typical roles. This was critical, as the approach was quite different from the traditional face-to-face approaches. In line with this, the researcher obtained the participants' informed consent in writing. The researcher guaranteed that no participants would be put in a situation where they might be harmed physically or psychologically as a result of their participation.

The researcher ensured the participants that their confidentiality and anonymity would be maintained through the removal of any identifying characteristics, before widespread dissemination of information. The researcher also made it clear that the participants' names would not be used for any other purposes, nor would information that contained their identity in any way, be shared. Despite all the above-mentioned precautions, it was made clear to the participants that the research was only for academic purposes and that their participation in it was absolutely voluntary. No one was forced to take part.

1.5.2.7 Reliability

Reliability refers to “the consistency or stability, but it may also imply dependability within a test” (Rosnow & Rosenthal, 2008). In referring to stability it can be as simple as measuring someone's aptitude in reading. If you measure the reading level of students at a tenth grade reading level, it can be assumed that they will be at the same level when they are tested again, which would mean that the test was reliable. The reliability of the research instrument is a major criterion for assessing its quality. An instrument's reliability is the consistency with which it measures the target's attributes. According to Polit, & Beck (2008), the definition of reliability is the accuracy and consistency of information obtained in a study. Attempts were made to improve reliability through the structure of the questionnaire, which considered the topic, the research objectives, as well as the type of respondents.

1.6 DELIMINATIONS AND LIMITATIONS

There might be a number of limitations to the investigation because the study focussed only on government projects that were managed by NDPW in the Northern Cape Province between 1995 and 2014. In the cases where specific literature regarding research and development projects was hard to find or not accessible, general literature on project management was used as a source to discuss relevant issues.

The scope of the study projected management of the public sector, however it was limited to a defined sample from the population of interest nationally. In addition, the findings could not be generalized to environments outside the NDPW or beyond the current investigation. Regardless of these limitations, a better understanding on the topic is possible through this study. Conclusions were reached and it provided a base of reference for academics, practitioners as well as members of the general public who are interested in the topic.

1.7 CONTRIBUTION OF THE STUDY

This research investigated the project management practices in the Northern Cape Province Department of Public Works. The main objective of this study was to identify the governance and management practices of the Northern Cape Province Department of Public Works. In addition, the aim was to explore the issues and difficulties that departments encounter during the process of managing capital projects. This study focussed on capital projects that were initiated in the Northern Cape Province. This is essential since the identification of the main causes for project failure may help similar projects in the future. It is recommended that future research covers the execution of projects across all three spheres of government. Furthermore, this study can be used as a base for further research on the matter; a stepping stone to go further.

1.8 CHAPTER LAYOUT

This dissertation is divided in to five chapters. The emphasis of each chapter is well defined below.

- **Chapter 1 Scope and nature of the study:** This is an introduction to the study. It starts with the introduction and background of the problem and then continues to describe the rationale behind doing this study. Subsequently the chapter discusses the study objectives and the questions that this study addresses. In the last section of the chapter, a discussion is presented on the scope of the study, the adoption of the research methodology for this study, and the limitations of the study.
- **Chapter 2 Project management of the public sector:** Literature provides insight into the underlying factors of the research problem, and consists of a well-researched literature study on the project management of the public sector, SCM methods, budget and tender processes, the role of the construction sector within the context of the South African governance and public sector project managers. The principles and operating behaviours of Project Management Body of Knowledge (PMBOK) are discussed in this chapter. This chapter also investigates the factors influencing government projects managed by NDPW in the Northern Cape to fail.
- **Chapter 3 Empirical investigation:** This chapter contains information about the empirical study. It documents the research methodology applied in the investigation and explains the suitability and limitations of the selected approach.
- **Chapter 4 Statistical analysis:** Chapter four presents the research data, analyses data and discusses the outcome of the analysis.
- **Chapter 5 Conclusion and recommendations:** This chapter records major findings and conclusions from the research results and documents possible answers to the management problems, subject to the investigation.

1.9 SUMMARY

NDPW has the potential to improve on the delivery of government projects in the Northern Cape Province. It is therefore of great value to study the failures of government projects in the Northern Cape Province, to determine why projects are not completed within the agreed schedule, budget and according to the specifications and

needs of the client departments. In Chapter two, a literature review is conducted to investigate the factors influencing government capital projects to fail.

CHAPTER 2

PUBLIC SECTOR PROJECT MANAGEMENT

2.1 INTRODUCTION

The purpose of this chapter is to provide an understanding of the concept of a project, project management in the public sector, the context of managing the projects in the public sector and its current state. The focus is on the project management practices in the Northern Cape Province. This chapter starts with defining the concept of projects and provides an overview of different perspectives regarding these ventures. It then delves into explaining the dimensions of project management, the development stages of the projects and the importance of the construction sector in the context of South African governance.

Subsequently governance issues are investigated, the budget and procurement processes in the public sector are explored, and the concept of supply chain management (SCM) guidelines is studied. The formation of the South African Council for Project and Construction Management Professions (SACPCMP), the international association of project management and their role in developing the standards of project management, are then discussed (Project and Construction Management Professions Act, 2000). A section is devoted to illustrate project success factors and existing problems after which the discussion is steered towards the Project Management Body of Knowledge's (PMBOK) principles.

The review of the public sector, public sector environments and project managers in public sector, describes how the public sector is different from the private sector and the constraints that make project management unique in the public sector context.

2.2 PUBLIC SECTOR PROJECT MANAGEMENT CONCEPTUAL FRAMEWORK

This chapter aims to present a conceptual framework for understanding the governance of construction project processes, the aim is to be comprehensive in covering all the different capital project lifecycles within one conceptual framework. Thereby it is hoped that more insightful empirical research can be developed and executed.

2.2.1 Legislative and other mandates

The Constitution of the Republic of South Africa, 1996 (The Constitution), has assigned powers and functions relating to public works at national level to the Minister of Public Works. In addition hereto, the National Department of Public Works' (NDPW) mandate is the custodianship and management of a significant portfolio of the National Government's immovable assets. This includes the provision of accommodation, strategic leadership to the construction and property industries, as well as user departments at National Government level, and the planning, acquisition, management and disposal of immovable assets under the custodianship of NDPW.

The mandate of NDPW is largely governed by the Government's Immovable Asset Management Act, 2007 (GIAMA). The act aims to ensure efficient and effective immovable asset management throughout government in order to improve service delivery (NDPW Strategic Plan, 2012-2016), and to ensure that the construction work executed by and on behalf of the department is in accordance with best practices and to the requirements of the client departments. NDPW established the Construction Industry Development Board Act, 2000, the Council for the Built Environment Act, 2000 and the six Professional Council Acts. These regulate the six built environment professions:

- The Engineering Council of South Africa (ECSA);
- The South African Council for the Architectural Profession (SACAP);
- The South African Council for the Landscape Architectural Profession (SACLAP);
- The South African Council for the Quantity Surveying Profession (SACQS);
- The South African Council for the Property Valuers Profession (SACPVP); and
- The South African Council for Project and Construction Management Professions (SACPCMP).

As a major custodian of state's immovable assets, NDPW is responsible for the planning, acquisition, management and disposal of state immovable properties. As the provider of accommodation to user departments, NDPW plays a key role in the delivery of infrastructure. National Departments are required to ensure that each of the

industries contribute to the national goals of economic growth, employment and investment; having pioneered the development of the Infrastructure Development Improvement Programme (IDIP) toolkit. The toolkit was revised in 2010 in partnership with the Construction Industry Development Board (CIDB) and the National Treasury. The toolkit has three delivery processes, namely portfolio management, project management and operations management. Most importantly, it has a construction procurement strategy that enables faster processes in the delivery of infrastructure. The Department of Public Works is responsible for managing and delivering on the building programmes of the department, and further ensures continuous development of norms and standards for the construction of government facilities.

Working in conjunction with public entities that report to NDPW, the delivery of social infrastructure, development of skills in the built and property environment, and national contractor development have been prioritized. The Council for the Built Environment (CBE), together with the 6 Professional Councils (ECSA, SACAP, SACLAP, SACQS, SACPVP, and SACPCM) and the Construction Industry Development Board (CIDB), are all playing an active role in this regard. The Independent Development Trust (IDT) is focusing on the delivery of social infrastructure on behalf of the Government. NDPW regulates the construction industry and built environment (NDPW Strategic Plan 2012-2016: 4-5). Stakeholders are the people involved in or affected by project activities.

Project management stakeholders of the NDPW include:

- The project sponsor (client departments);
- The project manager;
- The project team;
- Support staff;
- Customers;
- Users; and
- Suppliers.

List of clients (project sponsors) handled by the NDPW

- Department of Agriculture;
- Department of Correctional Services;
- Department of Defence;
- Department of Home Affairs;
- Department of Justice and Constitutional Development;
- Department of Labour;
- Department of Minerals and Energy;
- Department of Trade and Industry;
- Department of Water Affairs;
- Government Communication and Information Systems;
- Independent Complaints Directorate;
- Parliament;
- Public Protector;
- South African Police Services;
- South African Social Security Agency; and
- Statistics South Africa.

A client (project sponsor) is considered as the initiator of a project, responsible for the production of the project. It is important that clients understand the design, procurement, and construction processes. The clients (project sponsors) provide valuable information which may help various participants to improve their best performance on a project. Clients are either experienced or inexperienced. The clients' attitude and their project management approach could have a significant effect upon the attainment of project objectives.

The enormous importance of clients' influence on project performance can be accessed from factors such as the clients' understanding of the project constraints; their ability to effectively brief the design team; contribute ideas to the design and construction processes; and finally, to make authoritative as well as stable decisions quickly.

2.3 IMPORTANT ROLE OF THE CONSTRUCTION SECTOR IN THE SOUTH AFRICAN PUBLIC SECTOR

National Government is committed to economic growth (3,5% by the year 2020), employment creation, sustainable service delivery, poverty alleviation and the eradication of historic inequities. The contribution of the construction sector to the gross domestic product (GDP) provides an indication of the importance of the sector. The GDP reveals the levels of activity of each industry within the national economy. The figures of the GDP of each industry represent its performance in terms of employment levels, economic activity and its contribution to national development. The construction sector rose by 0,5 per cent in 2011 and 2,5 per cent in 2012, mainly due to stronger civil construction activity. The real value added by the construction sector gained further momentum in the first quarter of 2013 by 0,9% (SARB, 2013:6).

All infrastructure investment and development spending programmes should therefore support these objectives. In order to meet them in the most cost-effective, sustainable and equitable way, the Government has proposed a set of normative principles to be used as a guide by all spheres of government when making decisions on infrastructure investment and development spending.

These normative principles must be taken into account when planning for infrastructure. Norms and standards are to be obtained from the appropriate national departments – modified to be appropriated by the provincial policy. Many standards are independently established in accordance with independent tests and/or empirical best practices, and independently published by the SABS and similar institutions. Examples include:

- Construction Industry Development Board Act, 2000 (Act 38 of 2000): Establishes a means by which the Board can promote and implement policies, programmes and projects aimed at procurement reform, standardization and uniformity in procurement documentation, practices and procedures within the framework of the procurement policies of the Government. The CIDB establishes a national register of contractors (and if required, consultants and suppliers) to manage public sector procurement risks.

- Preferential Procurement Policy Framework Act, 2000 (Act No 5 of 2000): Establishes the manner in which preferential procurement policies are to be implemented. An organ of state must, in the tender documents, stipulate the preference point system which will be applied in the adjudication of tenders. Over and above the awarding of preference points in favour of historically disadvantaged individuals, the following activities may be regarded as a contribution towards achieving the national goals: the uplifting of communities through, but not limited to, housing, transport, schools, infrastructure donations, and charity organizations.

Community needs and the expectations of government are becoming more sophisticated and complex. These expectations are manifested by demands for better quality, value for money, environmental awareness, innovative solutions and relevant value-adding services. A clear identification or needs assessment of the community is required to ensure that infrastructure strategies accurately reflect both the quality and quantity of infrastructure required to satisfy the community's need for services.

Tabling the 2014 Budget in Cape Town, the previous Minister of Finance, Mr Pravin Gordhan, remarked that the country's National Development Plan (NDP) calls for investment in infrastructure to ensure that the economy grows at the 5% per annum level needed to make significant progress in creating jobs and reducing poverty. Gordhan said that expenditure on social infrastructure - which includes health, education and community facilities would increase from R30 billion to R43 billion over the next three years (M&G, 2013).

Government translates community needs and expectations into services by using its policy framework. The components include aspects such as legislation, government policies, priorities and strategies, White papers, and fiscal strategies. Each one of these aspects must be interpreted and analysed against community requests.

2.4 PROJECT MANAGEMENT PROCESSES IN THE PUBLIC SECTOR

The infrastructure planning process and the budget planning process are interconnected and dependent on each other. A new project that enters the planning

process for the first time in a specific year may only enter the construction phase 2 years later. The above is a result of the time required to perform feasibility studies and to design the project before procuring the contractors. On small projects, this process might only take a few months, but on larger projects, it might take up to 12 months or more. The budget process plans for a three year window that is moved forward by one year every year. Only the year 1 budget is implemented, and has to contain the following (CIDB Toolkit, 2006):

- Funds for commitments made in previous years required to complete implementation of projects started 2, 3 or more years previously;
- Funds for new projects planned the previous year; and
- Funds for the planning and implementation management processes, i.e. the organization and support requirement to plan and manage the implementation of the programmes.

In order for the delivery of projects to be sped up, various actions are required to plan, initiate and complete an infrastructure project which needs to be as streamlined as possible. Furthermore, it would be useful if the project planning activities (i.e. initiation, feasibility and design) could be completed in the preceding years in order for the construction project to commence at the beginning of a new financial year (CIDB Toolkit, 2006).

The implication is that the forward planning of the following year's projects needs to be incorporated into the annual infrastructure programme activities and budget, for the current year. Good strategy in the delivery and maintenance of construction works includes the skilful planning and managing of the delivery process. The strategy involves a carefully devised plan of action which needs to be implemented; it is all about taking appropriate decisions in relation to the available options and prevailing circumstances, in order to achieve optimal outcomes (CIDB Toolkit, 2006).

Procurement strategy is the combination of the delivery management strategy, contracting arrangements and procurement arrangements for a particular procurement. A procurement strategy could be developed for a single project, a programme of

projects, or a portfolio of projects, in order to identify the best way of achieving objectives and value for money whilst taking into account the risks and constraints. Once the necessary decisions relating to the delivery management strategy, the contracting arrangements and the procurement arrangements have been made, the procurement strategy may be implemented in respect of each package. Thereafter, depending upon the choices that are made, the design team might need to be managed, and the contract managed or administered in accordance with the provisions of the contract. Programme management will also be required where projects are delivered in terms of a programme (CIDB Toolkit, 2006).

2.4.1 Project life cycle

Project management is “the application of knowledge, skills, tools and techniques to project activities to meet project requirements” (PMBOK Guide, 2008). The South African Council for the Project and Construction Management Professions (SACPCMP), identified the project work stages for typical construction projects. According to them the stages are project initiation and briefing, concept and feasibility, design development, tender documentation and procurement, construction documentation and management, and project close out (SACPCMP, 2011).

Engineering and construction works in the public sector, irrespective of the project delivery option that is selected, require that the projects be managed within the following framework, describing the stages to be undertaken (CIDB Toolkit, 2006):

- Phase 1: Initiation;
- Phase 2: Design;
- Phase 3: Procurement of contractor by open bidding process;
- Phase 4: Construct and complete the works;
- Phase 5: Commissioning and handover of works; and
- Phase 6: Closing of the project.

Most infrastructure delivery projects will go through the stages as described in the framework above. This project delivery framework may be deviated from if, for example,

the works are constructed by a departmental team and the bidding process is not required.

Each phase, as described above, can be seen as a sub-project with its own unique goal. Phases are usually described in terms of deliverability (preferably template based), to be approved by an appropriate approval authority. These approvals are commonly known as “milestones” to be achieved or “gates” to be opened, which then “permits” the project manager to proceed with the next stage of the project. Project stages are therefore strictly sequential and may only be implemented concurrently if permission is obtained to “fast track” the project, i.e. starting the next stage before completing a previous phase.

The work to be done during each stage of the project is summarized in terms of management processes or work packages (PMI Body of Knowledge, 2008) to be completed in that particular phase of the project. A detailed description of the work to be done, in order to complete each management process or work package, is given in the form of tasks to be performed. Project management best practice requires that responsibility be assigned to a specific member of the project team for performing each listed task (i.e. in adherence to the project management principle of “single point of responsibility”). There are normally links between these tasks and they can be performed sequentially or concurrently, depending on the availability of the project’s human resources.

The above information indicates that project life cycle differences exist between various industries. Therefore, the life cycle stages are not accepted as generic, but are seen as industry specific, even though there are large similarities. This is important theoretical knowledge for the research study, as it delves into understanding whether project management is generic or not, and whether industry specific knowledge is needed within the project management. The objectives of project management should be completed on time, within cost budget and to a technical or performance standard which satisfies the end user.

2.4.2 Budget processes

In support of the broader governmental objective of continual improvement in service delivery, the National Treasury provides guidance on how infrastructure programmes and project proposals should be planned, appraised and evaluated before any significant funds are committed (National Treasury, 2014). The guidance encourages an analytically robust life-cycle evaluation process that ensures alignment, not only between departmental planning processes (strategic planning, infrastructure planning and budget planning), but also with the Immovable Asset Management Act (GIAMA).

The mandate (responsibility) and policies of government departments describe the minimum level of service to be provided and the manner in which a department should conduct its business. For example, NDPW as an asset manager ensures that immovable property owned and/or utilised by the State for delivering various government services, yield functional, economic and social benefits to the State. These mandates and policies are set through political processes in the legislative environment. The strategic plan takes a five year view of development in line with a department's defined mandate and policies.

A departmental strategic plan will define how the members of the communities will be provided with the services defined in the policies of government and it will comprise of two main components – the strategic plan for service delivery, and the supporting plans for human resources, asset management, infrastructure, information systems, financial strategies and so forth. Infrastructure planning is undertaken parallel with the development of the strategic plan and these must fully align. Governments are required to deliver services to people that they serve. Organs of state are instruments of government and the means by which services are rendered to the public (National Treasury, 2014).

These organs of state are provided with the necessary mandate to provide a range of services and the means to do so through the annual budgetary processes. Public services are delivered in line with the policies and departmental programmes and objectives are set out in the annual budget. Each year the annual budget is finalized for

the current financial year, whilst the Medium Term Expenditure Estimates (MTEE) are established for the next three years, on a continual rolling basis. Medium-term budgeting is a continuous process that culminates each year in an annual budget and a Medium Term Expenditure Estimate that the Minister of Finance tables in Parliament (National Treasury, 2014).

Planning and budgeting are not once-off processes, but are iterative and impact on each other. The annual budgeting cycle used by government requires the following (National Treasury, 2014):

- The service delivery plan and associated long-term budget of the previous year, is reviewed and updated to reflect the most current state. Some planned projects may have been delayed and other projects may have been completed earlier than planned.
- The window under review is moved on one year – expected expenditures are replaced with actual expenditures and a new future year becomes the third year of the window.
- The changes to budget baselines approved in the previous options process are made and if applicable, revenue estimates are updated.
- Changes in strategic priorities are noted and projects are re-prioritized by moving them earlier or later in the long-term budget. The movement is therefore in or out of the MTEF window, but never off the budget in total.
- The funding gap (for the next two years) is noted and if significant, various mechanisms are used to obtain additional funds.

After additional funding is obtained, the final prioritization takes place to ensure that the projects planned within the MTEF window are within the available budget. The annual budget – plus two years (MTEF) – takes its direction from the departmental strategic plans. The infrastructure plan informs the infrastructure component of the MTEF's budgeting process.

The National Treasury annually produces a set of complementary publications providing comprehensive information on the Government's revenue raising and spending plans

for the current and medium-term budgets. These are published annually, and are available on the National Treasury's website (www.treasury.gov.za).

Each responsible minister at national level of the Government is tasked with the appointment of an accounting officer to implement the departmental programmes that are identified within their budget vote. The accounting officer is required to put in place the required procedures, processes and controls that will allow the departmental and infrastructure programmes to be implemented, monitored and the objectives achieved. The obligations are placed on him through the Public Finance Management Act (Act No 1 of 1999) (PFMA), which furthermore requires the accounting officer to submit certain information and reports to National Treasury on a regular basis.

The intention behind the PFMA's reporting requirements is to ensure that the programmes and projects identified for each organ of state are implemented and that their respective objectives are achieved. The PFMA is applicable to both national and provincial departments as well as state owned enterprises.

All projects go through a series of distinct stages from the initial project idea to the time that the project is completed and handed over. It is important for institutions to understand these project stages and the analysis to be carried out at each stage. These analyses are integral to a logical approach to project planning that will assist in the appraisal of the project. The analyses will also provide the rationale or justification for government funding for the project. A clear need, which is in national interest, must be articulated (National Treasury, 2014).

2.4.3 Minimum information required for capital projects funding

The following information must be submitted for each capital project in the public sector. While every project must address all the steps, the detail and rigor applied at a particular stage will be dependent upon the size and complexity of the project, according to the following stages:

2.4.3.1 Stages - Preparatory work (National Treasury, 2014).

(a) Needs and demand analysis with output specifications - The needs analysis should demonstrate alignment with the institution's mandate and strategic objectives. The National Department of Public Works (NDPW) is the custodian of the National Government's immovable assets, and provides strategic leadership to the Construction and Property Industries. The purpose of this analysis is to enable the institution to visibly identify a clear infrastructure need, make obvious output specifications and ascertain the extent of the current and future demand for the service.

(b) Options Analysis - The purpose of an options analysis is to undertake an analysis of all feasible options that can achieve the identified output specifications. This will assist in identifying the preferred solution.

- **Demand Analysis:** The first step is to confirm that there is a demand for the goods and services that will be produced by the project. This is important because the levels of the current and forecasted demands should be sufficient to meet the financial and economic feasibility of the project
- **Technical Engineering Analysis:** This is an important step that determines the scale, design, location and technology that will be adopted by the proposed project. The input parameters necessary for the construction, operation and maintenance of the project are identified, quantified and the cost approximated over the life of the project. To be able to do this, it is necessary to come up with an implementation schedule that sets the output levels. The most cost effective procurement procedures are also considered at this stage. The technical assessment is crucial and needs to be accomplished accurately and thoroughly. The technical feasibility will then inform the financial analysis, by providing detailed clarification on the costs of construction, operation and maintenance of the project, identifying potential risks. Different technology choices for the project, including designs and the need for prototyping, should be assessed to determine whether they will be viable for delivering the desired project outputs.
- **Environmental Analysis:** Every project involving new construction or substantial rehabilitation of an existing structure, will involve undertaking an Environmental Impact Assessment (EIA). In those instances where the institution is going to

procure by conventional means, the construction of a facility of its own design, the institution must undertake the EIA and obtain all necessary environmental, zoning and town planning consents. The cost of doing this is one of the costs that must be identified early on and quantified when determining the feasibility of a particular project.

- **Socio-Economic Analysis:** Many service infrastructure projects provide potential economic benefits to BEE and SMME enterprises, as well as the community in general. The implementation of a project can result in an increase in land values or in an increase in the demand for affordable housing. The use of local labour and materials in a major infrastructure project also provides significant benefits to communities affected by the infrastructure project. There may also be costs that are not easily realizable, such as those resulting from congestion in the city caused by the implementation of the project. All these need to be translated into economic values.
- **Legal and Regulatory Due Diligence:** A legal and regulatory due diligence study should investigate whether the project complies with all regulatory requirements, as well as identify any risks and obligations that could increase costs or decrease benefits. The cost of compliance must be included in the financial and economic analysis.

(c) Procurement Plan - A procurement plan must be submitted. The plan needs to demonstrate that the proposed procurement method is the most appropriate for the project and should result in the achievement of the targeted outcomes. This includes indicating the procurement methodology that will be employed, and the way it will be managed. The plan should include a description of the bidding and bid evaluation process, a high-level project plan, key milestones and timelines, as well as the envisaged institutional and financial arrangements.

Appraisal of capital projects is not a straight forward step by step process where the different analyses are independent from each other and can be performed in a perfectly sequential manner. Information needs to flow between the different capital planning

guidelines analyses, and constant feed-back mechanisms need to be in place to ensure the coherency of all the documentation.

The appraisal activities may be outsourced, depending upon the capacity resident in an institution. Institutions must provide for project planning within their current MTEF budget baselines, including as necessary, funding for outsourced capital project appraisals. Multiple small projects with the same outputs may be grouped and motivated as a single infrastructure programme, requiring funding (National Treasury, 2014)

2.4.4 Procurement Processes - CIDB, PFMA and Treasury Regulations

Procurement is the process to create, manage and fulfil contracts. Procurement as such forms an integral part of construction projects and occurs at any point in a project cycle where external resources are required to provide supplies and services in any combination or in the disposal of surplus plant, equipment or materials and the demolition of redundant buildings and infrastructure (CIDB, 2007: 01).

Procurement may be defined as the process which creates, manages and fulfils contracts relating to the provision of supplies, services or engineering and construction works, the hiring of various items, disposals, and the acquisition or granting of any rights and concessions (CIDB Toolkit, 2006). If procurement is indeed a process, it can be documented as a succession of logically related actions occurring or performed in a definite manner, which culminates in the completion of a major deliverable or the attainment of a milestone. Processes in turn are underpinned by methods (i.e. a documented, systematically-ordered collection of rules or approaches) and procedures (i.e. the formal steps to be taken in the performance of a specific task, which may be evoked in the course of a process), which are informed and shaped by the policy of an organization. Methods and procedures should likewise be documented and linked to processes (CIDB 2007:01).

2.4.5 Overview of the Construction Register Service

The Construction Register Service comprises the Register of Contractors and the Register of Projects which have been established in terms of the CIDB Act (Act 38 of 2000). The Register of Contractors grades and categorises contractors according to financial and work capability. It is mandatory for public sector clients to apply at the Register of Contractors when considering construction work tenders. The Register of Contractors facilitates public sector procurement and serves as a framework for contractor development. The Register of Projects gathers information on the nature, value and distribution of projects. When clients register projects, the track records of contractors are updated and the information is made available to other clients through the CIDB website.

Public sector clients are required to register projects above R200 000, while private sector clients and large state owned entities are required to register projects above R10 million. The CIDB has also developed the I-Tender service, which enables clients to contact contractors available for tender opportunities, via email and sms. Tenders are also displayed on the CIDB Register of Projects website. Table 2.1 below displays classes of works by grading for all provinces while Table 2.2 is only for the Northern Cape Province.

TABLE 2.1 Classes of Works by Grading – All Provinces (South Africa)

Designation	CE	EB	EP	GB	ME	SW	Total
1	25084	1680	6085	54683	6058	20541	114131
2	1593	157	171	2132	309	604	4966
3	920	60	94	609	114	197	1994
4	909	105	241	855	181	195	2486
5	692	122	215	594	163	168	1954
6	789	62	180	687	151	112	1981
7	426	42	88	327	60	61	1004
8	154	11	37	124	40	39	405
9	73	2	24	46	30	24	199
Total	30640	2241	7135	60057	7106	21941	129120

(Source: CIDB website 30/07/2015).

There are a high number of contractors active in the general building (GB) and civil engineering (CE) construction categories between CIDB grading 1 and 2, with the

numbers lower for grades 8 and 9, as displayed in Table 2.1 above. Although grade 9 is the highest a contractor can achieve, its threshold starts at a contract value of over R130 million, meaning that the contractors graded here can qualify to bid for large infrastructure projects. As on 30/07/2015 there were only 2 contractors registered under CIDB grading 9 for electrical building (EB) in the entire country. In practice, out of the 129 120 contractors registered on the CIDB database, only a few (about 199) have the capacity to undertake large infrastructure projects (value threshold above R130 million), like the constructions of highways, stadiums, and power stations.

TABLE 2.2 Classes of Works by Grading – Northern Cape Province

Designation	CE	EB	EP	GB	ME	SW	Total
1	498	52	102	1438	137	353	2580
2	31	5	5	80	9	23	153
3	9	1	1	15	2	5	33
4	12	3	4	15	2	3	39
5	10	2	3	9	3	2	29
6	13	1	1	12	2	0	29
7	7	0	0	5	0	0	12
8	5	0	0	1	0	0	6
9	0	0	0	0	0	0	0
Total	585	64	116	1575	155	386	2881

(Source: CIDB website 30/07/2015).

There are many contractors registered with the CIDB in South Africa, as required by the CIDB Act. Most of these contractors are concentrated in the lower CIDB grades 1 and 2 (Table 2.2). For example, to be registered as a grade 1 contractor, a contractor is not required to have any turnover, work experience on a project or even have working capital (CIDB, 2015). According to the CIDB database as on 30/07/2015, there were no contractors registered under CIDB grading 9 in the Northern Cape Province. In practice, if there are infrastructure projects with a value threshold of more than R130 million, none of the contractors in the province will be able to submit their bids because of their insufficient grading.

There are, however, provisions in the CIDB regulations to allow contractors to enter into joint ventures. By doing this they could receive a higher grade in order to bid for certain projects. The joint venture arrangements set out in the CIDB regulations, ensure that

contractors are provided with an opportunity to bid for work that they would otherwise not qualify for individually. For instance, in the case of large projects with a value of over R130 million (grade 9), there is a provision for a joint venture by three grade 8 contractors, which could provide some scope for competition for grade 9 contractors.

The Construction Register Service was established in terms of the CIDB Act 38 of 2000. The service offers a basis for sustainable construction development and growth through improved delivery, performance and sustainable empowerment (CIDB, 2015). The categories under which these entities are graded are as follows (CIDB, 2015):

Category	Definition
Civil Engineering (CE),	Construction works primarily concerned with materials such as steel, concrete, earth and rock; and their application in the development, extension, installation, maintenance, removal, renovation, alteration or dismantling of building and engineering infrastructure.
General Building Works (GB)	Construction works that: a) Are primarily concerned with the development, extension, installation, renewal, renovation, alteration, or dismantling of a permanent shelter for its occupants or contents; or b) Cannot be categorized in terms of the definitions provided for civil engineering works, electrical engineering works, mechanical engineering works or specialist works.
Specialist Works (SW)	A subset of construction works identified and defined by the CIDB that involves specialist capabilities for its execution. The development, extension, installation, removal, and dismantling and everything relevant to or associated with building excavations, shaft sinking and lateral earth support.
Electrical Building Works (EB)	Construction works that are primarily concerned with the installation, extension, modification or repair of electrical installations in or on any premises used for the transmission of electricity from a point of control to a

	point of consumption, including any article forming part of such an installation.
Electrical Engineering Works (EP)	Construction works that are primarily concerned with the development, extension, installation, removal, renovation, alteration or dismantling of engineering infrastructure: a) Relating to the generation, transmission and distribution of electricity; or b) Which cannot be classified as EP.
Mechanical Engineering Works (ME)	Construction works that are primarily concerned with the development, extension, installation, removal, alteration and renewal of engineering infrastructure for gas transmission and distribution, solid waste disposal, heating, ventilation and cooling, chemical works, metallurgical works, manufacturing, food processing and material handling.

(Source: CIDB website 30/07/2015).

The grading system reflects contracting financial and works capability as it pertains to the value range of each tender that contractors are able to handle, based on their individual grades. All contractors seeking to participate in public sector infrastructure delivery must be registered on the CIDB Register of Contractors. Contractors who are exempted from registration are:

- Home builders, unless they also wish to tender for other types of public sector construction work.
- Those who undertake contracts consisting substantially of the provision of labour.
- Those who undertake contracts consisting substantially of the provision of supplies.

According to the CIDB Act 38 of 2000, no public sector client may award construction contracts to a contractor who is not registered. The register grades contractors according to their capability to carry out construction projects. There are 9 different grading levels according to which contractors can be registered. A grade determines the maximum Rand value of a project as well as the type of construction works a contractor is capable to perform. See Table 2.3 below for tender value ranges.

TABLE 2.3 Tender Grades and Value Ranges

Grade	Tender value less than or equal to (R)
1	200 000
2	650 000
3	2 000 000
4	4 000 000
5	6 500 000
6	13 000 000
7	40 000 000
8	130 000 000
9	No limit

(Source: CIDB website 30/07/2015).

The CIDB grades, from 1 to 9, determining the value of tenders a firm can bid for based on its annual turnover, the value of projects undertaken and available working capital. This system thus regulates the extent to which contractors can participate in bids in the public sector. There are, however, provisions in the CIDB regulations that allow contractors to enter into joint ventures. This enables them to receive a higher grade in order to bid for certain projects. The joint venture arrangements set out in the CIDB regulations ensure that contractors are provided with an opportunity to bid for work that they would otherwise not qualify for individually. For instance, in the case of large projects with a value of over R130 million (grade 9) there is provision for a joint venture by three grade 8 contractors, which could provide some scope for competition for grade 9 contractors.

The current grading of contractors is set out in Table 2.3. There are six principal procurement activities and a number of generic steps that need to be taken to proceed from one activity to another (CIDB, 2007):

1. Establish what is to be procured;
2. Decide on procurement strategies;
3. Solicit tender offers;
4. Evaluate tender offers;
5. Award contract; and
6. Administer contracts and confirm compliance with requirements.

Procurement activities commence once the need for procurement is identified and end when the transaction is completed. The activities will commence when the client department issues the National Department of Public Works (NDPW), with a procurement instruction (PI), and the activities will end when the project is handed over to the client department. The starting point in developing any procurement system is to identify procurement activities that commence once the need for procurement is identified and end when the transaction is completed (see Table 2.4).

TABLE 2.4: Principal procurement activities, associated steps and internal controls.

ACTIVITY		STEPS	
#	DESCRIPTION	Inputs	Procedural milestone (control point)
1	Establish what is to be procured	1. Prepare broad scope of work for procurement	3 Obtain permission to start with the procurement process
		2. Estimate financial value of proposed procurement	
2	Decide on procurement strategies	1. Establish applicable preferential procurement policy	5. Obtain approval for procurement strategies that are to be adopted
		2. Establish contract and pricing strategy	
		3. Establish targeting strategy	
		4. Establish procurement procedure	
3	Solicit tender offers*	1. Prepare procurement documents	2. Obtain approval for procurement documents 3. Confirm that budgets are in place
		4. Invite contractors to submit tender offers or expressions of interest#	8. Confirm shortlist #
		5. Receive tender offers or expressions of interest#	
		6. Evaluate expressions of interests #	
		7. Prepare evaluation report on shortlisting process#	
		9. Invite tender offers from shortlist#	
4	Evaluate tender offers*	1. Open and record tender offers received	7. Confirm recommendation contained in the tender evaluation report.
		2. Determine whether or not tenders offers are complete	
		3. Determine whether or not tender offers are responsive	
		4. Evaluate tender submissions	
		5. Perform a risk analysis.	
		6. Prepare a tender evaluation report	
5	Award contract*	1. Notify successful tenderer and unsuccessful tenderers of outcome	3. Formally accept tender offer
		2. Compile contract document	
		4. Capture contract award data	
6	Administer contracts and confirm compliance with requirements	1. Administer contract in accordance with the terms and provisions of the contract	3. Capture contract completion / termination data
		2. Ensure compliance with requirements	

(Source: CIDB, 2007)

These generic steps in Table 2.4 may be categorized as either inputs towards the attainment of a milestone within the procurement process, or procedural milestones

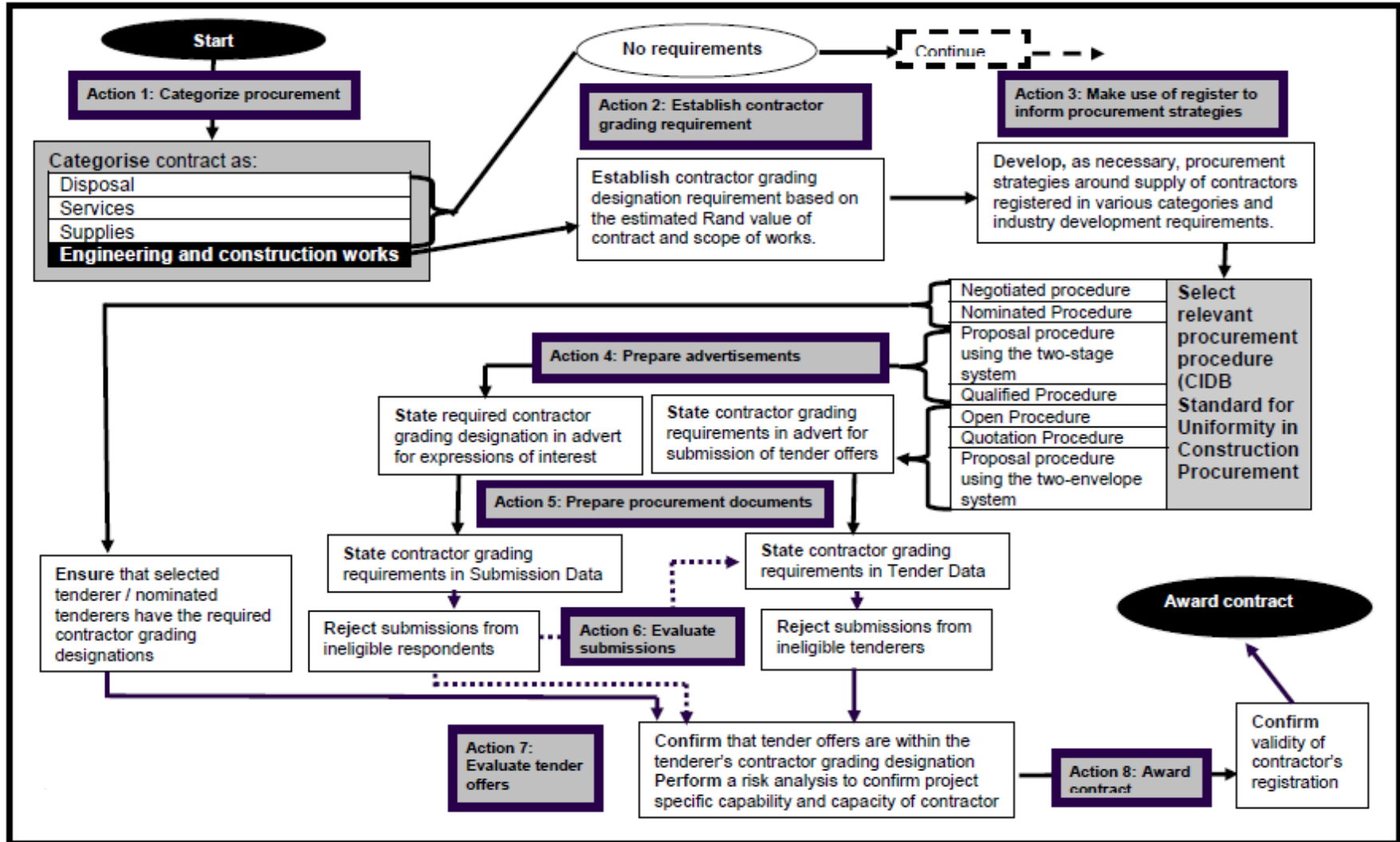
which require decisions or approvals in order to proceed to the next step. Not all of these steps will necessarily be required in a particular procurement.

Figure 2.1 below illustrates the steps to be followed for inviting, awarding and managing public sector contracts in accordance with the registrar of contractors. The major activities associated with infrastructure or related acquisitions are:

- Acquire supplies, services, engineering and construction works; and
- Take delivery of supplies, project deliverables, engineering and construction works.

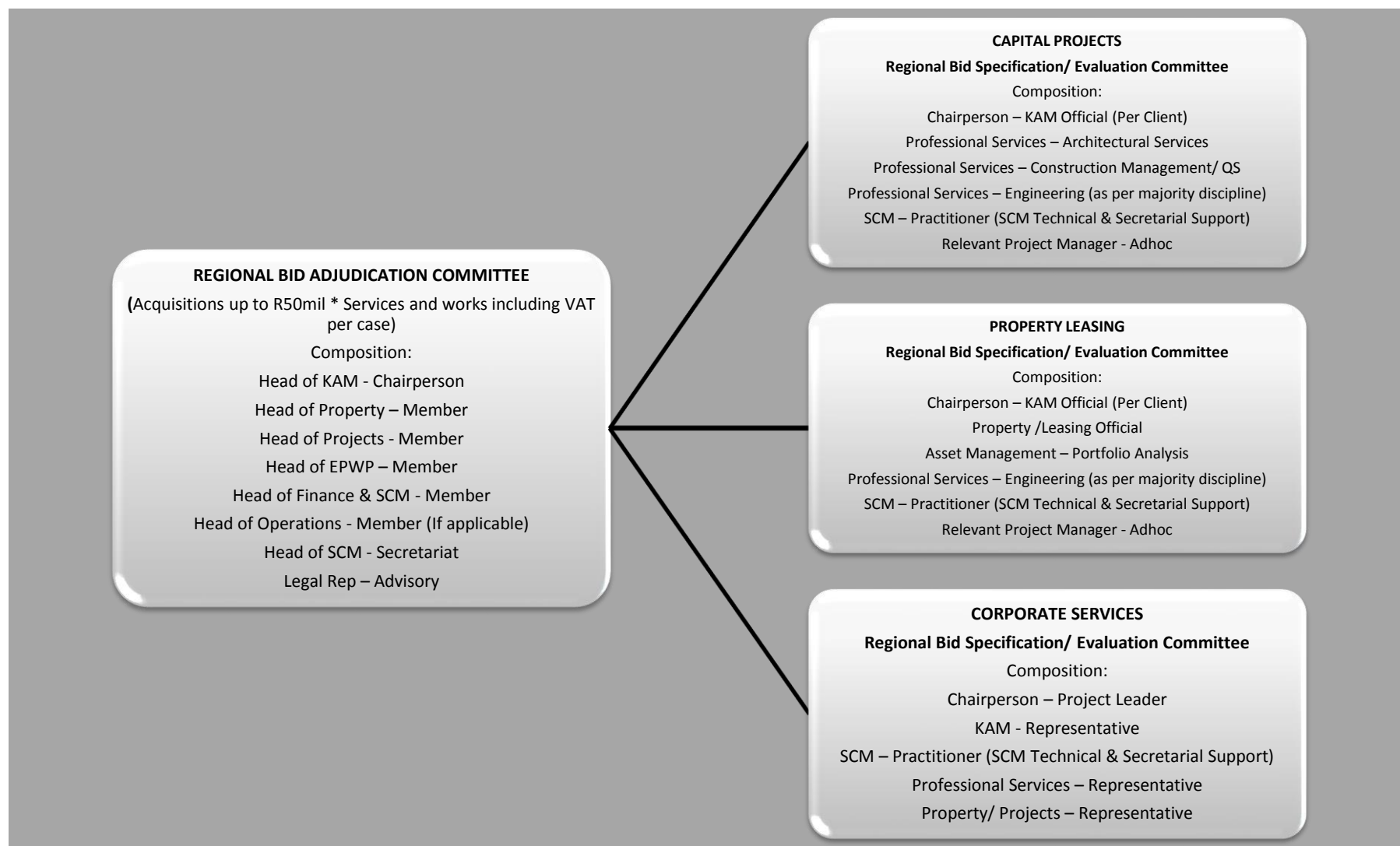
Once the procurement process is completed, the NDPW delegated official/s will need to administer the contracts that are awarded to the winning vendors. This can involve things like monitoring the quality of deliverables, performance of the project schedule and communicating changes to the project team. Outside vendors or contractors should submit a project management plan that integrates with the plan and schedule for the overall project within the organization, see Figure 2.1 below.

FIGURE 2.1 – Framework for inviting, awarding and managing public sector contracts in accordance with the Registrar of Contractors



(Source: CIDB website 30/07/2015).

TABLE 2.5: Composition of the regional bid specification/evaluation/adjudication committees.



(Source: NDWP SCM Policy, 2014)

Table 2.5 illustrates the different bid committees in the NDPW, their composition and delegations of power. The next paragraph explains in detail the roles and functions of the different bid committees in the NDPW.

2.4.6 NDPW Bid Committees.

Capital Projects Regional Bid Specification/Evaluation Committee in Table 2.5 is responsible for all Engineering and Construction Works (including planned and unplanned maintenance) and professional services in the built environment.

2.4.6.1 This Bid Specification and Evaluation Committee will comprise of the following officials (NDPW SCM Policy, 2014):

- Chairperson – Key accounts manager (KAM) official (as per Client);
- Professional Service - Architectural services;
- Professional Service - Construction management/QS;
- Professional Service - engineering (as per majority discipline); and
- SCM – Practitioner to provide – SCM technical and secretarial support.

The relevant project manager is ex officio a member on an ad hoc basis per specified project. The role of the project manager is:

- To initiate the project;
- To facilitate the crafting of draft specifications;
- To manage the scope of the project; and
- To draft the procurement strategy and where applicable, do the application to extend the tender validity period, as well as present this to the Regional Bid Specification Committee (RBSC) for deliberation, assessment, review and recommendations to the relevant Regional Bid Adjudication Committee (RBAC) for approval thereof.

Where a position is not available at the regional office, a request must be made through the relevant line function for, as far as pragmatic, the assignment and inclusion of the relevant official from head office in the committee. This process must not in any way be protracted to cause delays in service delivery.

The regional bid specification/evaluation committees for acquisitions in excess of R50 million, will be constituted as per functional categories. The appointment of these committees is per project and the composition thereof will be recommended by the regional manager or the chief director, SCM, at head office, for approval. The recommendations of the duly appointed Regional Specification/Evaluation Committees for acquisitions in excess of R50 million shall be submitted through the office of the regional manager for noting and concurrence with the relevant National Bid Adjudication Committee (NBAC).

2.4.6.2 Roles and Functions of the Bid Specification Committees (BSC)

The Regional Bid Specification Committees for acquisitions in excess of R50 million will be constituted as per functional categories. See Table 2.5 (NDPW SCM Policy, 2014).

- The project manager must compile a request for the chief director, SCM (head office), or regional manager (regions) for the composition of a BSC. The request must be on a PA25, the request for approval of a BSC/BEC form.
- Where standard specifications are available, the standard specifications must be used and the BSC shall merely endorse the use of the standard specifications.
- Where the project manager does not utilise the standard specifications he/she must motivate to the BSC for approval for not utilising the standard specifications.
- Where there are no standard specifications available, or where the project managers elect not to utilise the standard specifications, they will distribute draft specifications to members of the BSC, to familiarize themselves with and to prepare comments on the specification.
- The appointed chairperson (KAM) in consultation with the project manager and the BSC/BEC secretariat will convene a meeting where members of the BSC will ensure that the requirements for developing specifications have been adhered to.
- Any amendments to the approved specifications, required after the sourcing strategy is approved, must be approved by the BAC.

- The BSC will produce the sourcing/procurement strategy (PA01: request for approval of a procurement strategy) for the specific project for approval by the relevant BAC.
- Although bid specifications may be developed by consultants, the relevant manager is responsible to verify and ensure that bid specifications are drafted in such a way that it promotes competition among prospective vendors.
- The project manager must submit the approved bid specifications to the acquisition unit at least 5 working days before the bid advertising date.

2.4.6.3 Roles and Functions of the Supply Chain Management (SCM) Practitioner in BSC: Administrative Support.

The SCM practitioner in Regional Bid Specification Committees for acquisitions in excess of R50 million will be constituted as per functional categories. See Table 2.5 (NDPW SCM Policy, 2014).

- Ensure the PA-25 (approval of the BSC / BEC) is correct and duly signed;
- Ensure signature of the code of conduct (PA-00) by all bid members;
- Minute taking;
- Provide the declaration of interest and ensure signature thereof by all members;
- Compile a bid plan, in collaboration with the project manager and chairperson of the relevant committee, as well as obtain approval thereof;
- Ensure compilation of the procurement strategy (PA-01);
- Ensure that the project is on the procurement plan;
- Record keeping as per checklist;
- Ensure that the budget is approved prior the advertisement;
- Ensure compliance with the National Treasury practice notes or the CIDB regulations and relevant SCM framework;
- Ensure that specifications are in line with SANAS or the relevant accreditation body; and
- Once a bid specification has been approved, that the specification may not be altered or amended in any manner without the consent of all the members of the BSC who recommended the bid specification, and the approval of the Regional Bid Adjudication Committee (RBAC).

2.4.6.4 Roles and Functions of the Bid Evaluation Committees (BEC)

The Regional Bid Evaluation Committees for acquisitions in excess of R50 million, will be constituted as per functional categories. See Table 2.5 (NDPW SCM Policy, 2014).

- All acquisitions above the value threshold of R500 000.00 must be submitted to the BEC for verification and endorsement of the administrative compliance evaluation must be done by the acquisition unit.
- The BEC will verify:
 - That bids declared non responsive by the acquisition unit, are indeed non responsive;
 - The correctness of all calculations in respect of evaluation scores by the acquisition unit;
 - That the bids that were rejected by the acquisition unit have been rejected on legitimate grounds;
 - That bids were evaluated within the validity period; and
 - That points allocated for price and preference are in line with the approved sourcing strategy.
- In addition to verifying the above, the BEC is also responsible for endorsing the recommendations of the acquisition unit. Before the endorsing of the recommendations by the acquisition unit, the BEC must conduct a risk assessment of the recommended bidder.
- The risk assessment should be conducted by the BEC as a whole, who must agree on the matters to be investigated by the committee. All risk assessment investigations must be conducted in writing and must be in accordance with the risk assessment guidelines issued by the department.
- If, on the basis of the risk assessment conducted by the BEC it is determined that the recommended bidder is a risk to the department, the BEC must document their findings and provide reasons to the acquisition unit for not endorsing their recommendation of the bidder.

- The BEC shall conduct the risk assessment in a fair and unbiased manner. A BEC may be appointed to conduct the functions for a cluster of bids.
- The results of the risk assessment and verification process must be printed as an evaluation report (PA:21) and submitted as a recommendation, together with the relevant supporting documentation to the relevant RBAC for assessment, and for the awarding of the contract. The evaluation report will be considered incomplete, and will not be accepted by the relevant RBAC unless:
 - Each member of the BEC endorsed the bid; and
 - All relevant supporting documentation is attached in support of the recommendation.
- Where the recommendation of the acquisition unit is not endorsed by the BEC, the BEC must also inform the chief director (SCM) of the reasons for the rejection. The chief director (SCM) may uphold or overturn the rejection on justifiable grounds.
- The recommended bidder should be submitted to the RBAC for adjudication and award. Where the highest scoring bidder is not recommended, the bid documents of that bidder, together with the reasons for the rejection, must also be submitted to the RBAC.

2.4.6.5 The Regional Bid Adjudication Committee (RBAC) should comprise of the following officials:

The RBAC for acquisitions in excess of R50 million will be constituted as per functional categories; see Table 2.5 (NDPW SCM Policy, 2014).

- Chairperson - Head of KAM;
- Head of Property – Member;
- Head of Projects – Member;
- Head of Finance & SCM – Member;
- Head of Operations - Member (if applicable);
- Head of EPWP – Member (where there is no Head of Operations);
- Head of SCM – Secretariat; and
- Legal Rep – Advisory.

2.4.6.6 The roles and responsibilities of the Regional Bid Adjudication Committee (RBAC).

The Regional Bid Adjudication Committees for acquisitions in excess of R50 million will be constituted as per functional categories. See Table 2.5 (NDPW SCM Policy, 2014).

- The relevant RBAC shall assess a bid on the basis of the sourcing strategy approved for that bid and accept or reject the recommendation of the Bid Evaluation Committee (BEC).
- The RBAC must assess whether the acquisition process has been found to be fair, equitable, transparent, competitive and cost effective.
- Where the acquisition process is found to be fair, equitable, transparent, competitive and cost effective, the relevant RBAC must accept the recommendation(s) submitted by the BEC, and award the bid to the recommended vendor.
- If the acquisition process is found not to be fair, equitable, transparent, competitive and cost effective, the relevant RBAC must reject the BEC's recommendation, with reasons, and refer the bid back to the BEC/acquisition unit for re-evaluation.
- The RBAC must ensure that recommended vendors are cleared with the Department of Trade and Industry (DTI), regarding the National Industrial Participation Programme for all contracts over R10 million, if applicable.
- The relevant Regional Bid Adjudication Committee must reject a proposal for the award of a bid if there is prima facie evidence that:
 - The recommended vendor has committed a corrupt or fraudulent act in competing for that particular bid;
 - The recommended vendor had access to confidential information within the department;
 - That there is evidence of conflict of interest; or
 - The recommended vendor has abused the department's supply chain management system.

- Where a bid is rejected on any of the above grounds in the RBAC, the rejection of the bid must be referred to the National Bid Adjudication Committee (NBAC) for final approval of the rejection.
- The NBAC must compile a report for submission to the Director General, on all bids rejected on the grounds listed above.
- The Regional Bid Adjudication Committee (RBAC) is required to report on a weekly basis to the accounting officer, through the regional manager, on all the transactions it has handled, indicating the awards made, disapproved submissions and/or returned submissions.
- A standardized reporting template to be updated weekly on Thursdays is provided in the SCM paper trail central repository. These reports must be captured timely on Thursdays to enable consolidations by SCM at the head office.
- A hard copy is to be signed off by the regional manager and also scanned on to the SCM paper trail central repository (NDPW SCM Policy, 2014).

Public procurement in South Africa is regulated in all spheres of government, and state owned enterprises through various pieces of legislation, see Table 2.6 below. The primary pieces of national legislation that govern procurement are listed in Table 2.6, and present an overview of the regulatory framework for procurement and supply chain management.

TABLE 2.6: Regulatory framework for project procurement

Act	Applicability	What it does in respect of Procurement / Supply Chain Management
Constitution of the Republic of South Africa, 1996 (Act No 108 of 1996)	All organs of state	Provides procurement objectives and establishes government's policy for preferencing
Public Finance Management Act, 1999 (Act 1 of 1999)	All organs of state, except in the local sphere of government	Establishes broad framework within which accounting officers / authorities must establish their procurement and provisioning system (supply chain management)
Preferential Procurement Policy Framework Act, 2000 (Act No 5 of 2000)	All organs of state (state owned enterprises) at discretion of Minister)	Establishes the manner in which preferential procurement policies are to be implemented
Local Government: Municipal Finance Management Act, 2003 (Act No 56 of 2003)	Municipalities and municipal entities	Establishes a detailed regulatory framework for supply chain management.
Local Government Municipal Systems Act, 2000 (Act No 32 of 2000); and Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003)	Local sphere of government	Establishes a framework for the establishment of service delivery agreements involving competitive bidding processes
Construction Industry Development Board Act, 2000 (Act 38 of 2000)	All organs of state involved in procurement relating to the construction industry.	Establishes a means by which the Board can promote and implement policies, programmes and projects aimed at procurement reform, standardization and uniformity in procurement documentation, practices and procedures within the framework of the procurement policy of government. Establishes a national register of contractors (and if required, consultants and suppliers) to manage public sector procurement risk.
Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003).	Procurement provisions apply to all organs of state.	Establishes a code of good practice to inform the: <ul style="list-style-type: none"> • Development of qualification criteria for the issuing of licenses or concessions, the sale of state owned enterprises and for entering into partnerships with the private sector; and • Development and implementation of a preferential procurement policy.

(NDPW SCM Policy, 2014)

The basic philosophy underlying the approach to the Public Finance Management Act (PFMA) is to allow “managers to manage and be held accountable,” while politicians are provided with information necessary to set overall policies and priorities for service delivery.

The constitution in Table 2.6 is applicable to all organs of state including municipalities and municipal entities, and requires accounting officers (heads of departments/chief executive officers) and accounting authorities (board/controlling

body/chief executive officer), to have appropriate procurement and provisioning systems in place, that are fair, equitable, transparent, competitive and cost effective. Effective, efficient and transparent systems of financial and risk management and internal control, as well as a system for properly evaluating all major capital projects prior to a final decision on the project, are also very important. When acquiring any goods or service organs of state, the project manager must operate in accordance with the MFMA, PMFA, CIDB Act, PPPFA, & BBBEE Acts. See Table 2.6 above.

Supplies and services which are not available within an institution can be sourced from other institutions or procured. Acquisition management as such deals with the decisions that have to be made in order to manage the acquisition of the required supplies or services from within the institution, or the procurement thereof from the open market. Accordingly, the options for acquisition are (NDPW SCM Policy, 2014):

- Acquisition of redundant/obsolete material, goods and assets from other institutions;
- Sourcing of expertise from other institutions;
- Utilisation of transversal contracts administered by others;
- Public/private partnerships; or
- Procurement from the private sector.

2.4.7 Supply chain management (SCM) guidelines

SCM is a collaborative strategy that integrates procurement and provisioning processes so as to eliminate non-value adding costs, time and activities, in a way that will serve end users better and more competitively (NDPW SCM Policy, 2014:08). Regulations relating to SCM issued in terms of the Public Finance Management Act (PFMA) and the Local Government: Municipal Finance Management Act (MFMA), require accounting officers and accounting authorities to ensure that these acts are applied and implemented within their institutions as part of the supply chain management system that provides for at least the following (NDPW SCM Policy, 2014):

- Demand management (i.e. identify demand, establish requirements and determine needs);

- Acquisition management (i.e. acquire supplies, services, engineering and construction works as well as take delivery of supplies, project deliverables, engineering and construction works);
- Logistics management (codify items, set inventory levels, place orders, receive and distribute, manage stores/warehouses, expedite orders, manage transport and monitor supplier performance);
- Disposal management (i.e. undertake obsolescence planning, find out where all redundant material is kept or located and identify the appropriate disposal strategies. Dispose of surplus and/or redundant assets, materials and equipment);
- Risk management (i.e. establish a culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects); and
- Regular assessment of supply chain performance (i.e. monitoring processes and perform a retrospective analysis to determine whether or not the proper process was followed and the desired objectives achieved).

The next section discusses the existing challenges of NDPW project management.

2.5 DEPARTMENT OF PUBLIC WORKS

Delay has an adverse effect on the delivery of public works projects. However, a large number of associated problems influence project delivery: clients' limited understanding of the construction process; inadequate design; poor quality management during design and construction; poor ground conditions; poor constructability; poor motivation of workers; non-participatory management styles and adverse physical, economical, and socio-political factors. These are all existing problems within the public sector project management.

2.5.1 Existing problems within the public sector project management

According to the Auditor General's South African report (AGSA Report, 2013), for the sector to deliver on its mandate, it needs to use an efficient and effective project management system to manage the budget allocation on its projects by completing projects on time, within the budget and according to the specifications and needs of

client departments. During the Auditor General's report on audit outcomes of the National Department of Public Works (NDPW), the following findings were noted regarding the project management of infrastructure projects (AGSA, 2013):

- Inadequate management information for the evaluation and monitoring of projects that should identify, avoid and address delays and/or overspending on projects;
- Non-compliance with Supply Chain Management (SCM) legislation in the appointment of contractors;
- Project managers not registered with the South African Council for Project and Construction Management Professions (SACPCMP);
- Adequate action not taken against non-performing contractors;
- High number of variation orders to change the scope of projects, resulting in potential fruitless and wasteful expenditure; and
- Construction contractors did not provide for penalties for late completion/penalties waived without valid reasons.

According to CIDB & National Treasury (2013), challenges within the public sector which have been identified as impeding an effectively delivered infrastructure, comprise of the following:

- Lack of infrastructure and delivery management skills;
- Lack of appropriately skilled resources;
- Inefficient /inappropriate systems and processes; and
- Inconsistent procurement procedures.

The previous public enterprises Minister, Malusi Gigaba (M&G online, 2013), remarked that the country's construction industry is extremely troubled. The delays and disruptions, poor site management, time and cost variations, skills and competence issues and a lack of worker participation, are among the challenges faced in the course of executing construction projects. There is no doubt that substantial improvements in quality and efficiency are needed and are possible; were his comments while speaking at the KPMG Global Construction Dialogue in Johannesburg (M&G, 2013).

Mr. Gigaba remarked that numerous indications highlighted the acute shortages of trained artisans and first level supervisory staff, which impacted on the demands for quality control, standard operating procedures and training: *"The shortage of these skills is further exacerbated by the ageing profile of artisans in South Africa, the average age of whom is reportedly around 55 years old. This shows the danger that most of the people available to transfer skills are getting older and older and there will not be sufficient mentoring for the future generations"* (M&G, 2013).

2.5.2 Project success factors

PMBOK (2008) stated that a project is successful if it achieves the triple objective outcome of within time, scope, and quality. There are several ways to define project success:

- The project met scope, time, and cost goals;
- The project satisfied the customer/sponsor; and
- The results of the project met its main objective, such as making or saving a certain amount of money, providing a good return on investment, or simply making the sponsors happy.

2.6 THE PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK) PRINCIPLES

The Project Management Body of Knowledge (PMBOK) is a collection of processes and knowledge areas accepted as best practice for the project management profession. As an internationally recognized standard (ANSI/PMI 99-001-2008 and IEEE 1490-2011) it provides the fundamentals of project management, irrespective of the type of project, be it construction, software, engineering, or automotive.

2.6.1 The ten project management knowledge areas:

The PMBOK recognizes ten knowledge areas typical of almost all projects. The basic concepts are applicable to projects, programmes and operations (PMBOK, 2012).

1. Managing Integration: Projects have all types of activities going on and there is a need to keep the “whole” thing moving collectively together – integrating all of the dynamics that take place.

2. Managing Scope: Projects need to have a defined parameter or scope and this must be broken down and managed through something called a Work Breakdown Structure or WBS.

3. Managing Time/Schedule: Projects have a definite beginning and a definite ending date. Therefore, there is a need to manage the budgeted time according to a project schedule.

4. Managing Costs: Projects consume resources and therefore, there is a need to manage the investment with the realization of creating value; i.e. the benefits derived exceed the amount spent.

5. Managing Quality: Projects involve specific deliverables or work products. These deliverables need to meet project objectives and performance standards.

6. Managing Human Resources: Projects consist of teams and you need to manage project team(s) during the life cycle of the project. Finding the right people, managing their outputs and keeping them on schedule, are a big part of managing a project.

7. Managing Communication: Projects invariably touch lots of people, not just the end users (customers), who benefit directly from the project outcomes. This includes project participants, managers who oversee the project and external stakeholders who have an interest in the success of the project.

8. Managing Risk: Projects are a discovery driven process, often uncovering new customer needs and identifying critical issues not previously disclosed. Projects also encounter unexpected events, such as project team members who resign, budgeted resources that are suddenly changed, the organization becomes unstable, and newer technologies are introduced. There is a real need to properly identify various risks and manage these risks.

9. Managing Procurement: Projects will procure the services of outside vendors and contractors, including the purchase of equipment. There is a need to manage the way that vendors are selected and managed within the project's life cycle.

10. Project Stakeholder Management (added in the 5th edition).

Each knowledge area contains some or all of the project management processes. For example, project procurement management includes:

- Plan Procurements;
- Conduct Procurements;
- Administer Procurements; and
- Close Procurements.

Much of PMBOK is unique to project management, for example critical path and work breakdown structure (WBS). Some areas overlap with other management disciplines. General management also includes planning, organizing, staffing, executing and controlling the operations of an organization. Financial forecasting, organizational behaviour and planning techniques are also necessary (PMBOK, 2012).

2.7 EFFICIENT AND EFFECTIVE PROJECT MANAGEMENT SYSTEMS

Mohammed, (2011) states that what a project manager is doing throughout the entire lifecycle of his project, is actually increasing efficiency and effectiveness. Management is defined as planning, organizing, leading, and controlling resources (human and other resources) to achieve organizational goals. This definition implies both increasing efficiency and effectiveness.

Efficiency measures how well and productively a manager use his resources to achieve goals. Project management places heavy focus on the way to acquire the right project team in order to perform project tasks and to close a project successfully within the agreed constraints. For example, in human resource planning - the project manager proactively boosts efficiency by deciding on the organizational structure, and roles and responsibilities to complete project tasks. Then, when the project team is acquired later, the right human resources are obtained according to their roles and

responsibilities. The project manager also decides on any training needs they may require for completing their tasks.

The project manager should keep an eye on the resource availability, and should use resource levelling as a tool to increase efficiency, by eliminating the over allocation of resources, and keeping to an almost constant or smooth use of resources throughout the span of the project lifecycle. When it comes to the monitoring and controlling phase, the project manager should try to increase efficiency by resolving conflicts that may arise within the project team, and by reviewing the team's performance so as to enhance the overall performance of the project.

On the other hand, effectiveness measures the appropriateness of the goals that organizations are pursuing and the degree of achieving these goals. Again, this is a core measure in project management, since it is all about applying knowledge, tools and techniques to achieve project goals. Building and measuring effectiveness in a project starts when the scope is defined during the planning phase (scope management plan, scope statement, and the work breakdown structure-WBS). Scope is built around the goals and end-deliverables the customer or sponsor needs. A solid scope change procedure is compiled during the scope planning process. Through this procedure the scope of the project is kept under control throughout the entire lifecycle.

At the end of each phase, and before moving to the next phase, the PM verifies the deliverables of the phase against the scope baseline to check whether the agreed upon scope is being met and also whether the project in total is still appropriate, as well as in line with the overall strategies of the company or the customer. As a result of this continuous control over the scope's corrective and preventative actions being taken to keep the project focused on the original plan, it is possible to update the plan itself to cope with the ultimate goals pursued by the customer or the sponsor.

Efficiency and effectiveness measures are pivotal in the project management profession. Not only do they apply to the cases mentioned above, but also to all project baseline-scopes, costs, time, quality, human resources and risks (Mohammed, 2011).

2.8 PUBLIC SECTOR PROJECT MANAGERS

A project manager (PM) is an official, appointed to take responsibility for a site clearance, building, leasing or engineering project (hereafter referred to as a project) on behalf of the Director-General in terms of the guidelines for project management (NDPW delegation of power, 2007). Powers are delegated to the lowest officials and also applied to officials in the line of authority, between the lowest delegated official and the accounting officer. If duties are delegated to the lowest rank official, the Director, Chief Director, Deputy Directors-General, Chief Operating Officer or Director General can also carry them out (NDPW delegation of power, 2007).

A project manager has an imperative position within an organization, such as the NDPW. This person will encounter many challenges. The most significant challenge is ensuring that, as a team, all various aspects of the situation are brought together to finish the project on time. A good project manager must be able to lead and guide the team to work together on complex matters and reach their goals on time. It is also vitally important to reach the goal within budget, uphold the team enthusiasm, stay motivated to achieve the goal of the project, keep up with all aspects of the project and ensure that the project is carried out satisfactorily.

A project manager is the person with the knowledge, skills, tools and techniques to project the activities that will meet the project requirements (Project Management Institute, 2008). A project manager is responsible for many tasks throughout the process. This person will be held accountable for the planning, managing and implementation of all trade shows, partners and customer events. Most projects will have limited resources and a budget. The project manager will be responsible for the entire project and should oversee all scheduling and changes that are made to the project in its entirety.

Project managers must stay within limits of the finances, excellence, schedule, budget, resources and risk. Project managers must set goals that are specific, quantifiable, achievable, and reasonable. By incorporating a goal, it will be easier to stay on task and within the required budget. The most important responsibility of the project manager is communication with the team, especially with senior management (Meredith, & Mantel, 2009).

A project manager's role is taking complete responsibility for the successful planning, execution, monitoring, control and closure of a project. This title is used in almost all industries. It is impossible to apply one job description to all project manager positions, as roles and responsibilities differ from company to company. The section below shows the requirements, roles and responsibilities for project manager positions:

2.8.1 Requirements for project manager positions in the NDPW

The requirements for a NDPW project manager's position:

- Tertiary qualification in the built environment (BE), recognized by the SACPCMP;
- Registration with the SACPCMP as Professional Construction Project Manager (CPM);
- Minimum 5 years' experience in the BE of which at least 5 years must have been in active project management as project manager (PM) (NDPW Records, 2014);
- A valid driver's license;
- Computer literacy; a knowledge and understanding of the following acts: the Public Finance Management Act; Occupational Health and Safety Act as well as the Building Regulations and the Environment Conservation Act;
- Knowledge and understanding of the Government's procurement system;
- Good financial and budget skills; and
- Sound analytical skills with good communication, both written and verbal.

2.8.1 Requirements for project manager positions in the NDPW:

Requirements for current project managers include a Bachelor's degree or equivalent experience, Project Management Professional (PMP) certification (preferred), experience in "Business Domain" or related industry is also valued, however possessing strong leadership, problem solving, decision making, analytical and organizational skills, are an absolute must (Edwards, 2011).

2.8.3 The duties of a project manager in the NDPW (NDPW Records, 2014)

- Manage/train project managers at lower levels;
- Perform professional (project management) according to the 9 knowledge areas of project management;
- Contribute to project initiation, scope definition and scope change control for envisaged projects;
- Identify, organize and co-ordinate project life cycle phases for control purposes;
- Schedule project activities to facilitate effective project execution in terms of cost, quality and time;
- Manage project cost estimates and control changes in line with allocated budgets;
- Plan and attend project meetings during the project phases;
- Assist with the compilation of project documentation to support project processes;
- Implement project administration processes according to government requirements;
- Ensure the implementation of procurement activities and the adherence thereof to government policies;
- Support the project environment and activities to ensure that project objectives are delivered timeously; and
- Management of and engagement in multi-disciplinary construction teams regarding the construction/maintenance of facilities.

There are a number of demands put upon the project manager and the accomplishment of the project depends on how the project manager handles the situation. Acquiring adequate resources that will assist in creating the final project within the budget can be difficult. There may be times when a project manager may have to be creative and implement other tools and people to achieve the desired outcome. A project manager should have an understanding that different organizational styles and cultural ways may affect the development of a project. A project manager would need to know who in the team have different cultures and work with them in order to make the project a success. When designing and planning

a project, project managers must not only take into account the views of project beneficiaries and stakeholders but also government policies.

2.9 SUMMARY

Chapter 2 consisted of a well-researched literature study on capital project management and methods. It was necessary to conduct a literature study on the project management body of knowledge (PMBOK) and operating behaviours. This chapter investigated the factors influencing the failure of capital projects, managed by the Government Department in the Northern Cape Province.

One of the objectives of the study was to identify the underlying governance issues relating to project failure, therefore the researcher needs to stay objective and our findings should not be influenced by any of our perceptions, impressions or biases which we might individually have developed towards the unsuccessful implementation of the projects under investigation.

Subsequently the literature review explored the budget and procurement processes in the public sector, as well as the concept of supply chain management (SCM) guidelines. A section was devoted to illustrate project success factors and existing problems. The formation of the South African Council for Project and Construction Management Professions (SACPCMP) and the international association of project management and their role in developing the standards of project management was also discussed.

The review was performed on the public sector, public sector environment and project managers in the public sector, in order to describe how the public sector is different from the private sector. In conclusion, this steers the discussion to the project management body of knowledge (PMBOK) principles. The basic concepts that are applicable to projects, programmes and operations were also discussed in this chapter.

In the next chapter, an empirical investigation of the targeted population is done.

CHAPTER 3

EMPIRICAL INVESTIGATION

3.1 INTRODUCTION

This chapter discusses the techniques and research methods used to investigate the research topic. As described in Chapter 1, the primary research objective was to evaluate the effect of delivery of government projects in the Northern Cape. To determine the root causes of the failure of government's projects managed by NDPW in the Northern Cape Province and why these projects are not completed within the agreed schedule, within the budgets and according to the specifications and needs of the client departments.

3.2 RESEARCH METHODOLOGY

The research method used in this study consisted of the qualitative and quantitative techniques. A literature review and an empirical study were also done for this dissertation. The primary aim of qualitative research is to provide a complete, detailed description of the research topic; it is usually more exploratory in nature. Quantitative research on the other hand focuses more on counting and classifying features and constructing statistical models and figures to explain what is observed (Explorable.com, November, 2009).

In this study, through an extensive literature review and consulting relevant industry experts, the researcher was able to gather sufficient data to be analysed. As a result, relevant global and national literature on the research topic was reviewed for two reasons, namely to enhance the quality of questions to be included in the questionnaires and to gather highly credible primary data for analysis. A pilot study on the way to structure the questions and which questions to ask, was done informally in conjunction with the officials (16 senior project managers and 11 project managers) of the National Department of Public Works and their client departments.

3.2.1 Literature review

The literature review focused on capital project management methods. It was also necessary to do a literature study on the project management body of knowledge

(PMBOK) and its operating behaviours. The available literature included books, acts, policies, published articles and the Internet (Google scholar, e-Books, J-tutor, and various databases form the NWU's e-library). All sources were relevant to the research topics. Literature provided insight into the underlying factors of the research problem and consisted of a well-researched literature study on project management by the public sector, supply chain management (SCM) methods, budget and tender processes, and the role of the construction sector in the South African context. It was also necessary to do a literature study on public sector project managers.

3.2.2 Empirical investigation

The empirical study section discussed the research design, the participants, the measuring instrument, and statistical analyses of the collected data.

3.2.2.1 Research design

Prior to conducting the research study, it is significantly important to craft the appropriate research design that constitutes the blueprint to be used for gathering data, measuring it, providing data analyses and setting up the entire investigation, in order to find solutions to all the research questions (Cooper & Schindler, 2008:156). A cross-sectional survey design, whereby a convenience sample is drawn from a population, was used to reach the selected objectives. Cross-sectional design means that the research is conducted within a brief period (Du Plooy, 2009:91). The design is also used to assess interrelationships among variables within a population and thus helps to achieve the various specific objectives of the research.

This study used the descriptive research strategy to determine the different challenges that the Department encounters during the process of managing government projects. Using a research strategy that combines qualitative and quantitative methods, this study applied frequencies and other descriptive statistics, including means and the standard deviations to analyse the data. ANOVA's were used to compare demographic groups on the scales, while the correlations between subscales were calculated.

3.2.2.2 Research procedure

The structured questionnaire was administered via e-mail and hand delivered to all the respondents.

3.2.2.3 Measuring instrument

This section of the study focused on the research questionnaire design, the various categories of questions included in the questionnaire and the different items that formed part of the research questionnaire. This section also took into account the reliability and validity of the questionnaire. Data gathering involved two key components of the research strategy – the literature and empirical studies. The empirical study focused on the basic fundamentals of the collected research data, to be applied to this study. On the other hand, the literature study, as another data gathering tool, focused on specific scientific journals and Internet sources to further augment and enrich the study's outcomes.

A detailed, structured, and self-administered questionnaire was designed for the purpose of this study. The items of this questionnaire consisted of open-ended questions, as well as 5-point Likert-scale questions, designed to investigate the research objectives. The questionnaire was organized into three sections that covered the different aspects outlined in the objectives. The first section consisted of demographic information, the second section of the 5 point Likert-scale questions and the third section was dedicated to general research questions. Open-ended questions are questions to which respondents express their views openly, in order to gain insight into their perceptions of project management and practices in the province. For the close-ended questions, a 5-point Likert-scale was utilised.

3.2.2.4 Statistical analysis of the data

The data that was collected during the survey was captured and analysed by the Statistical Consultation Services of the North West University. Descriptive statistics (means and standard deviations) as well as ANOVA's and correlations were used to analyse the data. The Cronbach alpha coefficients were used to determine the internal consistency and homogeneity of each section of the measuring instrument. The value of alpha (α) may lie between negative infinity and 1, however, only positive

values of α make sense. Generally, alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous questions (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e. rating scale: 1=poor, 5=excellent). Some professionals insist on a reliability score of 0.70 or higher in order to use a psychometric instrument. This rule should be applied with caution when α has been computed from items that are not correlated (Explorable.com, May, 2010).

Confirmatory factor analyses were carried out to determine the construct validity of the different sections of the measuring instrument. The descriptive statistics of the sections were calculated: the standard deviation (SD) was used to indicate the dispersion of the data and the mean was applied to measure the central tendency of the data.

The data used was collected from individuals, namely project management professionals, who provided answers to the questions based on their personal understanding and experience. This will likely differ from person to person.

3.2.2.5 Participants

During this study a non-probability sampling approach was used, specifically a convenience sampling approach, during which respondents were chosen on the basis of availability and accessibility. The study population consisted of client departments (project sponsors) officials, community members, contractors and service providers, as well as National Department of Public Works (NDPW) officials with different fields of specialty, such as occupational health and safety, employment equity, project managers, works managers, generalists and team leaders or overseers. All respondents were available and willing to participate during the week of sampling. A total sample of 150 was targeted, with a response rate of 82.67% (124 questionnaires) was achieved. The sample (N=124) was taken from the Northern Cape Province.

3.2.2.6 Characteristics of the participants

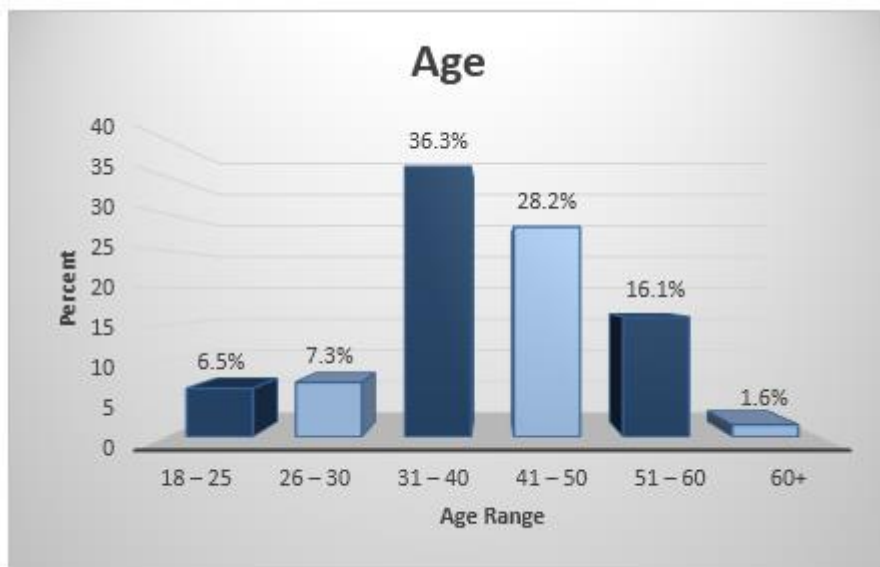
This subsection summarizes background characteristics of respondents. Demographic characteristics include age, gender, race and ethnicity, education and work experience. For these previously compiled factors, the tables below show the range, and unweighted frequencies (the raw percentage of respondents to the survey).

TABLE 3.1: Characteristics of the Participants

Demographics (n = 124)	Range	Frequency	%
Age	18 – 25	8	6.5
	26 – 30	9	7.3
	31 – 40	45	36.3
	41 – 50	35	28.2
	51 – 60	20	16.1
	60+	2	1.6
Race	Black	61	49.2
	White	19	15.3
	Indian	3	2.4
	Coloured	31	25
	Other	2	1.6
Gender	Male	80	64.5
	Female	38	30.6
Years of working experience	0-3	19	15.3
	4-6	15	12.1
	7-10	23	18.5
	11-15	13	10.5
	16-25	28	22.6
	26-30	13	10.5
	30+	9	7.3
Any formal project management qualification	Yes	19	15.3
	No	90	72.6
Highest qualification	Less than matric Grade 12	7	5.6
	Matric	26	21
	Certificate	17	13.7
	Diploma	32	25.8
	Degree	26	21
	Post graduate degree	13	10.5
Types of projects you have worked on	Offices	44	35.5
	Factories	4	3.2
	Shopping mall	3	2.4
	Residential	17	13.7
	Engineering Projects	33	26.6
	Other	34	27.4
Years of projects experience	0 - 3	37	29.8
	4-6	22	17.7
	7-10	10	8.1
	10+	29	23.4

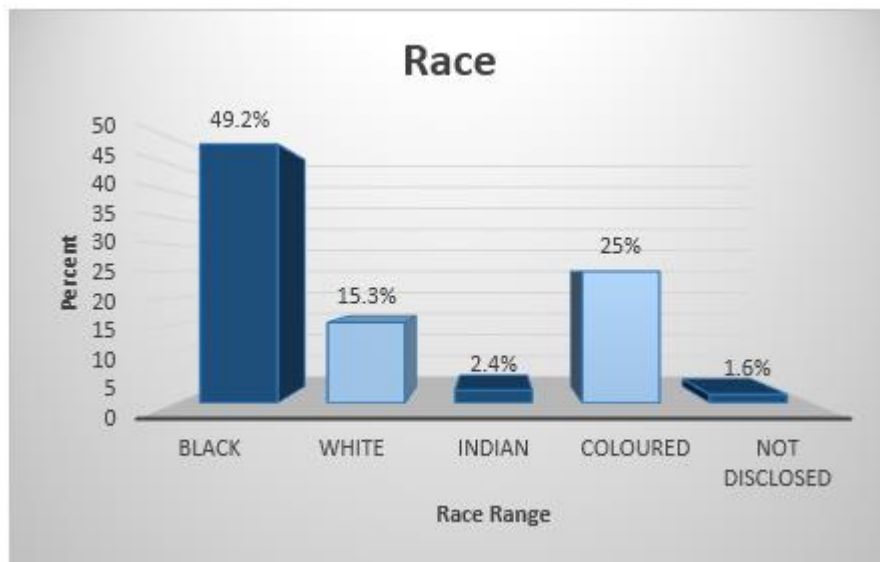
3.2.2.7 Demographic frequencies

FIGURE 3.1: Age ranges of participants



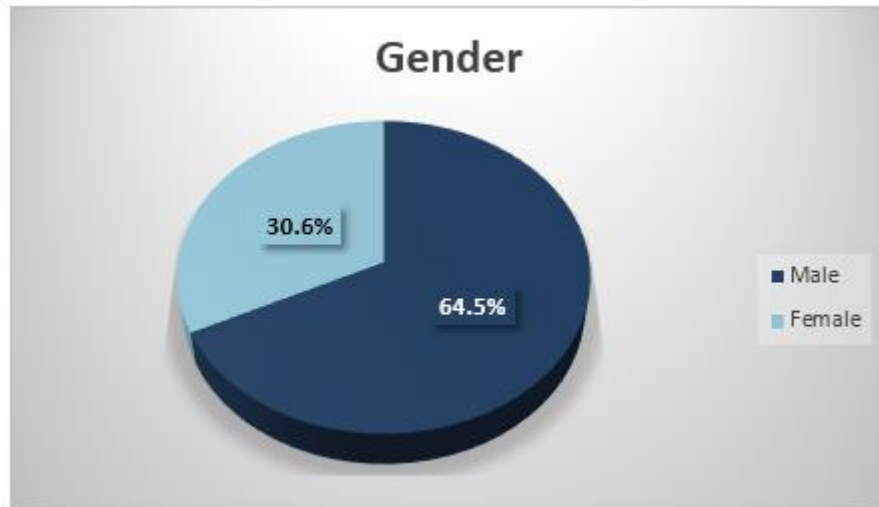
Over a third (36.3%) of the respondents were aged between 31–40 years, followed by 28.2% aged between 41–50 years. Only 2 respondents were above the age of 60.

FIGURE 3.2: Race of participants



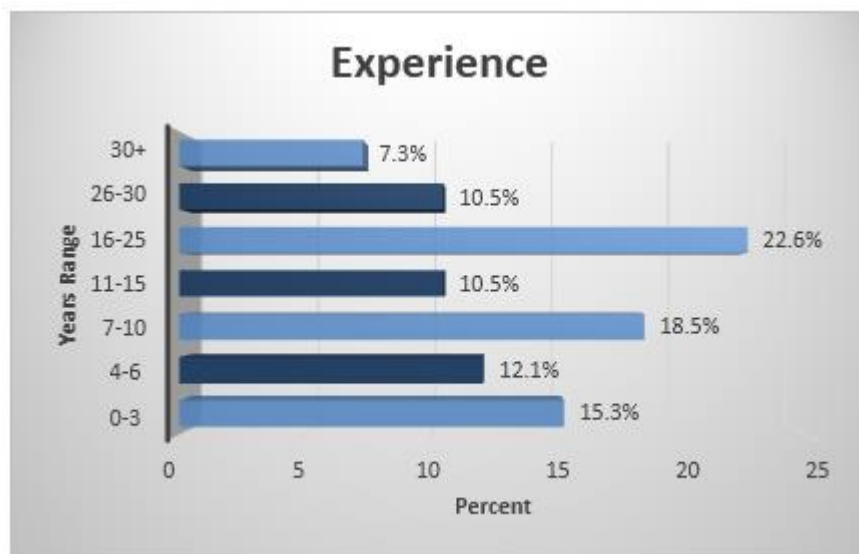
The majority (49.2%) of the respondents were black, followed by 25% coloured respondents and only 15.3% white participants.

FIGURE 3.3: Gender of participants



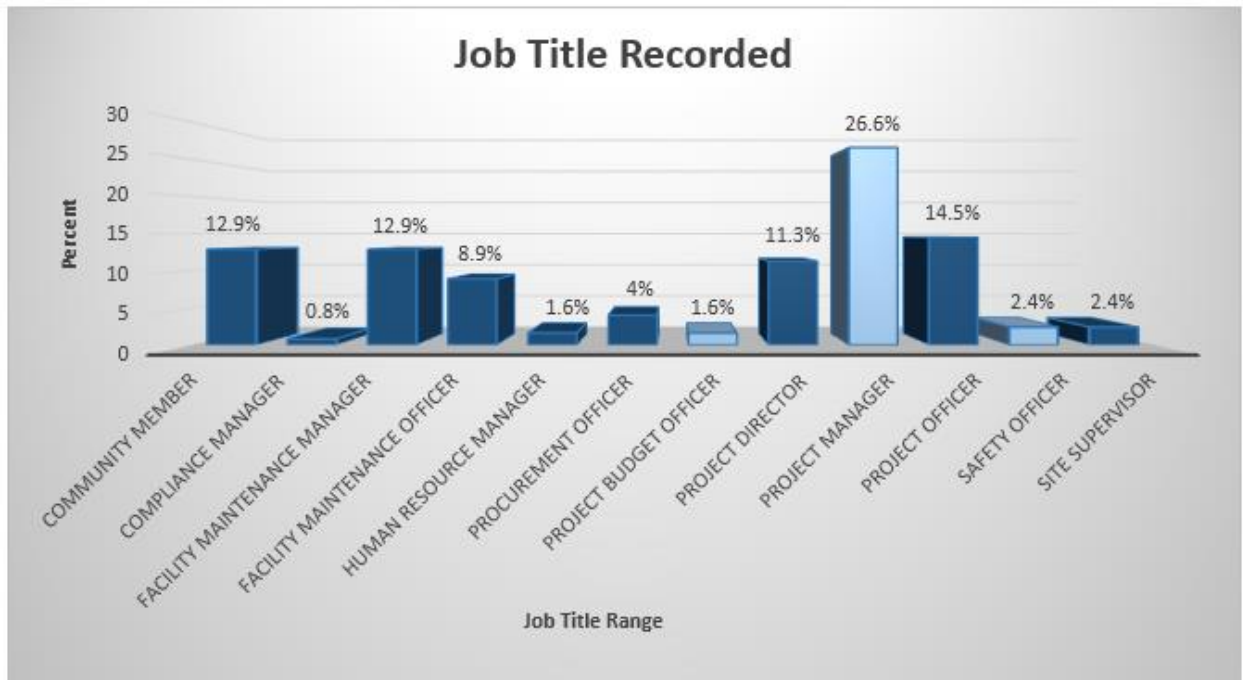
The majority (64.5%) of the respondents were male, while only 30.6% were female.

FIGURE 3.4: Working experience of participants



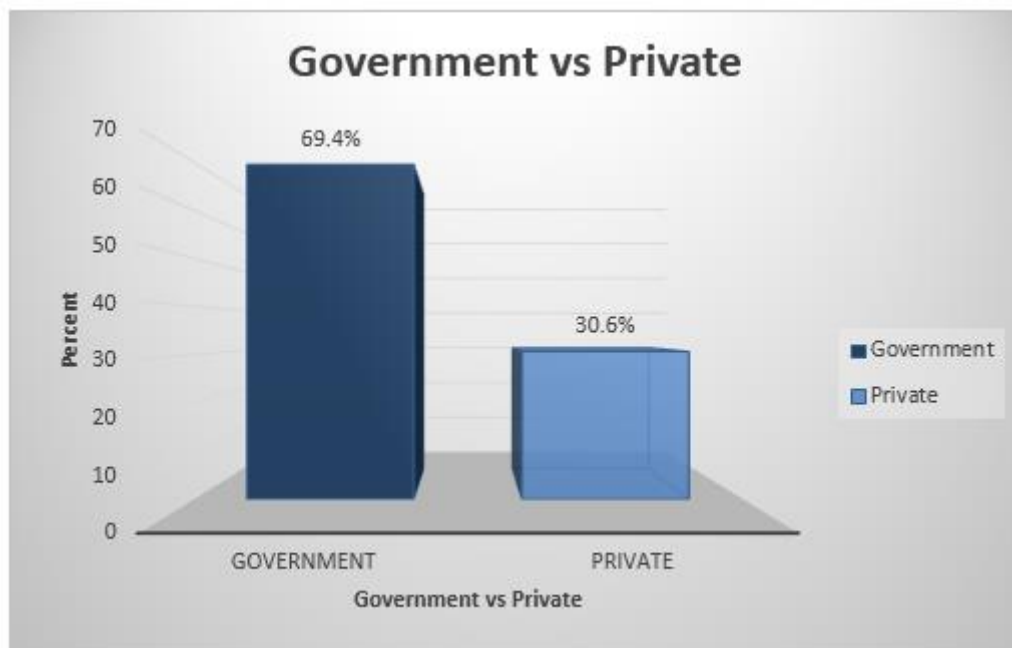
More than half (50.9%) of the respondents indicated that they had more than 10 years' working experience on projects.

FIGURE 3.5: Job titles of participants



The majority of 26.6% of respondents were project managers, followed by 14.5% project officers, while only 11.3% project directors participated in this study.

FIGURE 3.6: Government Officials vs. Private Sector Officials



More than two thirds (69.4%) of respondents were government officials, while only 30.6% were from the private sector. Private sector participants consisted of service providers and contractors' consultants that government outsourced projects to.

FIGURE 3.7: Formal project management qualifications



Almost 75% of respondents did not have formal project management qualifications. Only 15.3% of respondents indicated that they had formal project management qualifications such as quantity surveying, project management, a certificate in project management, mechanical or electrical engineering, civil engineering and plumbing qualifications.

FIGURE 3.8: Types of qualifications of participants



Only 5.6% of respondents indicated that they had less than a matric qualification. However 10.5% indicated that they had a post-graduate degree. Most of the respondents indicated that they had diplomas (25.8%), followed by a university degree (21%).

In summary, most of the respondents were government officials. The greatest portion (26.6%) was project managers. A total of 36.3% of the respondents were between the ages of 31 and 40, making them the majority of the sample. Black respondents that represented 49.2% of the sample were the majority race. Furthermore, 64.5% of the respondents were males and 30.6% females. It appeared that 22.6% of the respondents had 16 to 25 years of working experience, making this group a majority within the sample. A total of 72.6% of the respondents did not have any formal project management qualifications. It further appeared that 21% of the respondents had a grade 12 qualification, while the majority of 25.8% had a diploma and 13% had a post-graduate degree.

3.2.2.8 Reliability of subscales.

The reliability of the subscales in the questionnaire was investigated by means of Cronbach's alpha. Certain items in the questionnaire had to be reversed for the purpose of subscale calculations. Reverse scoring means that the numerical scoring scale runs in the opposite direction. For example, in the questionnaire strongly agree

would attract a score of 5, agree would be 4, neutral still equals 3, disagree would become 2 while strongly disagree would equal 1. These items had a detrimental effect on the alpha coefficients and some of them had to be removed. It is possible that respondents were not attentive enough to think about what the reversed items meant. This process is summarized below.

TABLE 3.2: Reliability Analysis

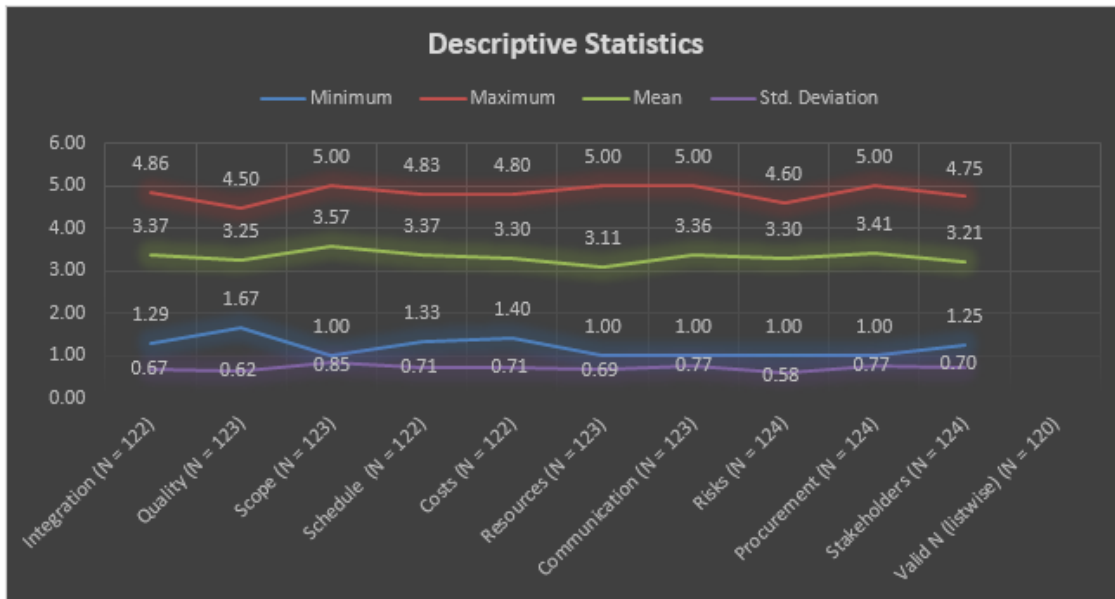
Scale	Items negatively phrased and reversed	Alpha with original items	Alpha for scale with negative items removed where relevant	Comment
Integration	2.3, 2.4	0.823	0.859	
Scope	3.3, 3.4	0.815	0.873	
Time	none	0.804		
Costs	5.6	0.613	0.67	
Quality	6.1, 6.2, 6.3, 6.4	0.402	0.709	Only 6.4 omitted
Resource	7.3	0.655	0.738	
Communication	none	0.907		
Risks	9.6	0.583	0.637	
Procurement	10.2	0.756	0.835	
Stakeholders	11.4	0.684	0.789	

As can be seen, all scales have adequate reliability (>0.70) when some of the negatively phrased items are omitted. Following the reliability analyses, subscale scores were calculated using the remaining items in the scale.

3.2.2.9 Descriptive statistics per subscale

Mean scores and standard deviations per subscale are reported below on a 5 point scale (1=strongly agree, 2=agree, 3=neutral, 4=disagree and 5=strongly disagree) with lower scores indicating more positive attitudes.

FIGURE 3.9: Descriptive Statistics



As can be seen above, the aspect rated most positively was resources, while scope was rated most negatively. It is concerning though that all means were above 3, which was the midpoint of the scale. This implies that the attitude of respondents towards all the aspects measured were mostly on the negative side.

3.3 DEMOGRAPHIC DIFFERENCES IN THE EXPERIENCES OF RESPONDENTS.

For this study, analysis of variance (ANOVA) were used to test for significant differences between means, managing project costs, procurement, integration, scope, time, communication, risk and stakeholders. Demographic characteristics such as gender, qualifications, age and race were also considered for these analyses. Effect sizes, in the form of eta squared were reported where there were significant differences. Eta² can be defined as the proportion of variance associated with or accounted for by each of the main effects, interactions, and errors in an ANOVA study (Tabachnick & Fidell, 2001:54; Thompson, 2006: 317).

The results of the ANOVA are presented in an ANOVA table, which has columns labelled as follows: Sum of Squares (sometimes referred to as SS), df (degrees of freedom), Mean Square (sometimes referred to as MS), F (for F-ratio), and Sig. The only column that is critical for interpretation is the last (Sig.), because this is the

exact significance level of the ANOVA. The others are used mainly for intermediate computational purposes. Eta squared and partial Eta squared are estimates of the degree of association for the sample (η^2) ranges between 0 and 1. Interpret η^2 as a rule of thumb:

.01 ~ small

.09 ~ medium

.25 ~ large

TABLE 3.3: Age Groups of participants

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	1.125	3	0.375	0.88	0.454
	Within Groups	48.566	114	0.426		
	Total	49.691	117			
Quality	Between Groups	0.192	3	0.064	0.176	0.912
	Within Groups	41.496	114	0.364		
	Total	41.688	117			
Scope	Between Groups	2.258	3	0.753	1.105	0.35
	Within Groups	77.667	114	0.681		
	Total	79.925	117			
Schedule	Between Groups	0.901	3	0.3	0.608	0.611
	Within Groups	55.862	113	0.494		
	Total	56.763	116			
Costs	Between Groups	1.605	3	0.535	1.065	0.367
	Within Groups	56.766	113	0.502		
	Total	58.371	116			
Resources	Between Groups	1.806	3	0.602	1.322	0.271
	Within Groups	51.937	114	0.456		
	Total	53.744	117			
Communication	Between Groups	1.73	3	0.577	1.029	0.382
	Within Groups	63.876	114	0.56		
	Total	65.606	117			
Risks	Between Groups	0.7	3	0.233	0.693	0.558
	Within Groups	38.695	115	0.336		
	Total	39.395	118			
Procurement	Between Groups	3.018	3	1.006	1.936	0.128
	Within Groups	59.744	115	0.52		
	Total	62.762	118			
Stakeholders	Between Groups	1.286	3	0.429	0.904	0.441
	Within Groups	54.524	115	0.474		
	Total	55.81	118			

As can be seen from the table above, there were no significant differences between the age groups on any of the scales, as all p-values are larger than 0.05.

TABLE 3.4: Government officials vs. private sector officials

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	1.769	1	1.769	4.085	0.045
	Within Groups	51.97	120	0.433		
	Total	53.74	121			
Quality	Between Groups	0.11	1	0.11	0.283	0.596
	Within Groups	47.213	121	0.39		
	Total	47.323	122			
Scope	Between Groups	3.585	1	3.585	5.089	0.026
	Within Groups	85.237	121	0.704		
	Total	88.822	122			
Schedule	Between Groups	0.117	1	0.117	0.229	0.633
	Within Groups	61.397	120	0.512		
	Total	61.514	121			
Costs	Between Groups	1.807	1	1.807	3.616	0.06
	Within Groups	59.945	120	0.5		
	Total	61.752	121			
Resources	Between Groups	0.001	1	0.001	0.002	0.961
	Within Groups	58.417	121	0.483		
	Total	58.418	122			
Communication	Between Groups	0	1	0	0	0.999
	Within Groups	71.574	121	0.592		
	Total	71.574	122			
Risks	Between Groups	0.001	1	0.001	0.002	0.961
	Within Groups	41.232	122	0.338		
	Total	41.233	123			
Procurement	Between Groups	2.184	1	2.184	3.748	0.055
	Within Groups	71.074	122	0.583		
	Total	73.258	123			
Stakeholders	Between Groups	0.051	1	0.051	0.103	0.749
	Within Groups	60.4	122	0.495		
	Total	60.451	123			

Only two differences were marginally significant, namely with regard to integration ($p=0.045$) and scope ($p=0.026$). If the numbers found in this column are less than the critical value of alpha, the effect is significant. Since this value is usually set at .05, any value less than this will result in significant effects, while any value greater than this value will result in non-significant effects. Inspection of the mean scores shows the following:

Group Statistics		N	Mean	Std. Deviation	Std. Error Mean
Integration	Government	84	3.4552	.62470	.06816
	Private	38	3.1952	.72745	.11801
Scope	Government	85	3.6800	.80342	.08714
	Private	38	3.3105	.91557	.14852

On both scales, respondents from government had significantly higher scores (i.e. tended to disagree with the statements more), than respondents from the private sector.

TABLE 3.5: Race of participants

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	0.812	2	0.406	0.963	0.385
	Within Groups	45.126	107	0.422		
	Total	45.939	109			
Quality	Between Groups	0.177	2	0.088	0.239	0.788
	Within Groups	39.572	107	0.37		
	Total	39.749	109			
Scope	Between Groups	1.504	2	0.752	1.076	0.345
	Within Groups	74.791	107	0.699		
	Total	76.296	109			
Schedule	Between Groups	0.636	2	0.318	0.678	0.51
	Within Groups	49.676	106	0.469		
	Total	50.312	108			
Costs	Between Groups	0.198	2	0.099	0.194	0.824
	Within Groups	54.092	106	0.51		
	Total	54.29	108			
Resources	Between Groups	0.428	2	0.214	0.448	0.64
	Within Groups	51.153	107	0.478		
	Total	51.581	109			

Communication	Between Groups	0.917	2	0.458	0.807	0.449
	Within Groups	60.784	107	0.568		
	Total	61.701	109			
Risks	Between Groups	0.058	2	0.029	0.096	0.908
	Within Groups	32.657	108	0.302		
	Total	32.715	110			
Procurement	Between Groups	0.793	2	0.397	0.762	0.469
	Within Groups	56.201	108	0.52		
	Total	56.994	110			
Stakeholders	Between Groups	0.766	2	0.383	0.813	0.446
	Within Groups	50.879	108	0.471		
	Total	51.645	110			

The table above illustrates that there were no significant differences between the race groups on any of the scales.

TABLE 3.6: Gender of participants

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	0.116	1	0.116	0.264	0.609
	Within Groups	50.777	115	0.442		
	Total	50.894	116			
Quality	Between Groups	0.438	1	0.438	1.135	0.289
	Within Groups	44.344	115	0.386		
	Total	44.781	116			
Scope	Between Groups	0.084	1	0.084	0.124	0.725
	Within Groups	77.601	115	0.675		
	Total	77.685	116			
Schedule	Between Groups	0.029	1	0.029	0.06	0.806
	Within Groups	54.722	114	0.48		
	Total	54.751	115			
Costs	Between Groups	0.027	1	0.027	0.053	0.819
	Within Groups	57.65	114	0.506		
	Total	57.677	115			
Resources	Between Groups	0.189	1	0.189	0.413	0.522
	Within Groups	52.624	115	0.458		
	Total	52.813	116			
Communication	Between Groups	0.922	1	0.922	1.674	0.198
	Within Groups	63.338	115	0.551		
	Total	64.26	116			

Risks	Between Groups	0.381	1	0.381	1.18	0.28
	Within Groups	37.461	116	0.323		
	Total	37.842	117			
Procurement	Between Groups	0.632	1	0.632	1.171	0.281
	Within Groups	62.551	116	0.539		
	Total	63.182	117			
Stakeholders	Between Groups	0.076	1	0.076	0.162	0.688
	Within Groups	54.298	116	0.468		
	Total	54.373	117			

It would appear that there were no significant differences between the gender groups either ($p > 0.05$).

TABLE 3.7: Working experience of participants

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	2.186	5	0.437	0.96	0.445
	Within Groups	51.427	113	0.455		
	Total	53.612	118			
Quality	Between Groups	1.44	5	0.288	0.739	0.596
	Within Groups	44.02	113	0.39		
	Total	45.46	118			
Scope	Between Groups	4.46	5	0.892	1.3	0.269
	Within Groups	77.504	113	0.686		
	Total	81.964	118			
Schedule	Between Groups	1.781	5	0.356	0.734	0.599
	Within Groups	54.328	112	0.485		
	Total	56.109	117			
Costs	Between Groups	2.279	5	0.456	0.906	0.48
	Within Groups	56.311	112	0.503		
	Total	58.59	117			
Resources	Between Groups	1.285	5	0.257	0.584	0.712
	Within Groups	49.722	113	0.44		
	Total	51.007	118			
Communication	Between Groups	3.46	5	0.692	1.256	0.288
	Within Groups	62.255	113	0.551		
	Total	65.715	118			

Risks	Between Groups	1.332	5	0.266	0.781	0.566
	Within Groups	38.901	114	0.341		
	Total	40.233	119			
Procurement	Between Groups	6.286	5	1.257	2.358	0.045
	Within Groups	60.793	114	0.533		
	Total	67.08	119			
Stakeholders	Between Groups	4.54	5	0.908	2.013	0.082
	Within Groups	51.432	114	0.451		
	Total	55.972	119			

With regard to experience, there was only one scale, namely procurement, on which there was a marginal difference between the groups ($p=0.045$). Post-hoc tests, however, revealed that none of the pairwise differences were statistically significant. The difference between groups on this variable was therefore largely negligible.

TABLE 3.8: Formal project management qualification

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	0.029	1	0.029	0.069	0.794
	Within Groups	44.069	106	0.416		
	Total	44.098	107			
Quality	Between Groups	0.78	1	0.78	2.161	0.144
	Within Groups	38.611	107	0.361		
	Total	39.391	108			
Scope	Between Groups	0.495	1	0.495	0.743	0.391
	Within Groups	71.259	107	0.666		
	Total	71.754	108			
Schedule	Between Groups	0.033	1	0.033	0.07	0.792
	Within Groups	49.682	107	0.464		
	Total	49.714	108			
Costs	Between Groups	0.066	1	0.066	0.126	0.724
	Within Groups	55.797	107	0.521		
	Total	55.863	108			
Resources	Between Groups	2.942	1	2.942	7.718	0.006
	Within Groups	40.79	107	0.381		
	Total	43.732	108			

Communication	Between Groups	0.01	1	0.01	0.018	0.894
	Within Groups	57.571	107	0.538		
	Total	57.581	108			
Risks	Between Groups	0.073	1	0.073	0.216	0.643
	Within Groups	35.963	107	0.336		
	Total	36.036	108			
Procurement	Between Groups	0.246	1	0.246	0.44	0.509
	Within Groups	59.908	107	0.56		
	Total	60.154	108			
Stakeholders	Between Groups	0.311	1	0.311	0.658	0.419
	Within Groups	50.525	107	0.472		
	Total	50.836	108			

The analysis above shows that the only differences between these groups were on the resources scale. Looking at the mean scores below, it is evident that those who did not have formal project management training, were more negative about resources than those who did. The effect size of the difference is:

Group Statistics		N	Mean	Std. Deviation	Std. Error Mean
Resources	Yes	19	2.7053	.57104	.13100
	No	90	3.1383	.62639	.06603

There were only seven respondents with less than a matric qualification, and they were omitted from the analysis. The remaining groups were compared.

TABLE 3.9: Type of qualifications of participants

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	1.867	4	0.467	1.106	0.357
	Within Groups	45.57	108	0.422		
	Total	47.437	112			
Quality	Between Groups	1.035	4	0.259	0.667	0.616
	Within Groups	41.908	108	0.388		
	Total	42.943	112			
Scope	Between Groups	3.115	4	0.779	1.268	0.287
	Within Groups	66.359	108	0.614		
	Total	69.474	112			
Schedule	Between Groups	2.056	4	0.514	1.214	0.309
	Within Groups	45.314	107	0.423		
	Total	47.37	111			
Costs	Between Groups	4.198	4	1.05	2.217	0.072
	Within Groups	50.648	107	0.473		
	Total	54.846	111			
Resources	Between Groups	3.17	4	0.792	1.866	0.122
	Within Groups	45.869	108	0.425		
	Total	49.039	112			
Communication	Between Groups	1.601	4	0.4	0.724	0.577
	Within Groups	59.66	108	0.552		
	Total	61.261	112			
Risks	Between Groups	2.143	4	0.536	1.842	0.126
	Within Groups	31.701	109	0.291		
	Total	33.844	113			
Procurement	Between Groups	5.691	4	1.423	2.708	0.034
	Within Groups	57.254	109	0.525		
	Total	62.944	113			
Stakeholders	Between Groups	3.375	4	0.844	1.869	0.121
	Within Groups	49.198	109	0.451		
	Total	52.573	113			

A marginally significant difference between these groups were found with regard to procurement ($p=0.034$). However, post-hoc tests revealed that there were no significant pairwise differences between the groups. The differences between the qualification groups on the subscales were therefore negligible.

TABLE 3.10: Years of project experience

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Integration	Between Groups	0.601	3	0.2	0.494	0.687
	Within Groups	38.129	94	0.406		
	Total	38.73	97			
Quality	Between Groups	0.22	3	0.073	0.196	0.899
	Within Groups	34.718	93	0.373		
	Total	34.938	96			
Scope	Between Groups	1.323	3	0.441	0.695	0.557
	Within Groups	59.653	94	0.635		
	Total	60.976	97			
Schedule	Between Groups	2.902	3	0.967	2.092	0.107
	Within Groups	43.002	93	0.462		
	Total	45.904	96			
Costs	Between Groups	0.529	3	0.176	0.339	0.797
	Within Groups	48.347	93	0.52		
	Total	48.877	96			
Resources	Between Groups	2.149	3	0.716	1.767	0.159
	Within Groups	37.686	93	0.405		
	Total	39.835	96			
Communication	Between Groups	1.154	3	0.385	0.805	0.494
	Within Groups	44.472	93	0.478		
	Total	45.626	96			
Risks	Between Groups	1.184	3	0.395	1.328	0.27
	Within Groups	27.945	94	0.297		
	Total	29.129	97			
Procurement	Between Groups	0.759	3	0.253	0.414	0.743
	Within Groups	57.477	94	0.611		
	Total	58.237	97			
Stakeholders	Between Groups	3.097	3	1.032	2.118	0.103
	Within Groups	45.811	94	0.487		
	Total	48.908	97			

The results of the ANOVA analyses above show that there were no significant differences between the groups with regard to their various years of project experience, in any of the scales.

In summary, the ANOVA analyses above would suggest that demographic variables have very little influence on respondents' perceptions on the various scales. Apart from the facts that those respondents with formal project management training experienced resources more positively, while respondents from government

experienced integration and scope more negatively. Further, no other significant differences were found. The sample thus seems uniform in the participants' responses to the questions.

3.3.1 Correlation between subscales

The correlation between subscales was investigated by means of a Spearman's Rho (Spearman Rank Correlation Coefficient tries to assess the relationship between ranks without making any assumptions about the nature of their relationship), as the scale was fairly small and the assumption of normality could not be made. The table of correlations show that correlations between the scales mostly ranged from a medium to a large effect size, indicating that the aspects measured are closely related to one another.

r_s = correlation coefficient

In general,

- $r_s > 0$ implies a positive agreement among ranks;
- $r_s < 0$ implies a negative agreement (or agreement in the reverse direction);
- $r_s = 0$ implies no agreement.

TABLE 3.11: Correlation between subscales

		Integration	Quality	Scope	Schedule	Costs	Resources	Communication	Risks	Procurement	Stakeholders
Integration	Correlation Coefficient	1	.535 ^{***}	.740 ^{***}	.603 ^{***}	.389 ^{***}	.323 ^{***}	.454 ^{***}	.421 ^{***}	.509 ^{***}	.431 ^{***}
	Sig. (2-tailed)		0	0	0	0	0	0	0	0	0
	N	122	121	121	120	120	121	121	122	122	122
Quality	Correlation Coefficient	.535 ^{***}	1	.411 ^{***}	.542 ^{***}	.366 ^{***}	.288 ^{***}	.525 ^{***}	.222 ^{***}	.344 ^{***}	.414 ^{***}
	Sig. (2-tailed)	0		0	0	0	0.001	0	0.014	0	0
	N	121	123	122	122	122	123	123	123	123	123
Scope	Correlation Coefficient	.740 ^{***}	.411 ^{***}	1	.630 ^{***}	.464 ^{***}	.346 ^{***}	.454 ^{***}	.468 ^{***}	.526 ^{***}	.436 ^{***}
	Sig. (2-tailed)	0	0		0	0	0	0	0	0	0
	N	121	122	123	122	122	122	122	123	123	123
Schedule	Correlation Coefficient	.603 ^{***}	.542 ^{***}	.630 ^{***}	1	.604 ^{***}	.387 ^{***}	.648 ^{***}	.376 ^{***}	.468 ^{***}	.542 ^{***}
	Sig. (2-tailed)	0	0	0		0	0	0	0	0	0
	N	120	122	122	122	122	122	122	122	122	122
Costs	Correlation Coefficient	.389 ^{***}	.366 ^{***}	.464 ^{***}	.604 ^{***}	1	.438 ^{***}	.592 ^{***}	.203 ^{***}	.516 ^{***}	.428 ^{***}
	Sig. (2-tailed)	0	0	0	0		0	0	0.025	0	0
	N	120	122	122	122	122	122	122	122	122	122
Resources	Correlation Coefficient	.323 ^{***}	.288 ^{***}	.346 ^{***}	.387 ^{***}	.438 ^{***}	1	.643 ^{***}	.320 ^{***}	.435 ^{***}	.518 ^{***}
	Sig. (2-tailed)	0	0.001	0	0	0		0	0	0	0
	N	121	123	122	122	122	123	123	123	123	123
Communication	Correlation Coefficient	.454 ^{***}	.525 ^{***}	.454 ^{***}	.648 ^{***}	.592 ^{***}	.643 ^{***}	1	.418 ^{***}	.519 ^{***}	.662 ^{***}
	Sig. (2-tailed)	0	0	0	0	0	0		0	0	0
	N	121	123	122	122	122	123	123	123	123	123
Risks	Correlation Coefficient	.421 ^{***}	.222 ^{***}	.468 ^{***}	.376 ^{***}	.203 ^{***}	.320 ^{***}	.418 ^{***}	1	.361 ^{***}	.447 ^{***}
	Sig. (2-tailed)	0	0.014	0	0	0.025	0	0		0	0
	N	122	123	123	122	122	123	123	124	124	124
Procurement	Correlation Coefficient	.509 ^{***}	.344 ^{***}	.526 ^{***}	.468 ^{***}	.516 ^{***}	.435 ^{***}	.519 ^{***}	.361 ^{***}	1	.470 ^{***}
	Sig. (2-tailed)	0	0	0	0	0	0	0	0		0
	N	122	123	123	122	122	123	123	124	124	124
Stakeholders	Correlation Coefficient	.431 ^{***}	.414 ^{***}	.436 ^{***}	.542 ^{***}	.428 ^{***}	.518 ^{***}	.662 ^{***}	.447 ^{***}	.470 ^{***}	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	
	N	122	123	123	122	122	123	123	124	124	124

The results reported above show that there were strong positive correlations between the subscales. All correlations were significant and showed from moderate to large effect sizes.

3.4 EXPLORATORY FACTOR ANALYSIS

A factor analysis consists of a number of statistical techniques, the aim of which is to simplify complex sets of data. A factor analysis is usually applied to correlations between variables,; which are now described. A correlation is a numerical measure of the degree of agreement between two sets of score; it runs from +1 to -1, where +1 indicates full agreement, 0 no relationship, and -1 complete disagreement (Kline, 2014:01).

3.4.1 Factor Analysis: Managing project integration

There are many different methods that can be used to conduct a factor analysis (such as principal axis factor, maximum likelihood, generalized least squares and unweighted least squares). There are also many different types of rotations that can be done after the initial extraction of factors. These include orthogonal rotations such as varimax and equimax, which impose the restriction that the factors cannot be correlated, and oblique rotations, such as promax, which allow the factors to be correlated with one another. Given the number of factor analytic techniques and options, it is not surprising that different analysts could reach very different results, when analysing the same data set. However, all analysts are looking for a simple structure. A simple structure is a pattern of results that each variable loads highly onto only one factor (Sidanius, UCLA online).

TABLE 3.12: Correlation Matrix - Managing Project Integration

Correlation Matrix ^a								
Correlation	B2N1	B2N2	B2N3	B2N4	B2N5	B2N6	B2N7	B2N8
B2N1	1.000	.676	.057	.195	.430	.409	.645	.271
B2N2	.676	1.000	.133	.274	.544	.498	.595	.369
B2N3	.057	.133	1.000	.258	.251	.288	.198	.224
B2N4	.195	.274	.258	1.000	.218	.207	.193	.173
B2N5	.430	.544	.251	.218	1.000	.806	.554	.397
B2N6	.409	.498	.288	.207	.806	1.000	.584	.405
B2N7	.645	.595	.198	.193	.554	.584	1.000	.425
B2N8	.271	.369	.224	.173	.397	.405	.425	1.000

a. Determinant = .035

In the table above (Table 3.12) each variable is assumed to correlate perfectly with itself. In practice (which will be discussed later in this chapter), this is not always the

case. What goes into the diagonals of the correlation matrix is important in understanding and interpreting factor analyses. There is considerable redundancy in the matrix with each entry appearing twice, as it logically must. Factor analysis is designed to simplify these correlation matrices.

The next item shows the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which measure varies between 0 and 1 and where values closer to 1 are better (Kline, 2014:01). A value of .6 is the suggested minimum. Bartlett's Test of Sphericity tests with the null hypothesis whether the correlation matrix is an identity matrix. An identity matrix is a matrix in which all of the diagonal elements are 1 and all off diagonal elements are 0, rejecting this null hypothesis. Taken together, these tests provide a minimum standard which should be passed before a factor analysis (or a principal components analysis) should be conducted.

TABLE 3.13: KMO and Bartlett's Test - Managing Project Integration

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.810
Bartlett's Test of Sphericity	Approx. Chi-Square	375.105
	Df	28
	Sig.	.000

The table above indicates the Kaiser-Meyer-Olkin (KMO) and Bartlett's test output. The KMO measures the sampling adequacy which should be greater than 0.5 in order for a satisfactory factor analysis to proceed. Looking at the table above, the KMO measure is 0.810 and it can be noted that the Bartlett's test of sphericity is significant. This means that associated probability is less than 0.05, and that the correlation matrix is not an identity matrix.

Communalities

The communalities of the variables may be such that the differences among most components and common factor procedures become trivial. For example, all the exploratory common factor procedures merge towards principal component analysis as the communalities approach 1.0 (Gorsuch, 2015:129). The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors; for instance over 70% of

the variance in, project manager has his/her own version of project plan, is accounted for, while 37.4% of the variance in, sketch plan approvals, is accounted for.

TABLE 3.14: Communalities - Managing Project Integration

Communalities		
	Initial	Extraction
B2N1	1.000	.701
B2N2	1.000	.694
B2N3	1.000	.708
B2N4	1.000	.380
B2N5	1.000	.669
B2N6	1.000	.669
B2N7	1.000	.707
B2N8	1.000	.374

Total Variance Explained

The next item shows all the factors extractable from the analysis, along with their eigenvalues, the percentage of variance attributable to each factor, the cumulative variance of the factor and the previous factors. Notice that the first factor accounts for 47.070% of the variance and the second for 14.197%. All the remaining factors are not significant.

TABLE 3.15: Total Variance - Managing Project Integration

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.766	47.070	47.070	3.766	47.070	47.070
2	1.136	14.197	61.268	1.136	14.197	61.268
3	.898	11.231	72.498			
4	.705	8.816	81.314			
5	.646	8.077	89.392			
6	.391	4.893	94.285			
7	.271	3.388	97.673			
8	.186	2.327	100.000			

The scree plot

The scree plot graphs the eigenvalue against the factor number; it can be seen in these values in the first two columns of the table immediately above. From the third factor on, it can be seen that the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

FIGURE 3.10: Scree Plot - Managing Project Integration



The scree plot is a graph of the eigenvalues against all the factors. The graph is useful for determining how many factors to retain. The point of interest is where the curve starts to flatten. It can be noted that the curve begins to flatten between factors 3 and 4. Also note that factors 3 and 4 have eigenvalues of less than 1, meaning that only two factors have been retained (factors 1 and 2).

TABLE 3.16: Component (Factor) Matrix - Managing Project Integration

Component Matrix ^a		
	Component	
	1	2
B2N1	.723	-.422
B2N2	.793	
B2N3	.354	.764
B2N4	.382	.484
B2N5	.816	
B2N6	.812	
B2N7	.817	
B2N8	.591	

The table above shows the loadings of the eight variables on the two factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. The factor loadings are correlations of the variables with the factor, which is usual to regard factor loadings as high if they are greater than 0.6 (the positive or negative sign is irrelevant) and moderately high if they are above 0.3 (Kline, 2014:01). Other loadings can be ignored; from these loading the following two deductions can be made:

Factor 1 correlates with all eight the variables, but the highest correlation is with the design of the project meets users' practical needs (B2N7). Note that some variables load higher on this factor than others, suggesting that variable seven is not very important. Variable numbers three and four appear not to require as much as variables five to eight.

Factor 2, when calculated with the same process of deduction as used above, each project manager uses his/her own version of project plan, loads highly on the other factors. Table 3.16 clearly illustrates the nature of factors as constructs defined by their loadings. They also illustrate how a complex set of data, in this instance a large number of scores on different questions can be reduced and simplified.

3.4.2 Factor Analysis: Managing project scope.

TABLE 3.17: Correlation Matrix - Managing Project Scope

Correlation Matrix ^a								
		B3N1	B3N2	B3N3	B3N4	B3N5	B3N6	B3N7
Correlation	B3N1	1.000	.688	.197	.228	.649	.628	.479
	B3N2	.688	1.000	.149	.104	.614	.612	.428
	B3N3	.197	.149	1.000	.521	.170	.071	.197
	B3N4	.228	.104	.521	1.000	.214	.230	.240
	B3N5	.649	.614	.170	.214	1.000	.650	.514
	B3N6	.628	.612	.071	.230	.650	1.000	.590
	B3N7	.479	.428	.197	.240	.514	.590	1.000

a. Determinant = .051

In the table above, each variable is assumed to correlate perfectly with itself. In practice (which will be discussed later in this chapter), this is not always the case. What goes into the diagonals of the correlation matrix is important for understanding and interpreting the factor analyses. There is considerable redundancy in the matrix, with each entry appearing twice, as it logically should.

As indicated in the table below, the KMO measure is 0.810, therefore it can be deduced that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.18: KMO and Bartlett's Test - Managing Project Scope

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.810
Bartlett's Test of Sphericity	Approx. Chi-Square	333.263
	Df	21
	Sig.	.000

Communalities

The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors, in connection with the construct managing project scope, for instance, over 76% of the

variance in Project, is often informally initiated by the client department (sponsor) and is accounted for, while 52.5% of the variance in Users, is consulted on at the design stage and accounted for.

TABLE 3.19: Communalities - Managing Project Scope

Communalities		
	Initial	Extraction
B3N1	1.000	.720
B3N2	1.000	.688
B3N3	1.000	.762
B3N4	1.000	.753
B3N5	1.000	.709
B3N6	1.000	.735
B3N7	1.000	.525

Total Variance Explained

The next item shows all the factors extractable from the analysis, along with their eigenvalues, the percentage of variance attributable to each factor, the cumulative variance of the factor and the previous factors. Note that the first factor accounts for 50.197% of the variance and the second for 19.892%. None of the remaining factors is significant.

TABLE 3.20: Total Variance - Managing Project Scope

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.514	50.197	50.197	3.514	50.197	50.197
2	1.379	19.694	69.892	1.379	19.694	69.892
3	.639	9.130	79.022			
4	.505	7.208	86.230			
5	.370	5.283	91.513			
6	.315	4.497	96.010			
7	.279	3.990	100.000			

Scree Plot

The scree plot is a graph of the eigenvalues against all the factors. The graph is useful for determining how many factors to retain. The point of interest is where the curve starts to flatten - it can be noted that the curve begins to flatten between

factors 3 and 4. Note also that factors 3 and 4 have eigenvalues of less than 1, thus only three factors have been retained. From the third factor onwards, it can be seen that the line is almost flat, indicating that each successive factor is accounting for smaller and smaller amounts of the total variance.

FIGURE 3.11: Scree Plot - Managing Project Scope



3.4.3 Factor Analysis: Managing project time/schedule

TABLE 3.21: Correlation Matrix - Managing Project Time/Schedule

		Correlation Matrix ^a					
		B4N1	B4N2	B4N3	B4N4	B4N5	B4N6
Correlation	B4N1	1.000	.584	.391	.346	.385	.229
	B4N2	.584	1.000	.404	.393	.235	.180
	B4N3	.391	.404	1.000	.681	.533	.280
	B4N4	.346	.393	.681	1.000	.536	.359
	B4N5	.385	.235	.533	.536	1.000	.541
	B4N6	.229	.180	.280	.359	.541	1.000

a. Determinant = .117

In the table above, each variable is assumed to correlate perfectly with itself. In practice (which will be discussed later in this chapter), this is not always the case. What goes into the diagonals of the correlation matrix is important for understanding

and interpreting factor analyses. There is considerable redundancy in the matrix with each entry appearing twice, as it logically must.

Looking at the table below, the KMO measure is 0.741. From the same table it can be noted that the Bartlett's test of sphericity is significant. That is, its associated probability less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.22: KMO and Bartlett's Test - Managing Project Time/Schedule

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.741
Bartlett's Test of Sphericity	Approx. Chi-Square	240.293
	Df	15
	Sig.	.000

Communalities

The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors, for instance, over 78% of the variance states that the whole project team is involved prior to the start of construction, while 62.4% of the variance in WBS is always used as the basis of determining the project's activities.

TABLE 3.23: Communalities - Managing Project Time/Schedule

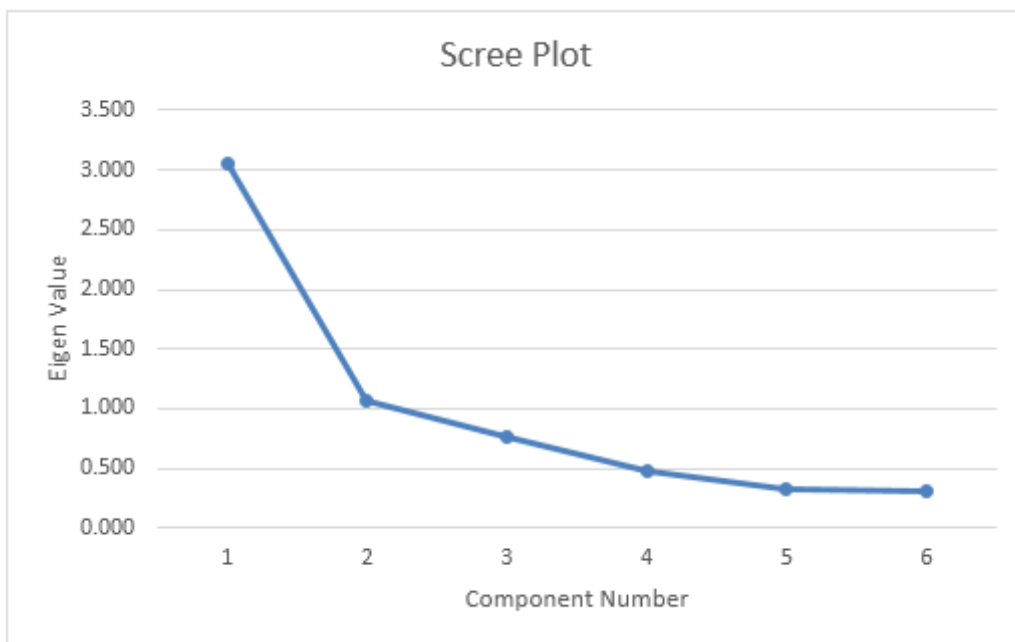
Communalities		
	Initial	Extraction
B4N1	1.000	.694
B4N2	1.000	.782
B4N3	1.000	.633
B4N4	1.000	.652
B4N5	1.000	.745
B4N6	1.000	.624

TABLE 3.24: Total Variance - Managing Project Time/Schedule

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.058	50.971	50.971	3.058	50.971	50.971
2	1.072	17.866	68.837	1.072	17.866	68.837
3	.765	12.752	81.588			
4	.480	8.002	89.590			
5	.319	5.318	94.909			
6	.305	5.091	100.000			

The table above shows a column that contains the cumulative percentage of variance, accounted for by the current and all preceding factors, for example, the second row shows a value of 68.837. This means that the first two factors together account for 68.837% of the total variance.

FIGURE 3.12: Scree Plot - Managing Project Time/Schedule



The scree plot

In the scree plot graphs, the eigenvalue is set against the factor number. This can be seen in these values in the first two columns of the table immediately above. From

the third factor on, it can be noted that the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance. Only components above the change or elbow are retained.

TABLE 3.25: Component Matrix - Managing Project Time/Schedule

	Component	
	1	2
B4N1	.675	.489
B4N2	.639	.611
B4N3	.795	
B4N4	.800	
B4N5	.766	-.398
B4N6	.580	-.537

Table 3.25 illustrates clearly the nature of factors as constructs defined by their loadings. The variable with the strongest association to the underlying latent variable, Factor 1, is Scope variations, which are adequately managed, with a factor loading of 0.80. Since factor loadings can be interpreted like standardized regression coefficients, it could also be said that the variable, Scope variations, is adequately managed, since it has a correlation of 0.80 with Factor 1. This is considered as a strong association for a factor analysis.

Two other variables, Projects are completed within the agreed time frames, and Time period of performing a project activity is given in an optimum manner by the project manager, are also associated with Factor 1, and are based on the variables loading highly onto Factor 1. The whole project team, prior to the start of construction, are involved, has high factor loadings on Factor 2. The gap on the table represents loadings that are less than 0.5.

3.4.4 Factor Analysis: Managing project costs

TABLE 3.26: Correlation Matrix - Managing Project Costs

		B5N1	B5N2	B5N3	B5N4
Correlation	B5N1	1.000	.397	.438	.185
	B5N2	.397	1.000	.440	.274
	B5N3	.438	.440	1.000	.075
	B5N4	.185	.274	.075	1.000

a. Determinant = .556

In the table above, each variable is assumed to correlate perfectly with itself. In practice, which will be discussed later in this chapter, this is not always the case. What goes into the diagonals of the correlation matrix is important in understanding and interpreting factor analyses. There is considerable redundancy in the matrix, with each entry appearing twice, as it logically should.

Looking at the table below, the KMO measure is 0.659. From the same table it can be seen that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.27: KMO and Bartlett's Test - Managing Project Costs

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.659
Bartlett's Test of Sphericity	Approx. Chi-Square	69.749
	Df	6
	Sig.	.000

Communalities

The next item from the output is a table of communalities, which shows how much of the variance in the variables has been accounted for by the extracted factors, for instance, over 62% of the variance is for, Cost estimating, reporting and performance measurement are on projects management, while 18.9% of the variance is for, Service providers paid within 30 days of submission of an invoice.

TABLE 3.28: Communalities - Managing Project Costs

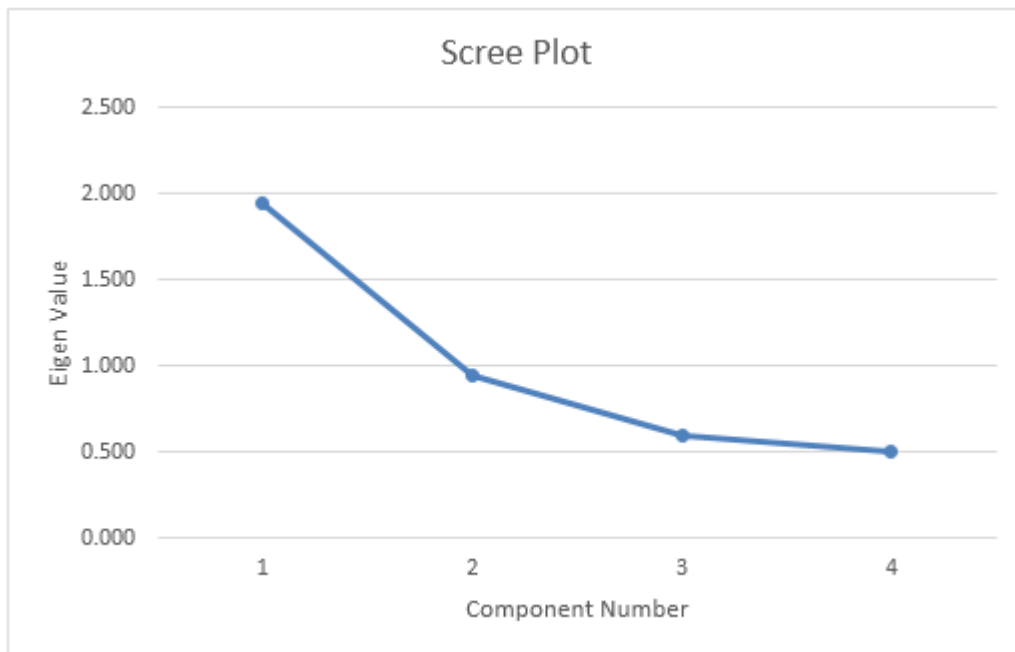
	Initial	Extraction
B5N1	1.000	.577
B5N2	1.000	.623
B5N3	1.000	.562
B5N4	1.000	.189

TABLE 3.29: Total Variance - Managing Project Costs

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.950	48.761	48.761	1.950	48.761	48.761
2	.949	23.736	72.498			
3	.598	14.951	87.448			
4	.502	12.552	100.000			

The table above shows a column that contains the cumulative percentage of variance, accounted for by the current and all preceding factors. For example, the second row shows a value of 72.498. This means that the first two factors together account for 72.498% of the total variance.

FIGURE 3.13: Scree Plot - Managing Project Costs



The scree plot

The scree plot graphs the eigenvalue against the factor number; it can be seen in the values in the first two columns of the table immediately above. From the third factor on, it can be noted that the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.30: Component Matrix - Managing Project Costs

	Component
	1
B5N1	.759
B5N2	.789
B5N3	.750
B5N4	.434

The table above shows the loadings of the four variables on the one factor extracted. There is only one variable (B5N4) on the table representing loadings that are less than 0.5. This makes reading the table easier. The variable (B5N2) has a correlation of 0.789 with Factor 1. The higher the absolute value of the loading, the more the factor contributes to the variable.

3.4.5 Factor Analysis: Managing project human resources

TABLE 3.31: Correlation Matrix - Managing Project Human Resources

Correlation Matrix ^a						
		B7N1	B7N2	B7N4	B7N5	B7N6
Correlation	B7N1	1.000	.292	.360	.402	.432
	B7N2	.292	1.000	.110	.312	.175
	B7N4	.360	.110	1.000	.630	.486
	B7N5	.402	.312	.630	1.000	.683
	B7N6	.432	.175	.486	.683	1.000

a. Determinant = .209

Looking at the table below, the KMO measure is 0.709. On the same table it is illustrated that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.32: KMO and Bartlett's Test - Managing Project Human Resources

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.709
Bartlett's Test of Sphericity	Approx. Chi-Square	180.942
	Df	10
	Sig.	.000

Communalities

The next item from the output is a table of communalities, which shows how much of the variance in the variables has been accounted for by the extracted factors, for instance, for more than 76% of the variance there is a documented, repeatable process in place for project human resource management, while 18.1% of the variance strives to select and hire architects, engineers and construction managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question.

TABLE 3.33: Communalities - Managing Project Human Resources

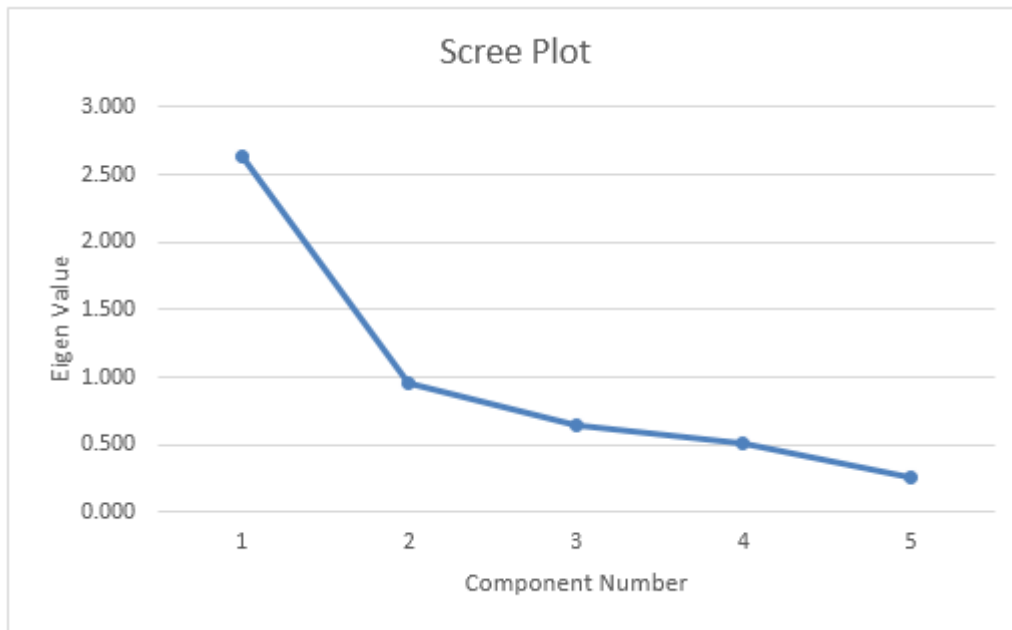
Communalities		
	Initial	Extraction
B7N1	1.000	.452
B7N2	1.000	.181
B7N4	1.000	.571
B7N5	1.000	.769
B7N6	1.000	.662

TABLE 3.34: Total Variance - Managing Project Human Resources

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.636	52.724	52.724	2.636	52.724	52.724
2	.958	19.151	71.876			
3	.646	12.923	84.799			
4	.508	10.165	94.964			
5	.252	5.036	100.000			

The table above shows a column that contains the cumulative percentage of variance accounted for by the current and all preceding factors, for example, the second row shows a value of 71.876. This means that the first two factors together account for 71.876% of the total variance.

FIGURE 3.14: Scree Plot - Managing Project Human Resources



The scree plot

The scree plot graphs the eigenvalue against the factor number, which can be noted from the values in the first column of the table immediately above. From the second factor on, you can see that the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.35: Component Matrix - Managing Project Human Resources

	Component
	1
B7N1	.673
B7N2	.425
B7N4	.756
B7N5	.877
B7N6	.814

The table above shows the loadings of the five variables on the one factor extracted. There is only one variable the researcher strived to select and that is, Hire architects, engineers and construction managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question (B7N2). This variable represents loadings on the table that are less than 0.5. The variable, There is a documented, repeatable process in place for project human

resource management (B7N5), has a correlation of 0.877 with Factor 1. The higher the absolute value of the loading, the more the factor contributes to the variable.

3.4.6 Factor Analysis: Managing project communication

TABLE 3.36: Correlation Matrix - Managing Project Communication

Correlation Matrix ^a							
		B8N2	B8N3	B8N4	B8N5	B8N6	B8N7
Correlation	B8N2	1.000	.708	.757	.462	.456	.520
	B8N3	.708	1.000	.691	.571	.446	.482
	B8N4	.757	.691	1.000	.598	.614	.615
	B8N5	.462	.571	.598	1.000	.703	.590
	B8N6	.456	.446	.614	.703	1.000	.743
	B8N7	.520	.482	.615	.590	.743	1.000

a. Determinant = .019

Looking at the table below, the KMO measure is 0.835. From the same table it can be seen that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.37: KMO and Bartlett's Test - Managing Project Communication

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.835
Bartlett's Test of Sphericity	Approx. Chi-Square	461.681
	Df	15
	Sig.	.000

Communalities

The next item from the output, is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors, for instance, over 77% of the variance is for The project manager is able to deal with conflict appropriately, while 63.4% of the variance is for, The project manager communicates openly and frequently.

TABLE 3.38: Communalities - Managing Project Communication

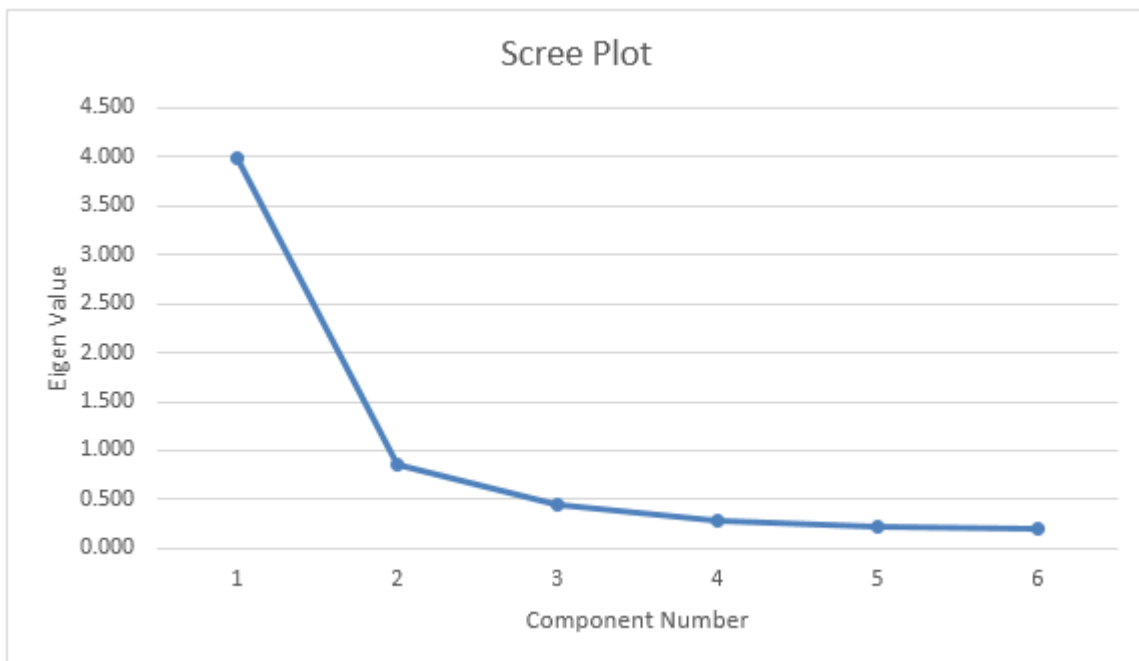
Communalities		
	Initial	Extraction
B8N2	1.000	.637
B8N3	1.000	.634
B8N4	1.000	.772
B8N5	1.000	.641
B8N6	1.000	.655
B8N7	1.000	.651

TABLE 3.39: Total Variance - Managing Project Communication

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.990	66.500	66.500	3.990	66.500	66.500
2	.847	14.112	80.611			
3	.456	7.604	88.216			
4	.289	4.820	93.036			
5	.215	3.582	96.618			
6	.203	3.382	100.000			

The table above shows a column that contains the cumulative percentage of variance accounted for by the current and all preceding factors, for example, the second row shows a value of 80.611. This means that the first two factors together account for 80.611% of the total variance.

FIGURE 3.15: Total Variance - Managing Project Communication



The scree plot

The scree plot above shows values in the first column of the table immediately above. From the second factor on, the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.40: Component Matrix - Managing Project Communication

Component Matrix ^a	
	Component
	1
B8N2	.798
B8N3	.796
B8N4	.878
B8N5	.800
B8N6	.809
B8N7	.807

The table above shows the loadings of the six variables on the one factor extracted. Factor 1 correlates with all six the variables, but most highly with, The project manager is able to deal with conflict appropriately (B8N4). This is considered to be a strong association for a factor analysis.

3.4.7 Factor Analysis: Managing project risks

TABLE 3.41: Correlation Matrix - Managing Project Risks

Correlation Matrix ^a						
		B9N1	B9N2	B9N3	B9N4	B9N5
Correlation	B9N1	1.000	.477	.431	.104	.153
	B9N2	.477	1.000	.579	-.007	.040
	B9N3	.431	.579	1.000	.084	.085
	B9N4	.104	-.007	.084	1.000	.715
	B9N5	.153	.040	.085	.715	1.000

a. Determinant = .231

Looking at the table below, the KMO measure is 0.595. From the same table it can be noted that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.42: KMO and Bartlett's Test - Managing Project Risks

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.595
Bartlett's Test of Sphericity	Approx. Chi-Square	172.079
	Df	10
	Sig.	.000

Communalities

The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors, for instance, over 85% of the variance is for, The political/ governmental problems that arise on site, while 59.2% of the variance is for, Project outcomes that support the achievement of clearly defined strategic objectives.

TABLE 3.43: Communalities - Managing Project Risks

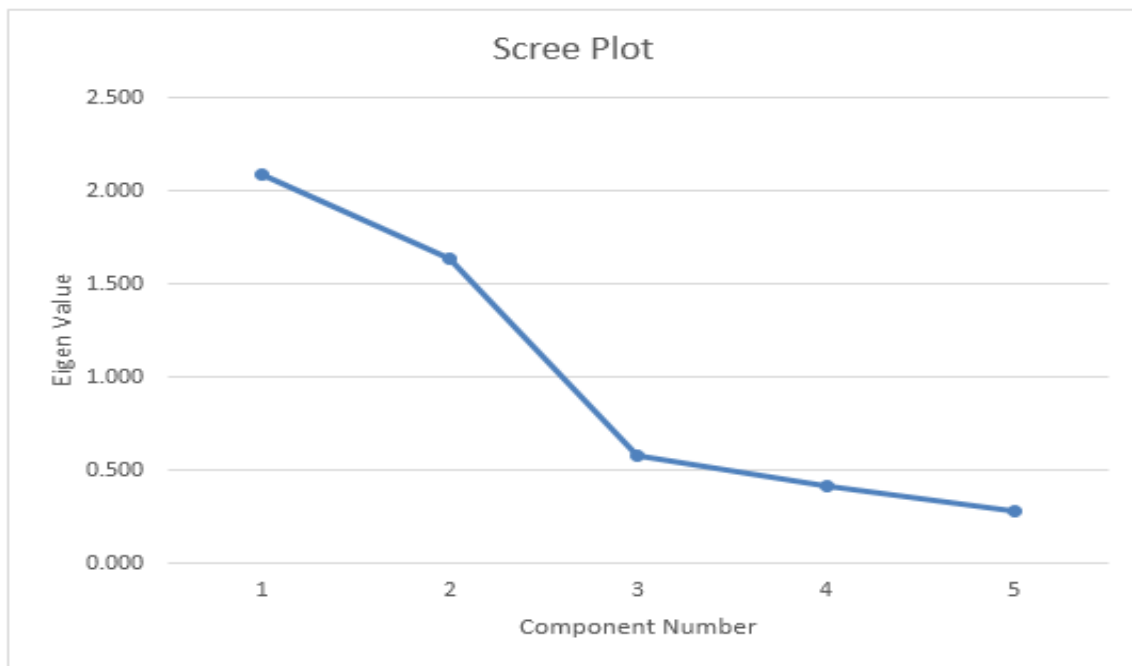
	Initial	Extraction
B9N1	1.000	.592
B9N2	1.000	.735
B9N3	1.000	.685
B9N4	1.000	.856
B9N5	1.000	.855

TABLE 3.44: Total Variance - Managing Project Risks

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.087	41.739	41.739	2.087	41.739	41.739
2	1.635	32.693	74.432	1.635	32.693	74.432
3	.584	11.687	86.118			
4	.414	8.276	94.395			
5	.280	5.605	100.000			

The table above shows a column that contains the cumulative percentage of variance accounted for by the current and all preceding factors. For example, the second row shows a value of 74.432. This means that the first two factors together account for 74.432% of the total variance.

FIGURE 3.16: Scree Plot - Managing Project Risks



The scree plot

The scree plot graphs the eigenvalue against the factor number; it can be noted from the values in the first two columns of the table immediately above. From the third factor on, the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.45: Component Matrix - Managing Project Risks

	Component	
	1	2
B9N1	.735	
B9N2	.741	-.431
B9N3	.758	-.333
B9N4	.440	.814
B9N5	.480	.790

The table above shows the loadings of the five variables on the two factors extracted. The gap on the table represents loadings that are less than 0.5. The variable with the strongest association to the underlying latent variable, Factor 1, is variable three (B9N3), with a factor loading of 0.758. Since factor loadings can be interpreted like standardized regression coefficients, it could also be said that variable three has a correlation of 0.758 with Factor 1. This would be considered a strong association for a factor analysis in most research fields. Two other variables, B9N1 & B9N2, are also associated with Factor 1. Variable four (B9N4) however, has high factor loadings on Factor 2 and a correlation of 0.814 with Factor 2. The higher the absolute value of the loading, the more the factor contributes to the variable.

3.4.8 Factor Analysis: Managing project procurement

TABLE 3.46: Correlation Matrix - Managing Project Procurement

Correlation Matrix ^a						
		B10N1	B10N3	B10N4	B10N5	B10N6
Correlation	B10N1	1.000	.581	.270	.582	.345
	B10N3	.581	1.000	.678	.810	.341
	B10N4	.270	.678	1.000	.636	.352
	B10N5	.582	.810	.636	1.000	.391
	B10N6	.345	.341	.352	.391	1.000

a. Determinant = .082

Looking at the table below, the KMO measure is 0.766. From the same table, it can be seen that the Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.47: KMO and Bartlett's Test - Managing Project Procurement

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.766
Bartlett's Test of Sphericity	Approx. Chi-Square	293.248
	Df	10
	Sig.	.000

Communalities

The next item from the output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors. For instance, over 81% of the variance in legislation promotes transparent procurement practices, while in 32.7% of the variance there is a defined process for managing materials from planning through to delivery and final use.

TABLE 3.48: Communalities - Managing Project Procurement

Communalities		
	Initial	Extraction
B10N1	1.000	.502
B10N3	1.000	.819
B10N4	1.000	.591
B10N5	1.000	.817
B10N6	1.000	.327

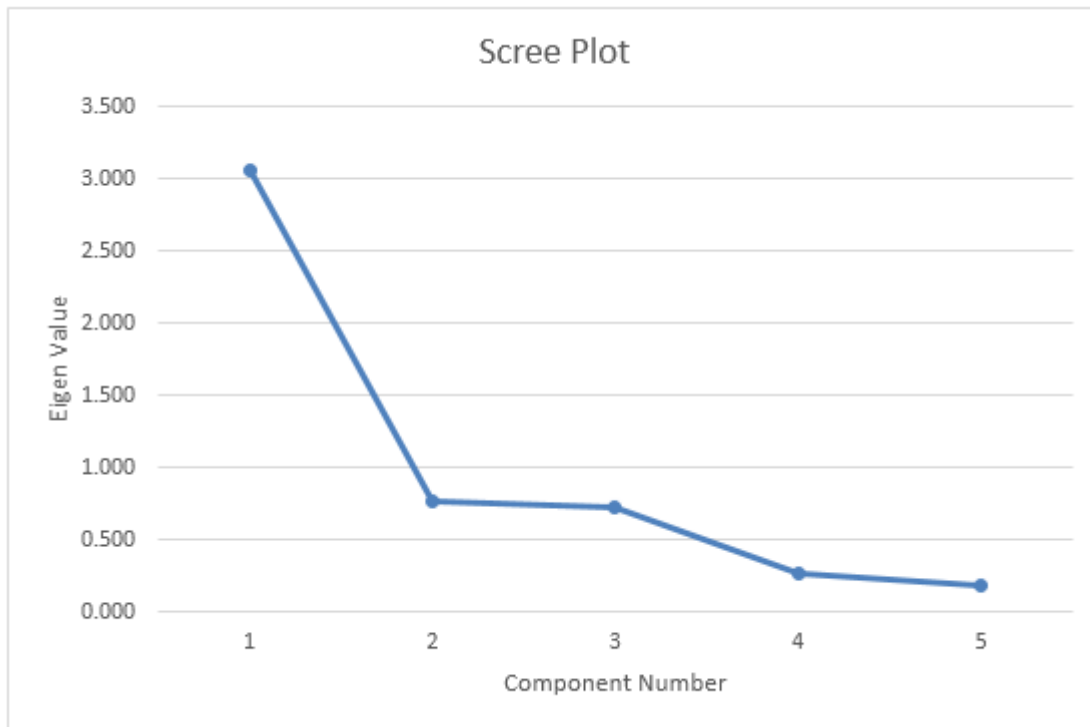
TABLE 3.49: Total Variance - Managing Project Procurement

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.056	61.120	61.120	3.056	61.120	61.120
2	.774	15.473	76.592			
3	.723	14.456	91.049			
4	.267	5.333	96.382			
5	.181	3.618	100.000			

The table above shows a column that contains the cumulative percentage of variance accounted for by the current and all preceding factors. For example, the

second row shows a value of 76.592. This means that the first two factors together account for 76.592% of the total variance.

FIGURE 3.17: Scree Plot - Managing Project Procurement



The scree plot

The scree plot graphs the eigenvalue against the factor number. It can be seen from the values in the first column of the table immediately above. From the third factor on, the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.50: Component Matrix - Managing Project Procurement

Component Matrix ^a	
	Component
	1
B10N1	.708
B10N3	.905
B10N4	.769
B10N5	.904
B10N6	.572

The table above shows the loadings of the five variables on the one factor extracted. Factor 1 correlates with all the variables but the variables with the strongest

association are two and four (B10N3 & B10N5), with a factor loading of 0.905 and .904 respectively. This is considered to be a strong association for a factor analysis.

3.4.9 Factor Analysis: Managing project stakeholders

TABLE 3.51: Correlation Matrix - Managing Project Stakeholders

Correlation Matrix ^a						
		B11N1	B11N2	B11N3	B11N5	B11N6
Correlation	B11N1	1.000	.630	.239	.396	.299
	B11N2	.630	1.000	.310	.401	.373
	B11N3	.239	.310	1.000	.427	.549
	B11N5	.396	.401	.427	1.000	.648
	B11N6	.299	.373	.549	.648	1.000

a. Determinant = .186

Looking at the table below, the KMO measure is 0.720. From the same table, it can be seen that Bartlett's test of sphericity is significant. That is, its associated probability is less than 0.05. This means that the correlation matrix is not an identity matrix.

TABLE 3.52: KMO and Bartlett's Test - Managing Project Stakeholders

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.720
Bartlett's Test of Sphericity	Approx. Chi-Square	197.413
	Df	10
	Sig.	.000

Communalities

The next item from output is a table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors. For instance, 83% of the variance is for 'project outcomes are monitored by the department or client (sponsor) after project closure in order to ensure the achievement of all benefits (deliverables) expected in the business case', while 65% of the variance is for 'project close reports issued within agreed time frames'.

TABLE 3.53: Communalities - Managing Project Stakeholders

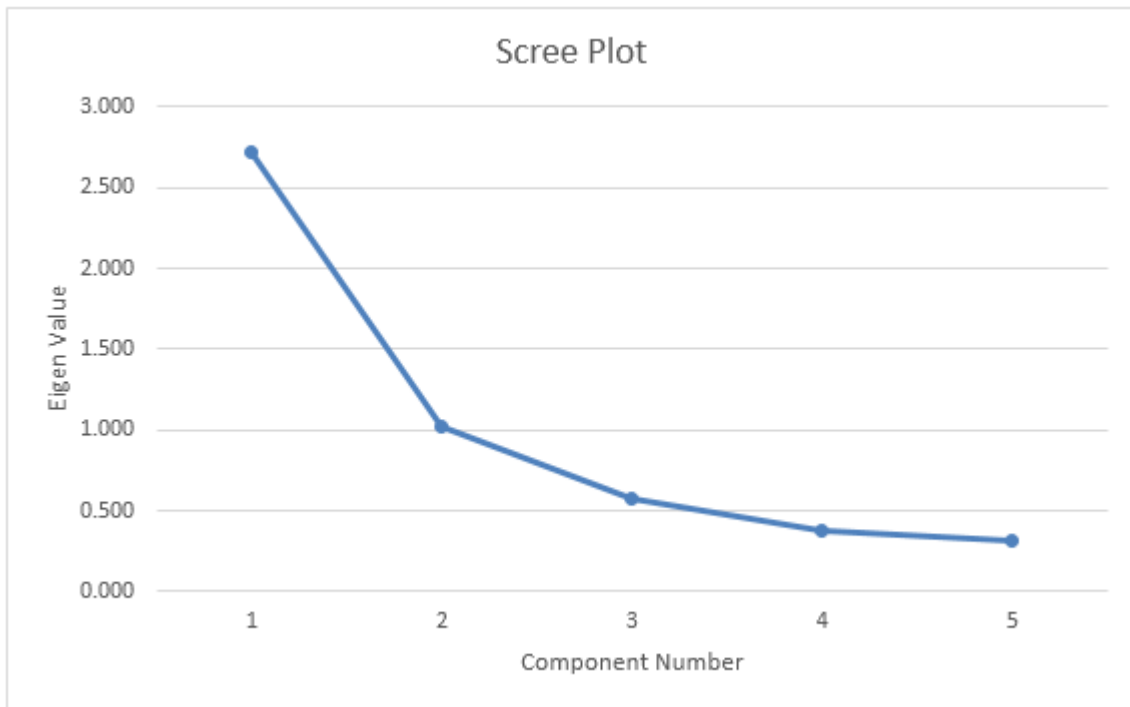
Communalities		
	Initial	Extraction
B11N1	1.000	.830
B11N2	1.000	.791
B11N3	1.000	.650
B11N5	1.000	.677
B11N6	1.000	.790

TABLE 3.54: Total Variance - Managing Project Stakeholders

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.719	54.381	54.381	2.719	54.381	54.381
2	1.019	20.387	74.767	1.019	20.387	74.767
3	.575	11.494	86.261			
4	.375	7.494	93.755			
5	.312	6.245	100.000			

The table above shows a column that contains the cumulative percentage of variance accounted for by the current and all preceding factors. For example, the second row shows a value of 74.767. This means that the first two factors together account for 74.767% of the total variance.

FIGURE 3.18: Scree Plot - Managing Project Stakeholders



The scree plot

The scree plot graphs the eigenvalue against the factor number; it can be seen from these values in the first two columns of the table immediately above. From the third factor on, the line is almost flat, meaning that each successive factor is accounting for smaller and smaller amounts of the total variance.

TABLE 3.55: Component Matrix - Managing Project Procurement

Component Matrix ^a		
	Component	
	1	2
B11N1	.683	.603
B11N2	.730	.508
B11N3	.678	-.437
B11N5	.795	
B11N6	.793	-.401

Table 3.55 clearly illustrates the nature of factors as constructs defined by their loadings. The variables with the strongest association to the underlying latent variable, Factor 1 is: ‘at the conclusion of a project the team of the project manager, superintendent, estimator and a senior executive conduct a “job close-out meeting”

to evaluate the highlights and lowlights of a project' (B11N5); and 'a close-out report with lessons learned are well communicated' (B11N6), with factor loadings of 0.795 and 0.793 respectively. This is considered to be a strong association for a factor analysis.

Three other variables are also associated with Factor 1 and based on the variables loading, highly onto Factor 1. There are two variables (B11N3 & B11N6) that have low factor loadings on Factor 2. The gap on the table represents loadings that are less than 0.5.

3.5 CHAPTER SUMMARY

This chapter discussed the techniques and research methods used to investigate the dissertation topic. This section of the study focussed on the research questionnaire design, the various categories of questions included in the questionnaire and the different items that form part of the research questionnaire. This chapter also provided the research design approach that was followed for this study and highlighted the statistical methods used, including the validity and reliability methods employed.

CHAPTER 4

STATISTICAL ANALYSIS

4.1 INTRODUCTION

This chapter presented an analysis of the data, namely - the descriptive statistics, including frequencies and factor analyses. Secondly, it covered the correlation between the measured constructs, regression analysis, multiple analyses of variance, and the content analyses of the open-ended questions related to the challenges facing project managers, as well as comments pertaining to project management practices in the Northern Cape Province.

4.2 STATISTICAL ANALYSIS

One of the objectives of the study was to determine whether participants perceived that the project managers of the National Department of Public Works, Kimberley Regional office, adhered to the project management body of knowledge (PMBOK) principles during the planning and implementation of construction projects in the Northern Cape Province. Frequencies of responses from participants are summarized in Table 4.1 (below).

TABLE 4.1: Indicates the descriptive statistics of the various factors tested in this study

Item	Mean	SD	Item Accepted	α
Managing project integration	27.84	5.53	8	0.823
Managing project scope	24.34	5.04	7	0.815
Managing project time	20.48	4.04	6	0.804
Managing project costs	19.43	3.77	6	0.613
Managing project quality	21.44	3.12	7	0.402
Managing human resources	15.58	3.49	5	0.739
Managing project communication	23.49	5.33	7	0.907
Managing project risks	16.5	2.91	5	0.637
Managing project procurement	20.01	4.05	6	0.756
Managing project stakeholders	16.29	3.35	5	0.788

Table 4.1 summarizes the scores for each of the ten variables on the five-point Likert-type scale, the mean values, standard deviations and Cronbach alpha coefficients. It appears that some of the variables such as managing human

resources, managing project risks and managing project stakeholders varied somewhat around the mean scores. The standard deviation scores were higher than one and the majority of the scales indicated acceptable and high Cronbach alpha coefficients; displaying the reliability of the scale apart from managing project quality scale, managing project costs and managing projects.

4.2.1 Adherence to the project management body of knowledge (PMBOK) principles

The project management body of knowledge (PMBOK) principles' questions were asked to determine if the project managers of the National Department of Public Works, Kimberley Regional office, adhered to these principles during the planning and implementation of construction projects in the Northern Cape Province. The frequencies of responses were reported as follows:

Question 2

Managing project integration - eight questions were asked about this topic. The table below presents the summary of the respondents.

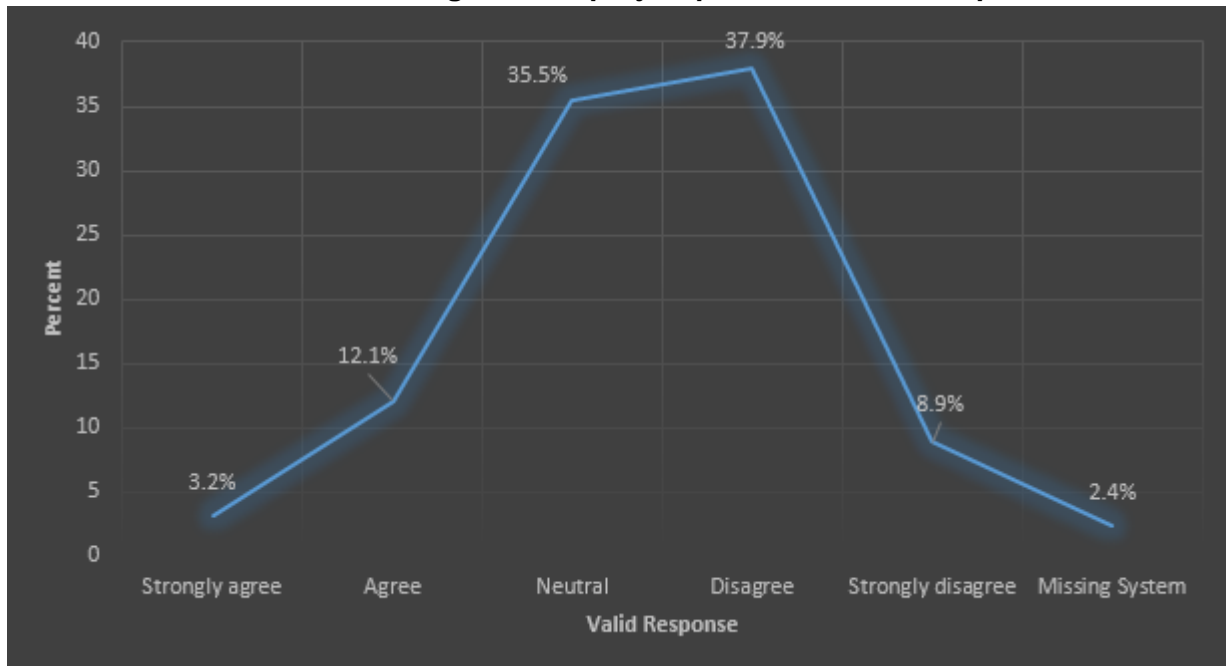
Questions	Agree	Neutral	Disagree
2.1	15.3%	35.5%	46.8%
2.2	17.7%	29.0%	50.8%
2.3	17.7%	24.2%	54.8%
2.4	21.8%	31.5%	44.4%
2.5	14.5%	8.1%	73.4%
2.6	12.9%	16.9%	68.5%
2.7	12.9%	25.0%	59.6%
2.8	26.6%	33.1%	38.8%

Question 2.1 There is a true integration of project plans and business plans

Just over a third of the respondents (35.5%) were neutral on this question, while almost half of the respondents disagreed (37.9% + 8.9%) that there was an integration of project plans and business plans. Only (12.1%) agreed with the

statement. This is confirmed by the mean score of 3.38, which is towards the higher side of the scale.

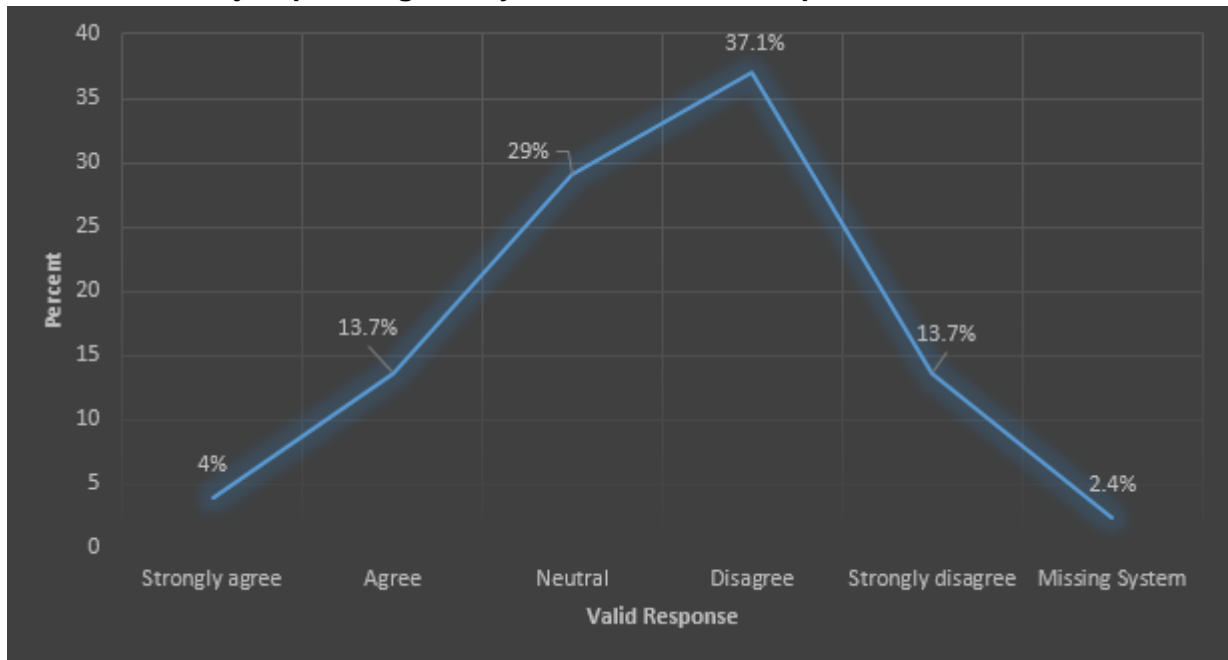
FIGURE 4.1: There is a true integration of project plans and business plans



Question 2.2 Project planning process is fully documented and implemented

A total of 17.7% (4% + 13.7%) of the respondents were of the opinion that the project planning process is fully documented and implemented, while 50.8% (37.1% + 13.7%) were of the opinion that the project planning process is not fully documented and implemented. Finally 29% decided to remain neutral on this matter.

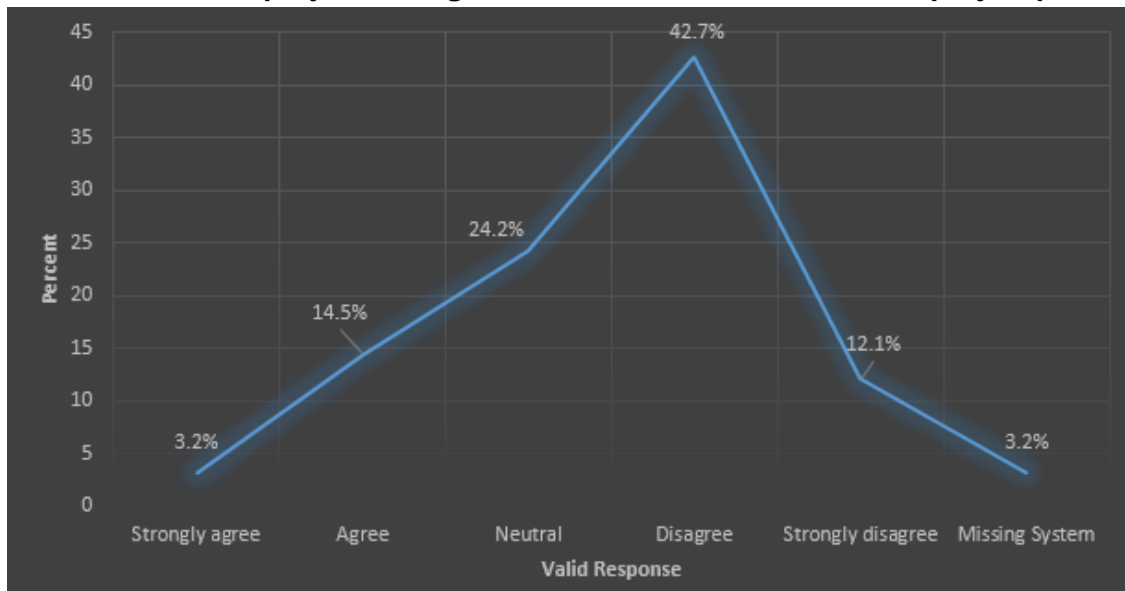
FIGURE 4.2: Project planning is fully documented and implemented



Question 2.3 Each project manager has his/her own version of the project plan

The largest group of respondents, 54.8% (42.7% + 12.1%), disagreed with the statement, while 24.2% indicated that they were neutral and 17.7% (3.2% + 14.5%) agreed that each project manager has his/her own version of project plan.

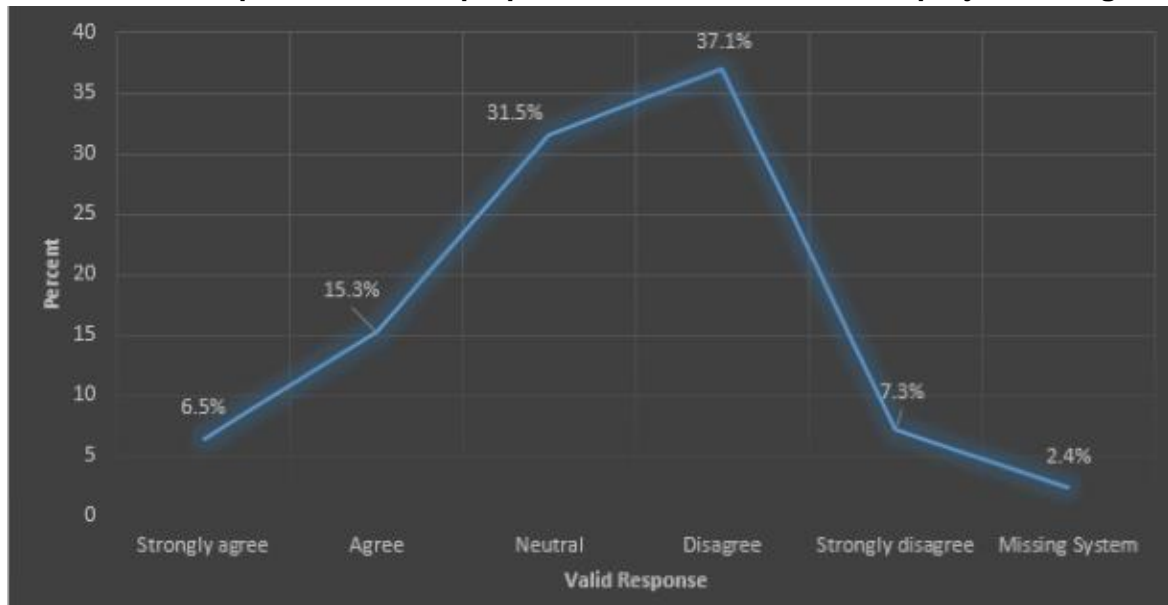
FIGURE 4.3: Each project manager has his/her own version of the project plan



Question 2.4 A scope statement is prepared at the discretion of the project manager

A total of 44.4% of the respondents were of the opinion that a scope statement was not prepared at the discretion of the project manager whereas 21.8% agreed with the statement and 31.5% of the respondents remained neutral.

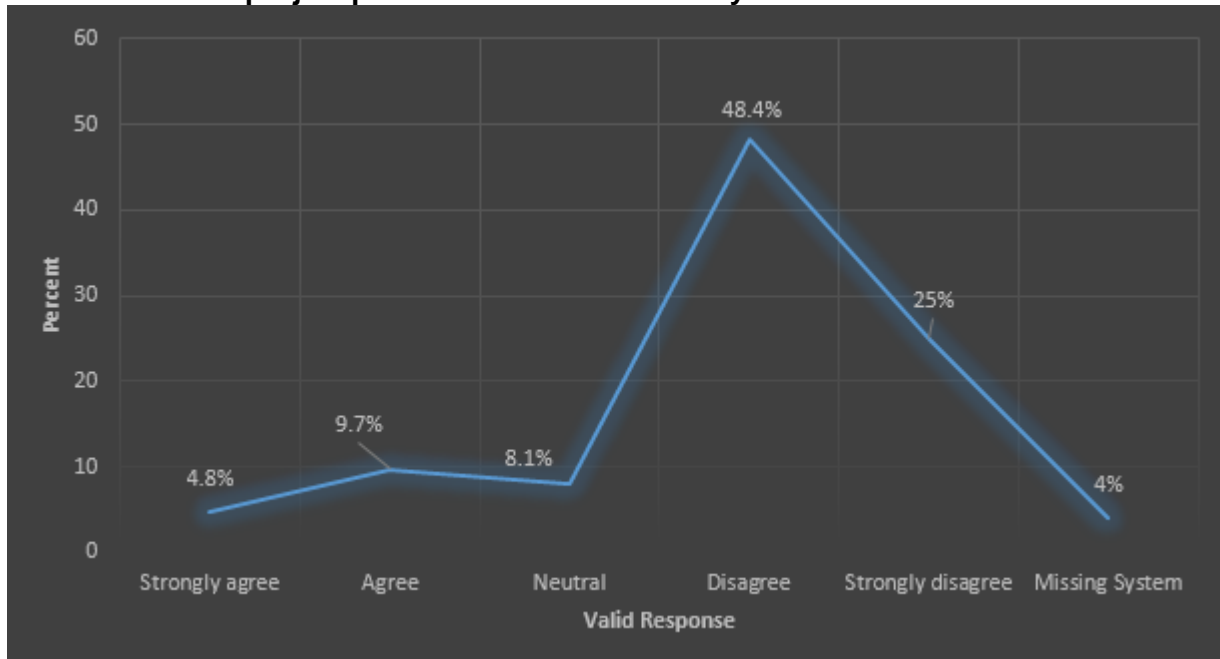
FIGURE 4.4: Scope statement is prepared at the discretion of the project manager



Question 2.5 The project plan includes cost summary estimates?

Almost three quarters of the respondents (73.4%) disagreed with the statement that the project plan includes cost summary estimates. A total of 8.1% remained neutral and 14.5% agreed with the statement. This might lead to over or under expenditure of the project.

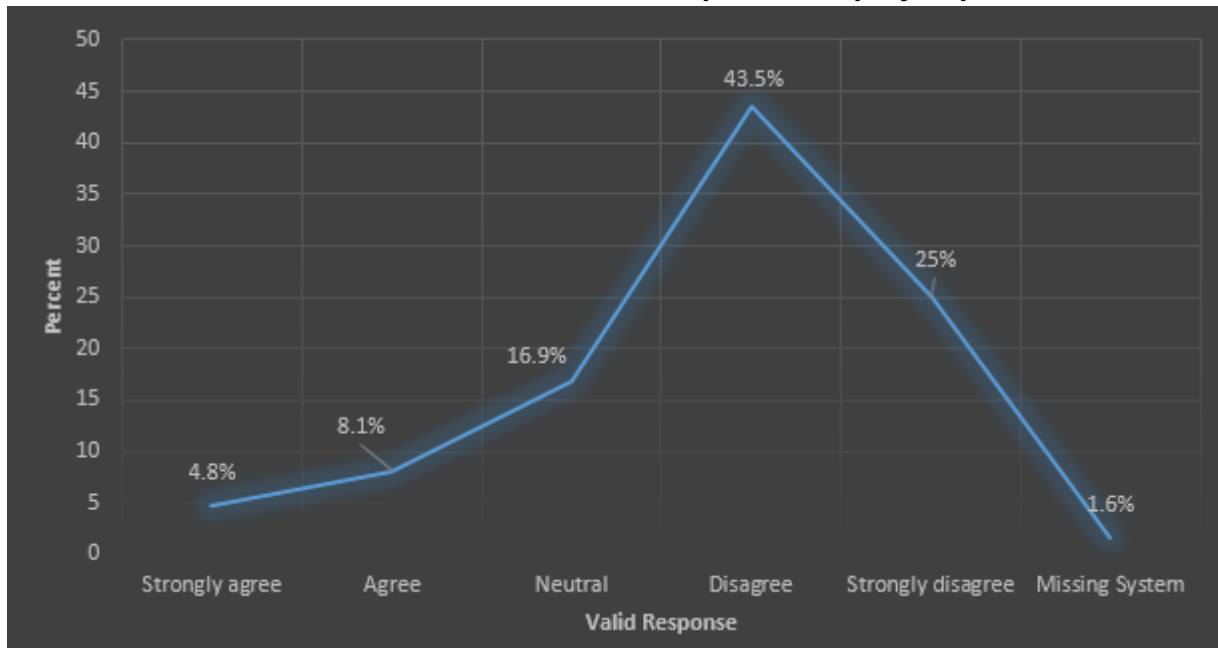
FIGURE 4.5: The project plan includes cost summary estimates



Question 2.6 Milestones with scheduled dates are part of the project plan?

Just more than two thirds (68.5%) of the stakeholders disagreed with the statement: milestones with scheduled dates are part of the project plan, while 16.9% were neutral and 12.9% agreed with the statement. This is confirmation that most of the project plans do not have milestones, while milestones are seen as “the holy grail” of effective project plan management. Without milestones the project manager will not be in a position to tell whether there is progress on the project or not, as the tool to manage performance against actual results is using the milestones outlined on the project plans.

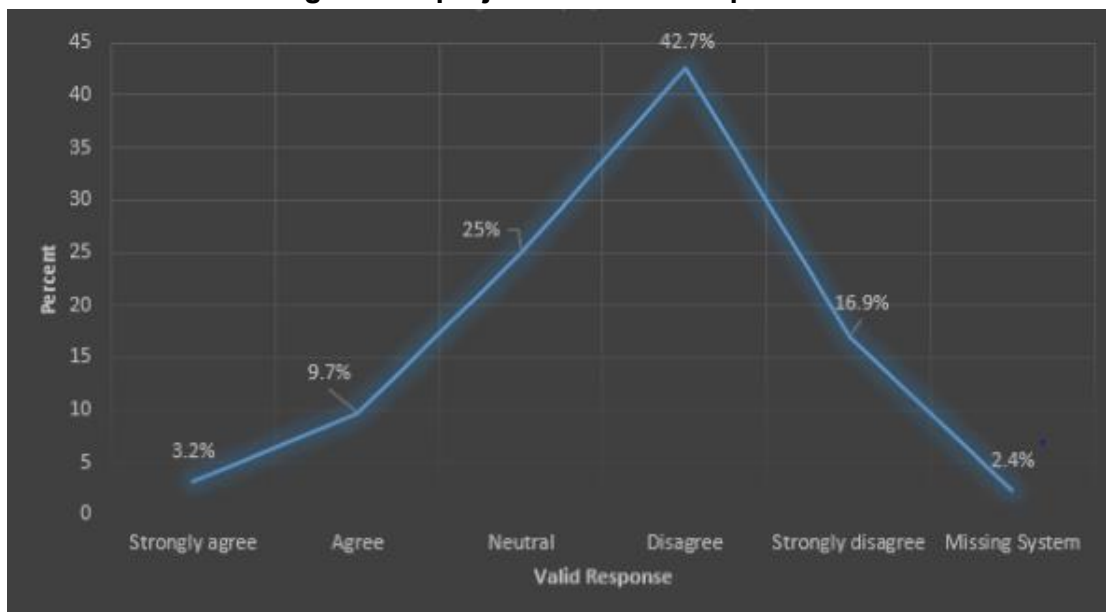
FIGURE 4.6: Milestones with scheduled dates are part of the project plan



Question 2.7 The design of the project meets users' practical needs

The largest group of respondents (59.6%) disagreed with the statement that the design of the project meets users' practical needs, while 25% indicated that they were neutral and only 12.9% felt that the designs met the user's practical needs. The end product (project deliverables) might not be what the client/sponsor requested.

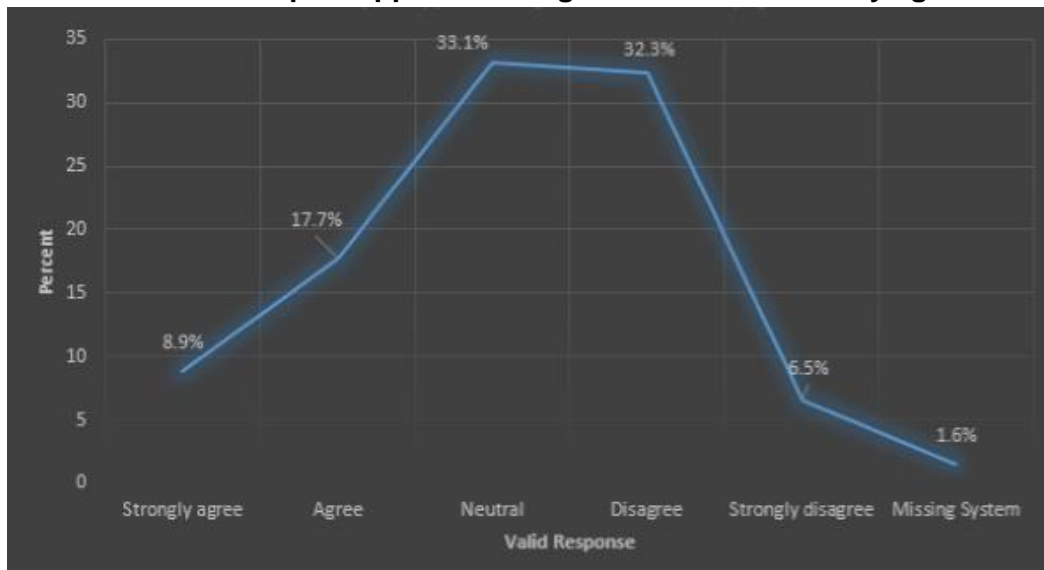
FIGURE 4.7: The design of the project meets users' practical needs



Question 2.8 Sketch plan approvals are granted within mutually agreed time frames

Almost a third of respondents (33.1%) were neutral to this question, only 26.6% agreed with the statement, while just over a third of respondents (38.8%) indicated that sketch plans were not approved within agreed time frames. This may delay the project if sketch plans are not approved within agreed time frames.

FIGURE 4.8: Sketch plan approvals are granted within mutually agreed time frames



Question 3

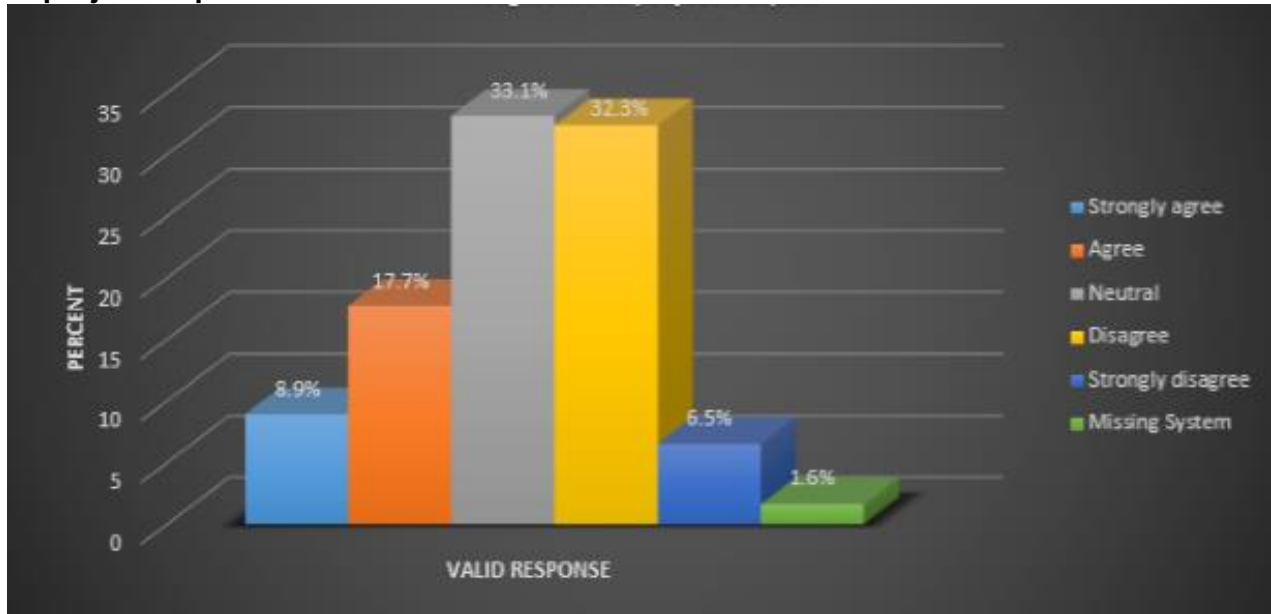
Managing project scope - seven questions were asked about this topic. The table below presents a summary of the responses.

Questions	Agree	Neutral	Disagree
3.1	26.6%	33.1%	38.8%
3.2	18.5%	24.2%	55.7%
3.3	20.1%	31.5%	45.2%
3.4	20.9%	38.7%	38.7%
3.5	16.1%	20.2%	62.1%
3.6	17.0%	15.3%	64.5%
3.7	18.6%	25.0%	53.2%

Question 3.1 The project’s scope includes activities aiming to ensure the integration of project outputs The majority of the respondents (38.8%) indicated

that the project's scope did not include activities aiming at integration of project outputs, while only 26.6% indicated that they did agree with the statement. Although this percentage is small, there is reason for concern because 33.1% remained neutral, neither agreeing nor disagreeing.

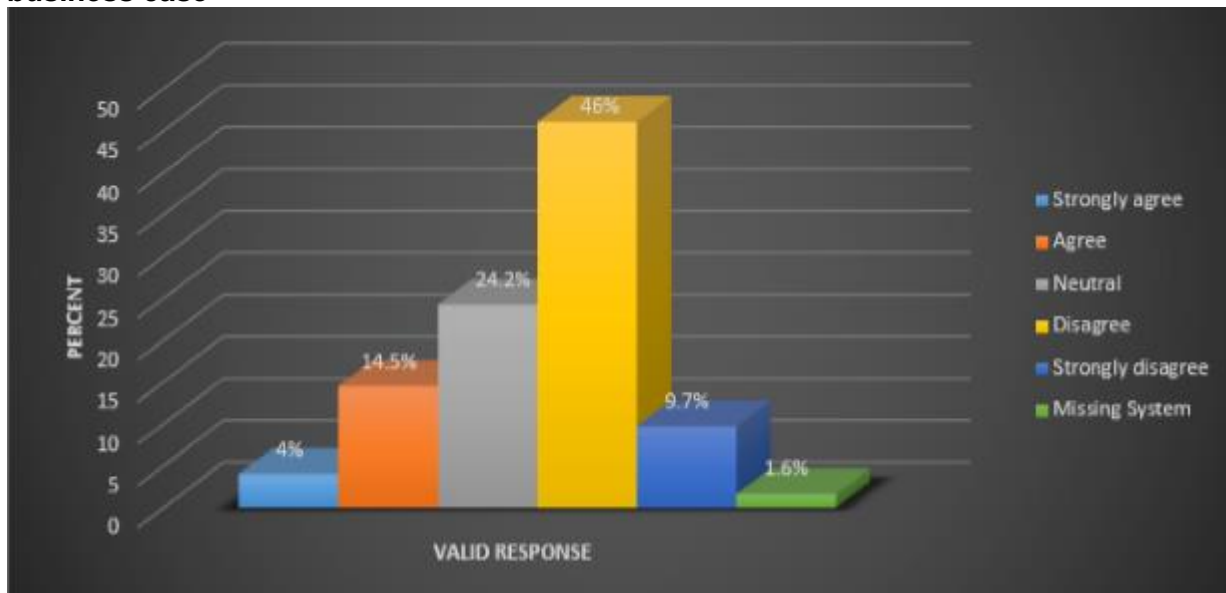
FIGURE 4.9: The project's scope includes activities aiming to ensure the integration of project outputs



Question 3.2 Project outcomes adhere to the expected outcomes planned in the business case

In this item, the smallest number of the respondents (18.5%) agreed with the statement that project outcomes adhere to the expected outcomes planned in the business case, while a total of 55.7% disagreed with the statement. A large percentage of the respondents (24.2%) remained neutral, neither agreeing nor disagreeing. Non-compliance to the plan might cause unnecessary project deviations.

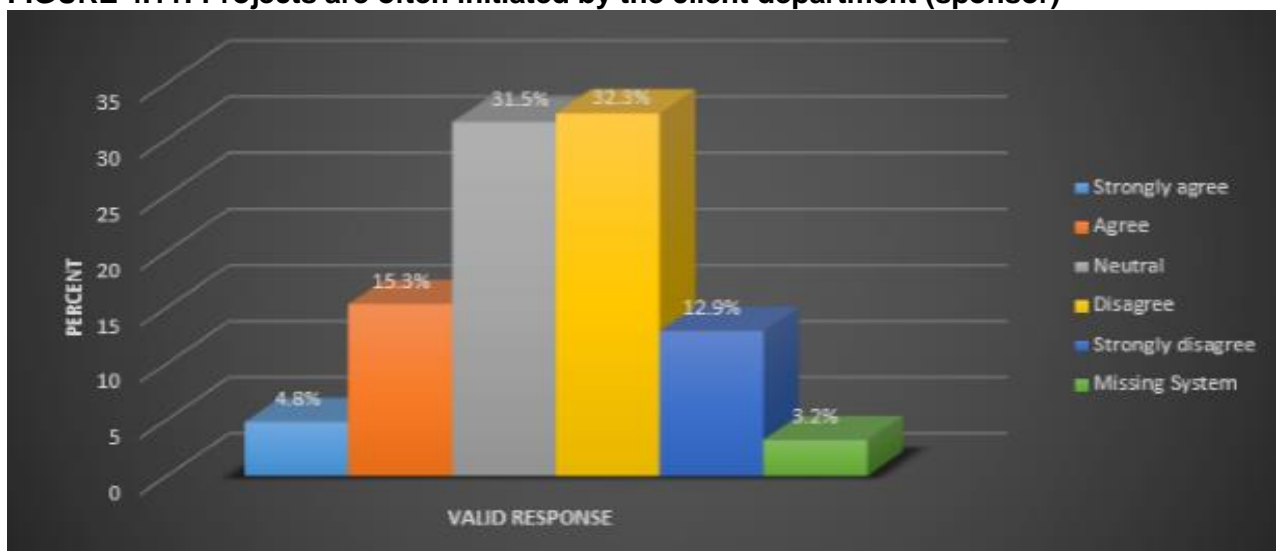
FIGURE 4.10: Project’s outcomes adhere to the expected outcomes planned in the business case



Question 3.3 Projects are often informally initiated by client department (sponsor)?

When requested to indicate the extent to which they agreed or disagreed with the statement, Projects are often informally initiated by client department (sponsor), the majority (45.2%) disagreed, 31.5% remained neutral, while only 20.1% agreed. Given that the majority of the respondents (45.2%) disagreed, it could be concluded that projects are formally initiated by the sponsors.

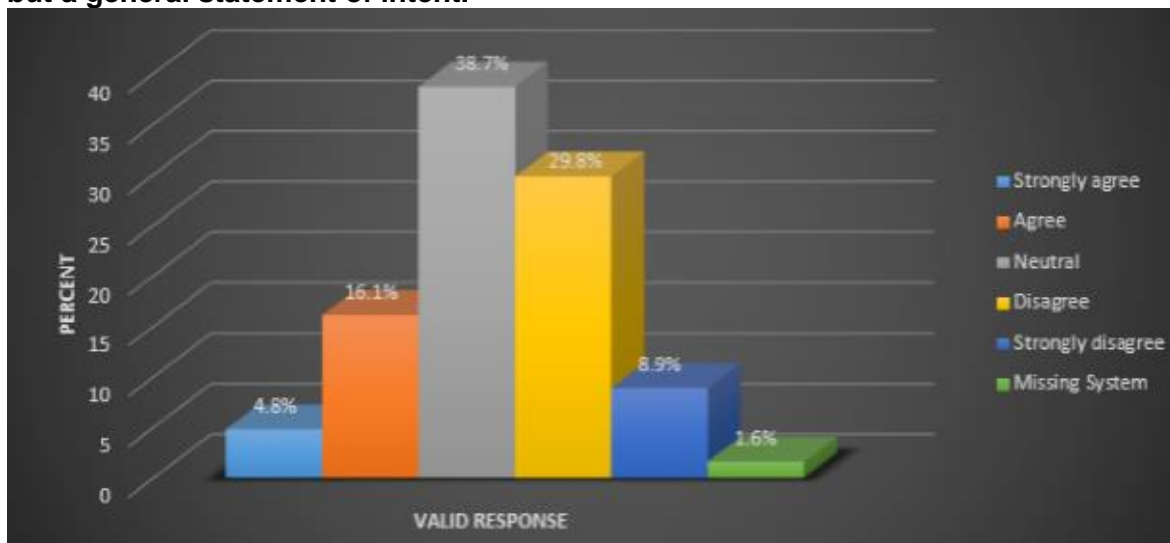
FIGURE 4.11: Projects are often initiated by the client department (sponsor)



Question 3.4 The client (sponsor) does not have a formal statement of requirements but rather a general statement of intent

The majority of the respondents (38.7%) remained neutral, neither agreeing nor disagreeing with this statement, while 38.7% indicated that they disagreed with the statement. This percentage is too high, so there is reason for concern because only 20.9% agreed with the statement.

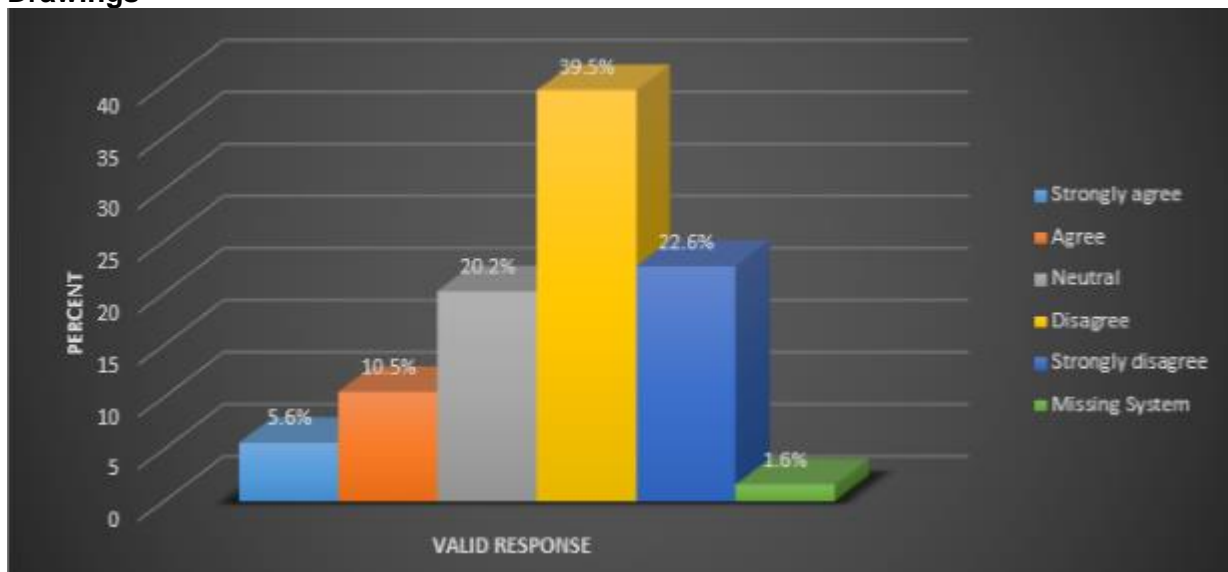
FIGURE 4.12: The client (sponsor) does not have a formal statement of requirements but a general statement of intent.



Question 3.5 Project scopes are sufficiently documented on the Bills of Quantities and Drawings

Almost two thirds (62.1%) of the stakeholders disagreed with the statement, Project scopes are sufficiently documented on the Bills of Quantities and Drawings, while 20.2% were neutral and 16.1% agreed with the statement. This was confirmation that most of the project scopes did not have Bills of Quantities and Drawings.

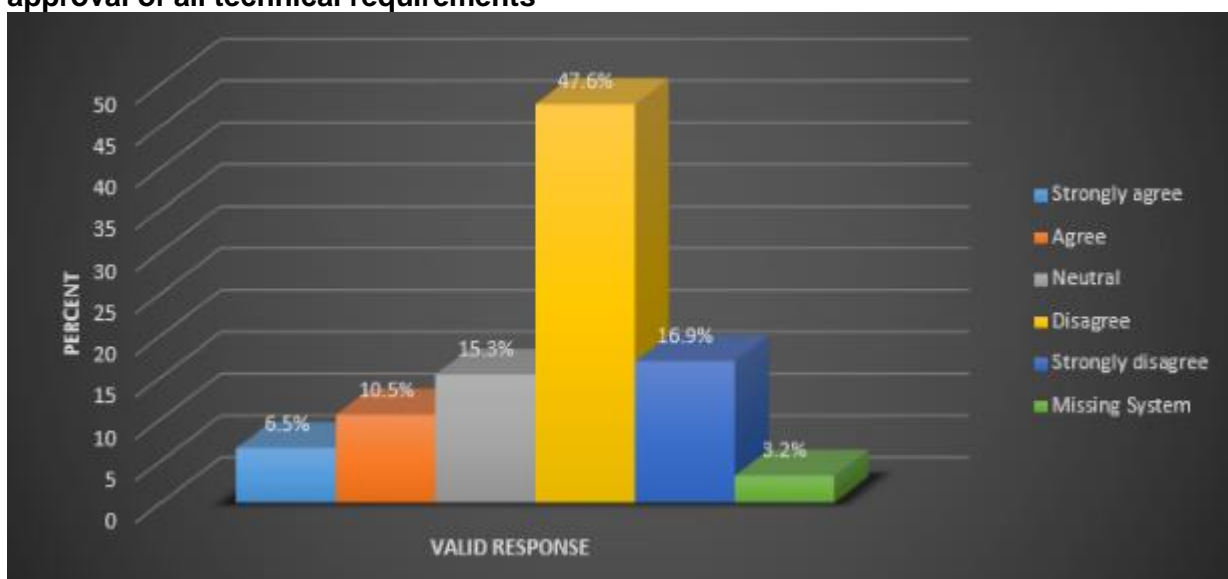
FIGURE 4.13: Project scopes are sufficiently documented on the Bills of Quantities & Drawings



Question 3.6 The project team is involved in the definition, documentation, and approval of all technical requirements

More than half (64.5%) of the respondents disagreed that the project team was involved in the definition, the documentation, as well as the approval of all technical requirements. This showed that project team members are not involved in the entire project plan cycle.

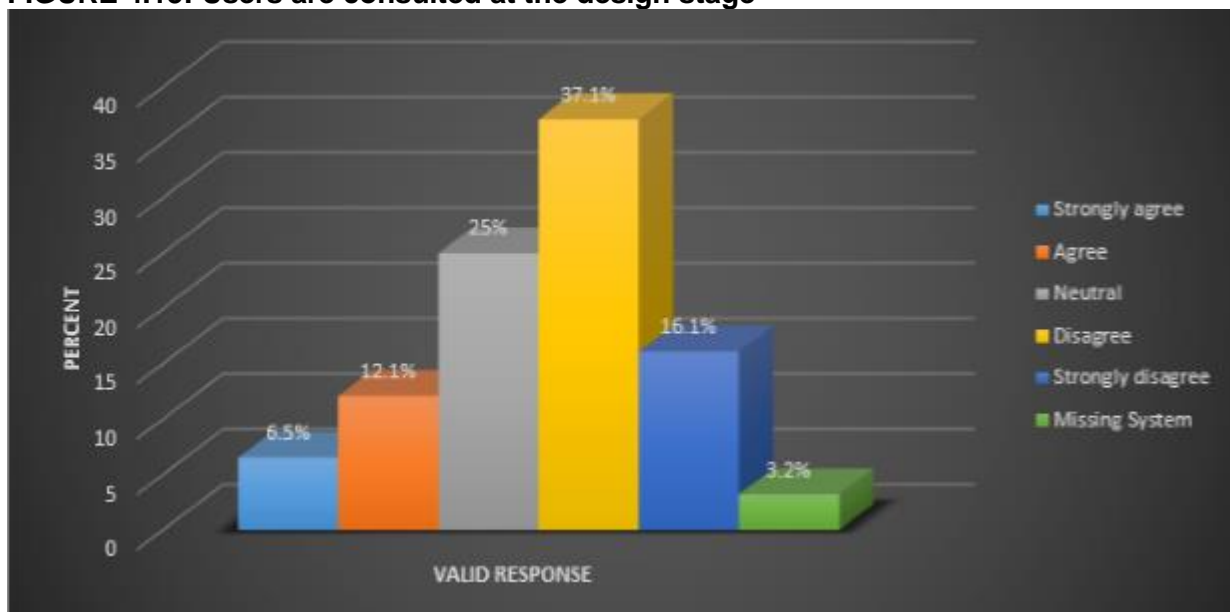
FIGURE 4.14: The project team is involved in the definition, documentation and approval of all technical requirements



Question 3.7 Users are consulted at the design stage

The majority (53.2%) of the respondents confirmed that project sponsors were not consulted during the design stage of the project. A total of 6.5% strongly disagreed with the statement. The project sponsor might have been dissatisfied with the end product (project deliverables) if they were not consulted during the design stage. This might also cause scope variations during the project process, which might result in additional expenditure. There seemed to be a lack of communication and consultation between the department and the project sponsors.

FIGURE 4.15: Users are consulted at the design stage



Question 4

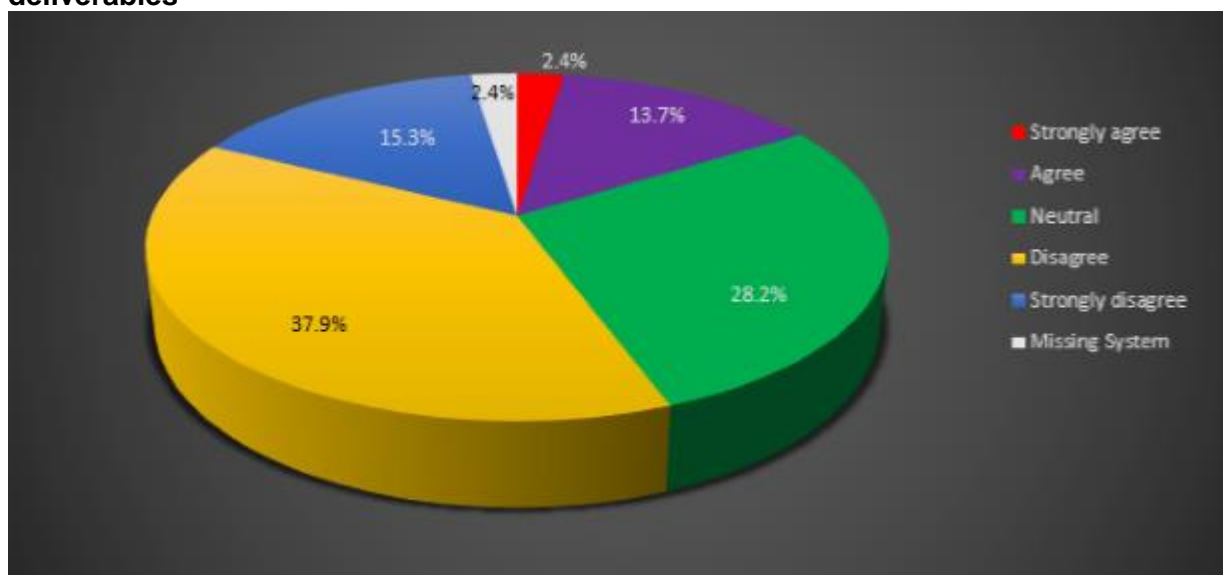
Six questions were asked on the topic: Managing project time/schedule. The table below is a summary of the responses.

Questions	Agree	Neutral	Disagree
4.1	16.1%	28.2%	53.2%
4.2	16.5%	20.2%	62.9%
4.3	32.3%	32.3%	33.9%
4.4	20.1%	40.3%	37.1%
4.5	12.9%	30.6%	54.9%
4.6	07.2%	38.7%	48.4%

Question 4.1 Enough Information is given during design and construction stages on deliverables

The majority of the respondents (53.2%) were of the opinion that not enough information was given during the design and construction stages on deliverables. A total of 16.1% were of the opinion that enough information was provided, while 28.2% decided to remain neutral on this matter. A lack of communication seemed to be the problem which might lead to delays in projects' completion times.

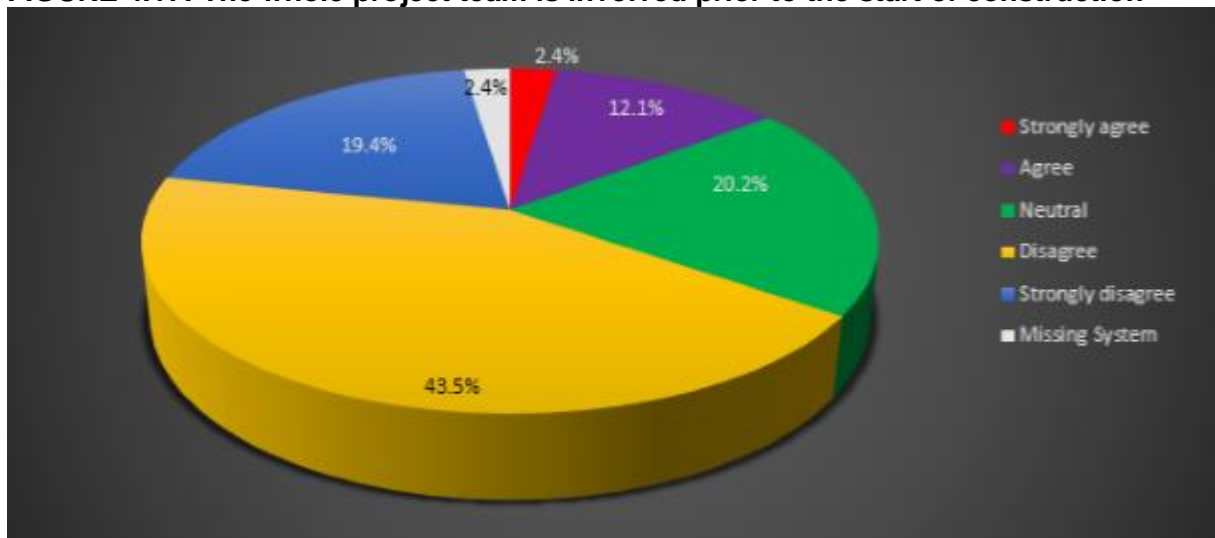
FIGURE 4.16: Enough Information is given during design and construction stages on deliverables



Question 4.2 The whole project team is involved prior to the start of construction

A total of 62.9% of the respondents were of the opinion that the need to involve the whole project team prior to the start of construction was not implemented, whereas 16.5% agreed that the whole project team was involved, and 20.2% remained neutral. The buy-in of team members to own up to the project might be a problem, because they were not involved prior to the start of construction. This might demoralize team members and could also delay the completion of the project on time.

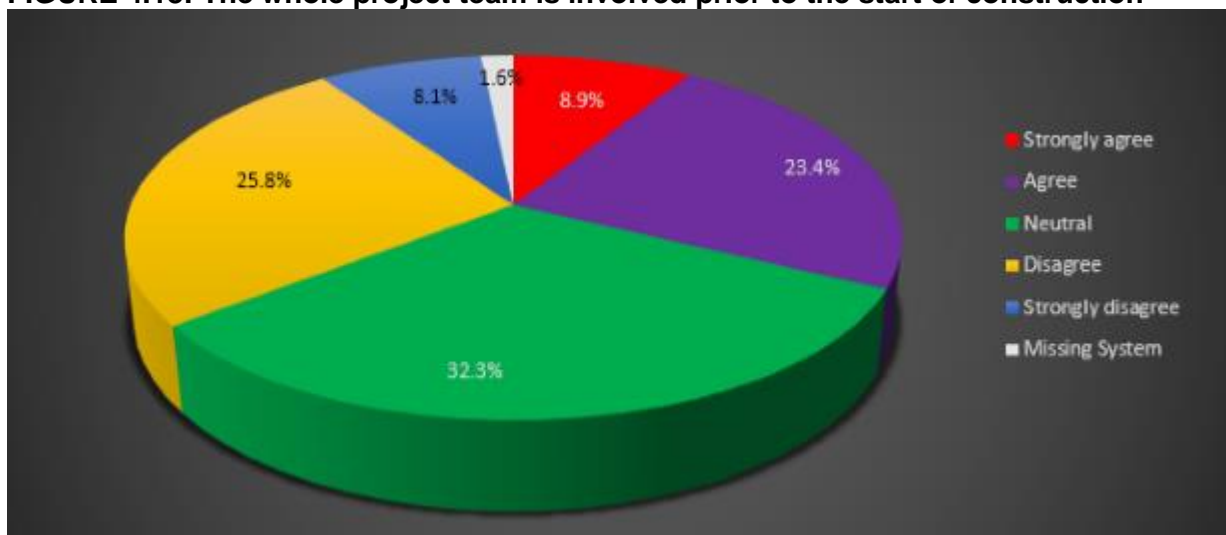
FIGURE 4.17: The whole project team is involved prior to the start of construction



Question 4.3 Projects are completed within the agreed time frames

A total of 33.9% of the respondents disagreed with the statement that projects are completed within the agreed time frames, while 32.3% indicated that they were neutral and 32.3% agreed that projects were completed within the agreed time frames. Delayed projects compromise service delivery and the more the projects are delayed, the more costs escalate. This impacts tax payers financially.

FIGURE 4.18: The whole project team is involved prior to the start of construction

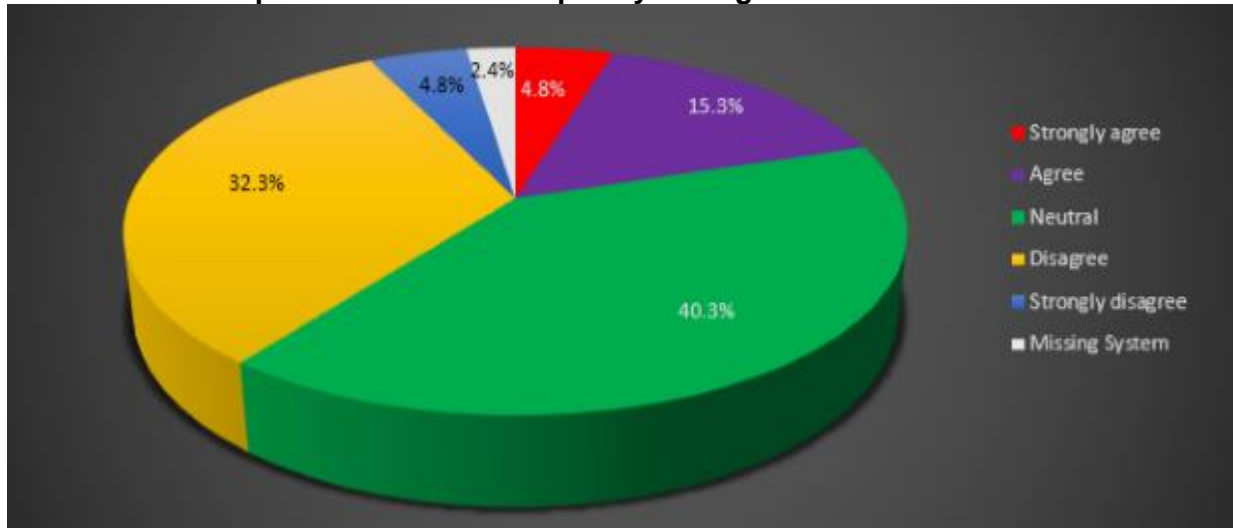


Question 4.4 Scope variations are adequately managed

The largest group of respondents (40.3%) indicated that they were neutral regarding the statement that scope variations were adequately managed, while 37.1%

indicated that they did not agree with the statement and only 20.1% agreed that scope variations were adequately managed. This means that scope variations were not adequately managed, and might result in unnecessary additional costs and delays in completing projects.

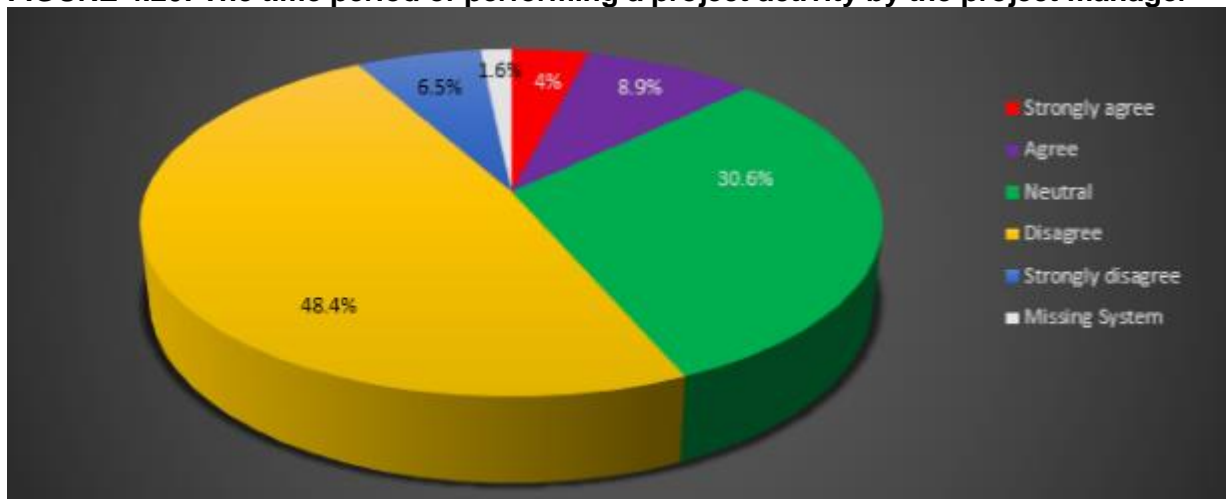
FIGURE 4.19: Scope variations are adequately managed



Question 4.5 Time period of performing a project activity is given in an optimum manner by the project manager

Most of the respondents (54.9%) indicated that they did not agree with the statement, The time period of performing a project activity is given in an optimum manner by the project manager, while 30.6% remained neutral on this matter and only 12.9% agreed with the statement. The activities were designed to significantly improve the likelihood of project success and the realization of intended project benefits, as well as to facilitate the project team’s ability to deliver quality products on time and within budget. If this is not done, projects are likely to fail.

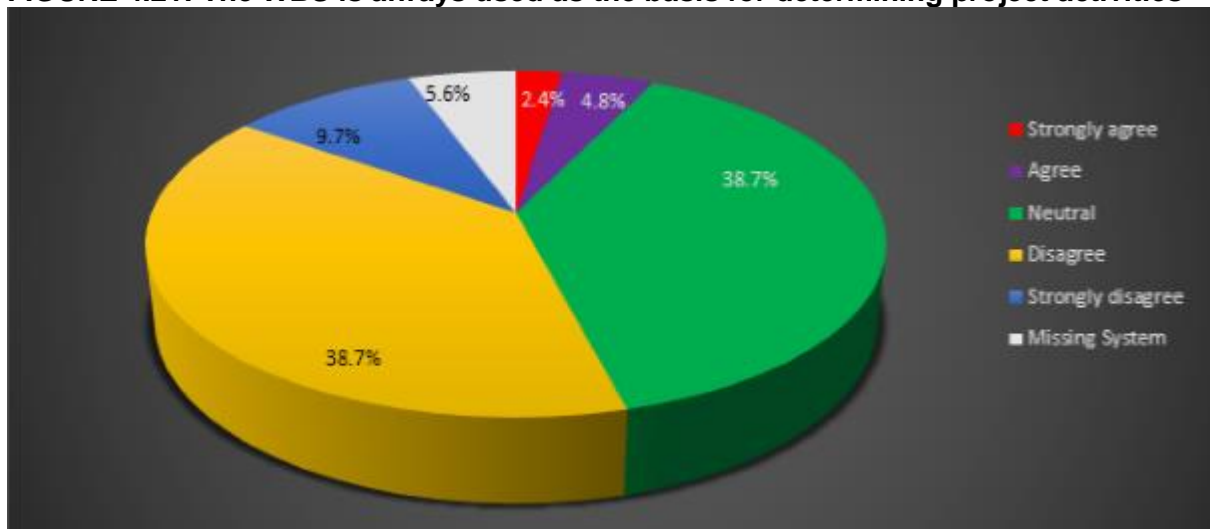
FIGURE 4.20: The time period of performing a project activity by the project manager



Question 4.6 The WBS is always used as the basis for determining project activities

Almost half (48.4%) of the respondents disagreed with the statement, that the work breakdown structure (WBS) was always used as the basis for determining project activities. A total of 38.7% remained neutral and only 7.2% agreed with the statement. When a project is falling behind, referring to the work breakdown structure will quickly identify the major deliverables impacted by a failing work package or late sub-deliverable. The work breakdown structure can also be colour coded to represent sub-deliverables' status. Assigning red for late, yellow for at risk, green for on-target, and blue for completed deliverables, is an effective way to produce a heat-map of project progress and draw management's attention to key areas of the work breakdown structure.

FIGURE 4.21: The WBS is always used as the basis for determining project activities



Question 5

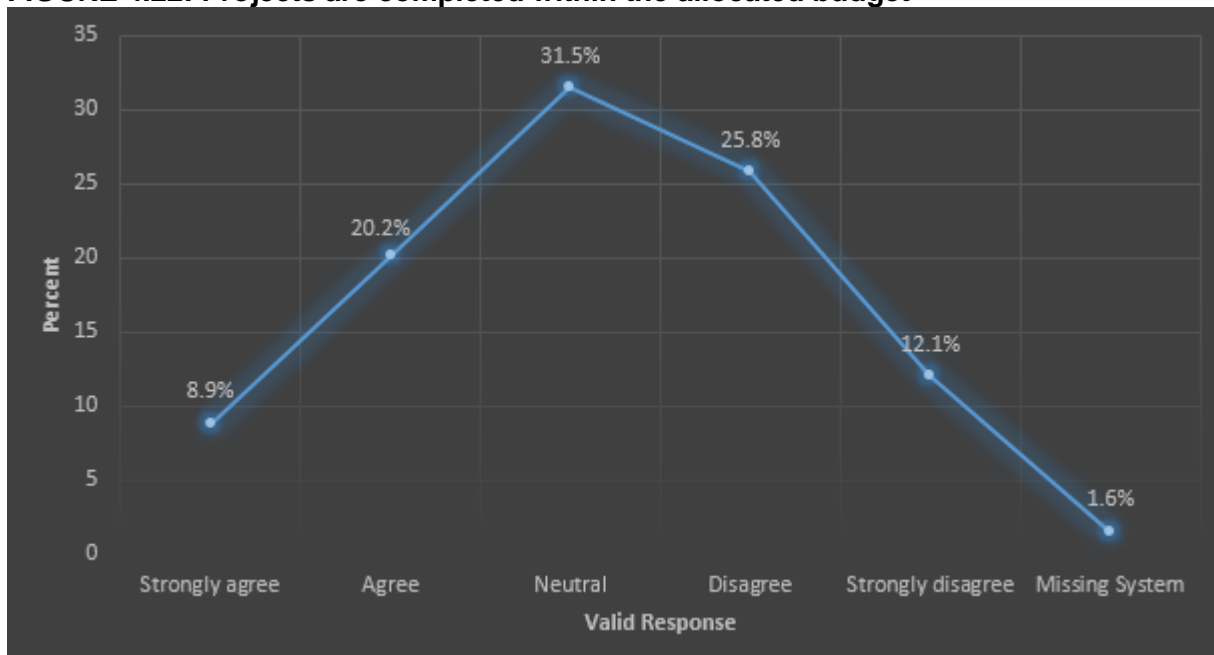
Six questions were asked about managing project costs. The table below summarizes the responses.

Questions	Agree	Neutral	Disagree
5.1	29,1%	31,5%	37,9%
5.2	15,3%	23,4%	59,7%
5.3	12,9%	41,1%	44,4%
5.4	31,4%	26,6%	40,3%
5.5	17%	37,9%	42,7%
5.6	33,9%	37,1%	27,4%

Question 5.1 Projects are completed within the allocated budget

Respondents were requested to respond to the following statement: Projects are completed within the allocated budget. A total of 37.9% disagreed, 31.5% remained neutral and only 29.1% agreed. When starting a project, it is difficult to know how much it will cost. Project managers are held accountable for their budget estimates, but with so much uncertainty in projects it can be one of the project managers' greatest challenges.

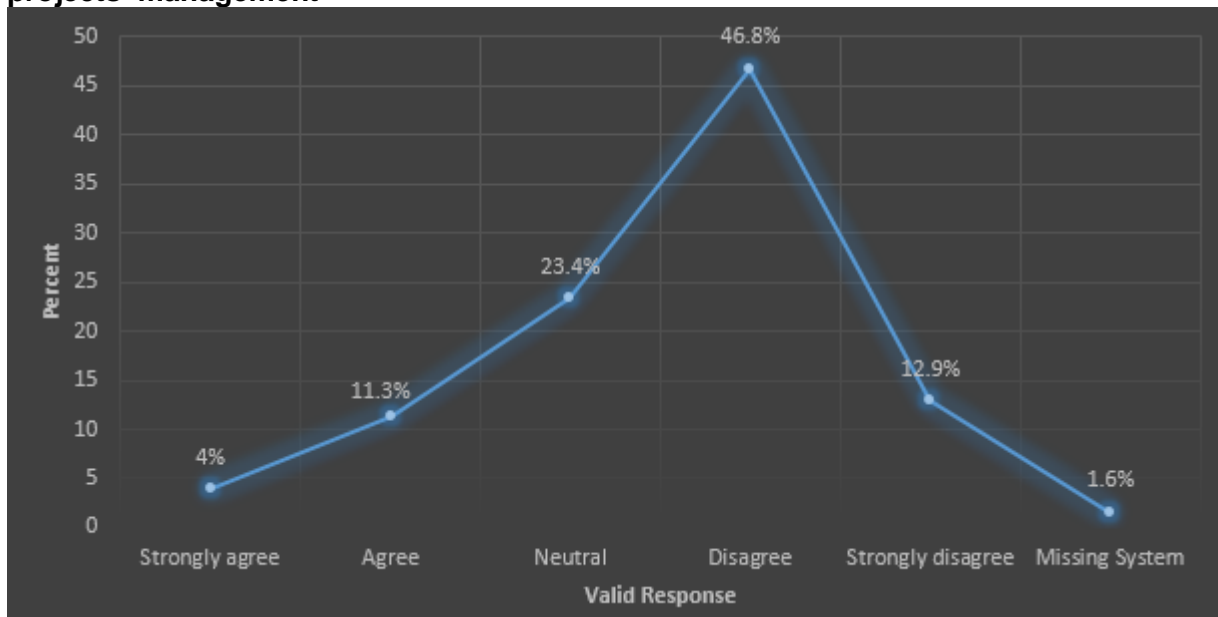
FIGURE 4.22: Projects are completed within the allocated budget



Question 5.2 Cost estimating, reporting, and performance measurement are on projects' management

Most of the respondents (59.7%) indicated that they disagreed that cost estimating, reporting, and performance measurement were the responsibility of the project's management. A total of 23.4% remained neutral on this matter and only 15.3% agreed. This is an indication that project managers did not monitor and control project costs and that could be why projects were not completed within the budget allocations.

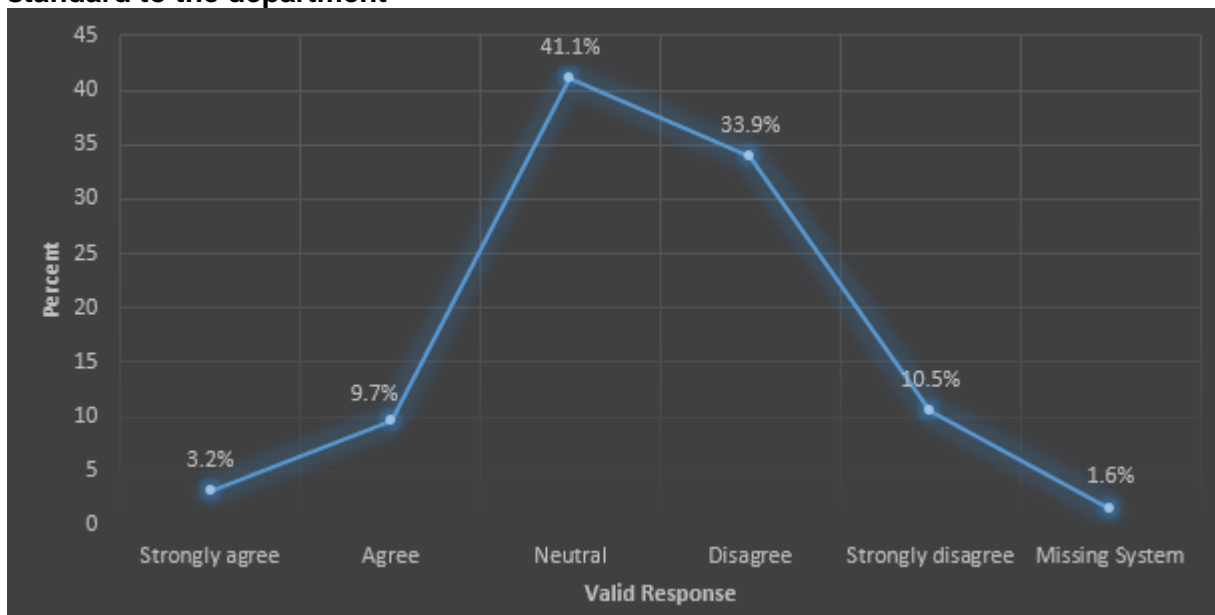
FIGURE 4.23: Cost estimating, reporting and performance measurement are on projects' management



Question 5.3 There is a defined and documented cost management process that is standard to the department

On this item, the responses were overall negative, except for 12.9% of the respondents who agreed with the statement that there is a defined and documented cost management process that is standard to the department. A total of 44.4% indicated that they disagreed with the statement, whilst 41.1% remained neutral. All too often project team members do not realize how many hours are spent or what sort of budget is allocated to their projects. If team members do not realize this, how can they be held accountable to get everything done within the allocated time and budget. The project manager must encourage all stakeholders to be accountable for communicating well with each other and completing the project tasks within the budget and allocated project hours.

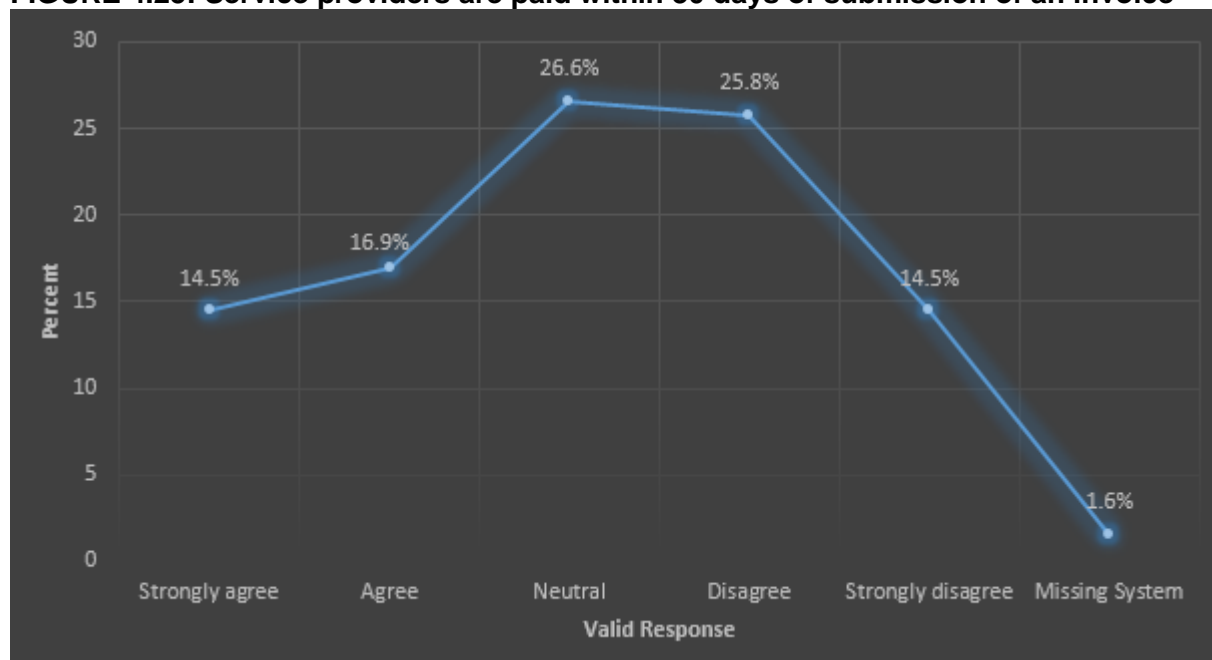
FIGURE 4.24: There is a defined and documented cost management process that is standard to the department



Question 5.4 Service providers are paid within 30 days of submission of an invoice

On this item, most of the respondents (40.3%) were of the opinion that service providers were not paid within 30 days of submission of an invoice, while a total of 31.4% agreed with the statement. A large percentage of the respondents (26.6%) remained neutral, neither agreeing nor disagreeing. Non-compliance to paying contractors on time might cause the contracts to have a cash flow problem, which might lead to contractors not to honouring their obligations, such as paying their employees. This in turn might lead to employees going on strike and delaying projects.

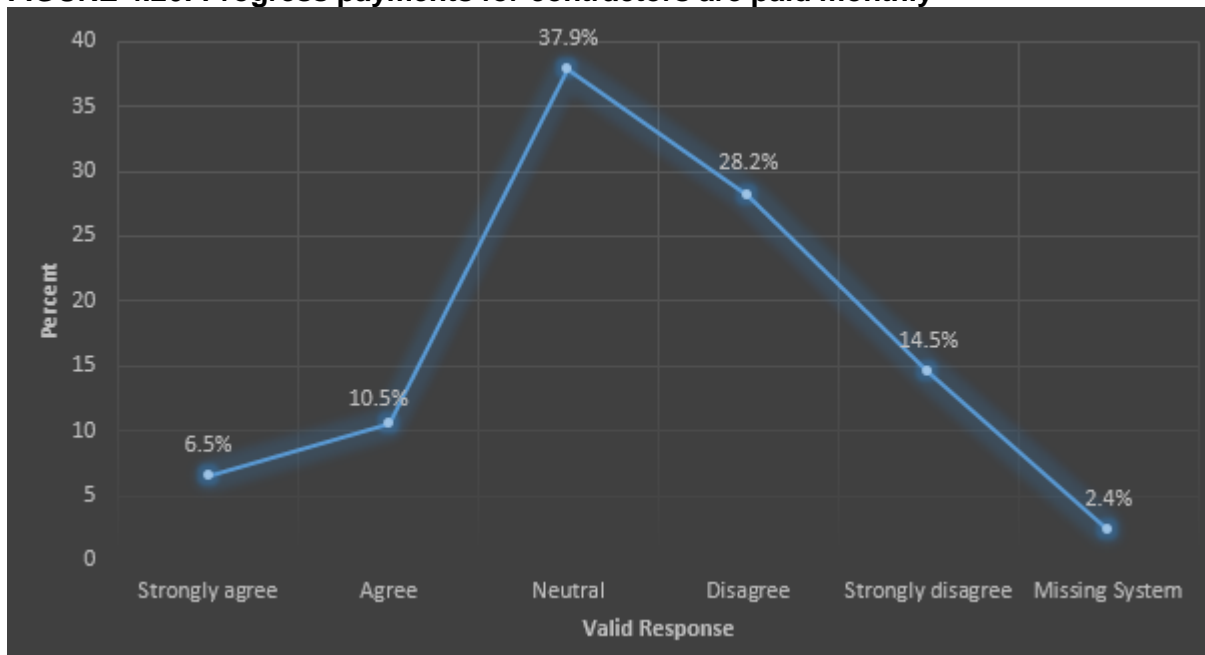
FIGURE 4.25: Service providers are paid within 30 days of submission of an invoice



Question 5.5 Progress payments for contractors are paid monthly

On a complex construction project involving work worth millions of Rand it is not reasonable to expect the contractor to finance the effort to completion. Consequently, construction contracts typically call for the project sponsor to make periodic progress payments to the contractor. The manner in which these payments are calculated or structured is a matter of contractual consent between the parties. Progress payments are frequently tied to the achievement of certain milestones in the work. On this item, most of the respondents (42.7%) were of the opinion that progress payments for contractors were not paid monthly, while a total of only 17% agreed with the statement. A large percentage of the respondents (37.9%) remained neutral, neither agreeing nor disagreeing. Non-compliance to pay contractors on time might cause the contractors to have a cash flow problem, which in turn might lead to contracts not honouring their obligations, such as paying their employees. This might lead to employees going on strike and delaying the projects.

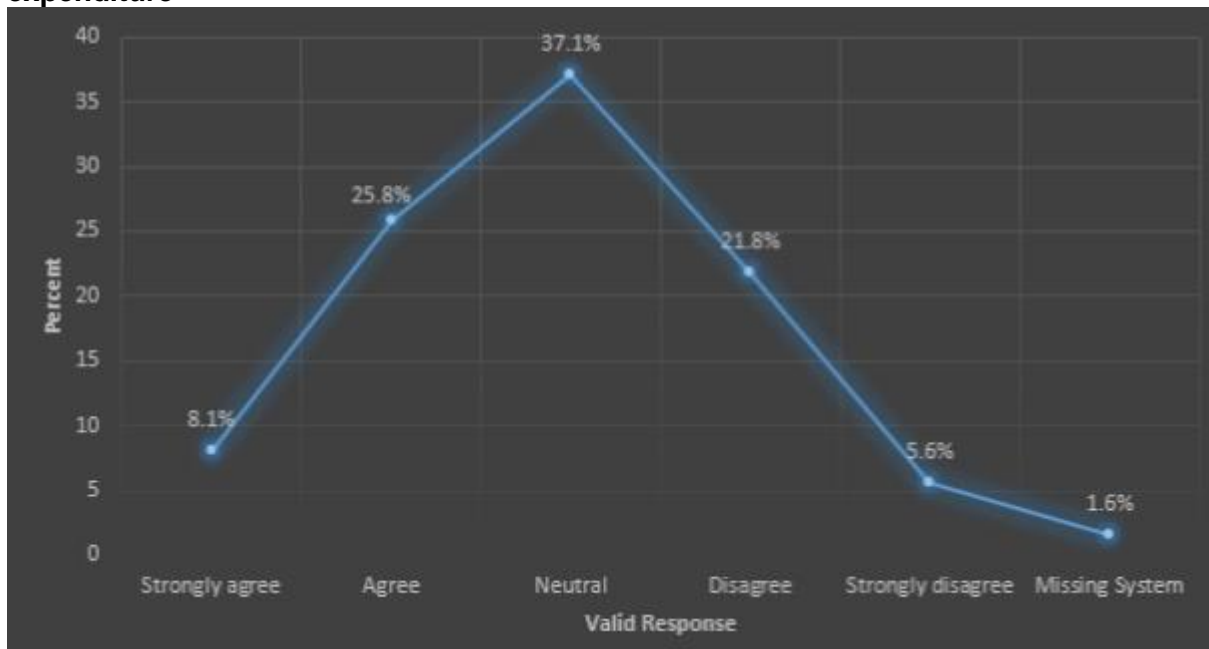
FIGURE 4.26: Progress payments for contractors are paid monthly



Question 5.6 Projects lack control mechanisms to track costs and project expenditure

When respondents were requested to respond to the following statement, Projects lack control mechanisms to track costs and project expenditure, a total of 33.9% agreed, 37.1% remained neutral and only 27.4% disagreed. Without proper control mechanisms to track cost and project expenditure, the department might not complete the project within the allocated budget.

FIGURE 4.27: Projects lack control mechanisms to track costs and project expenditure



Question 6

Seven questions were asked on the topic of managing project quality. The table below summarizes the responses.

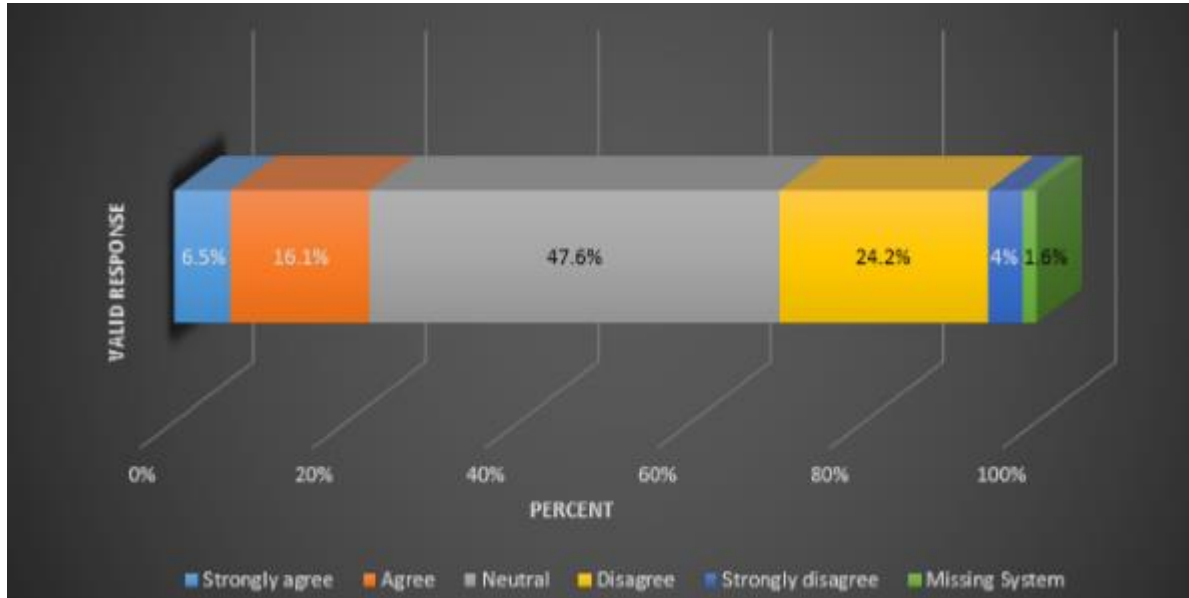
Questions	Agree	Neutral	Disagree
6.1	22.6%	47.6%	28.2%
6.2	42.0%	44.4%	12.9%
6.3	40.3%	31.5%	25.8%
6.4	33.8%	35.5%	29.0%
6.5	18.5%	33.1%	47.5%
6.6	25.0%	21.8%	50.8%
6.7	16.9%	28.2%	51.6%

Question 6.1 Sometimes desolate materials are used on construction sites

The largest group of respondents (47.6%) indicated that they were neutral on the statement that sometimes desolate materials are used on construction sites, while 28.2% indicated that they disagreed and 22.6% agreed that desolate materials are sometimes used on construction sites. The percentage of neutral answers was

above average, leading the researcher to speculate whether the respondents might be scared to commit to an answer.

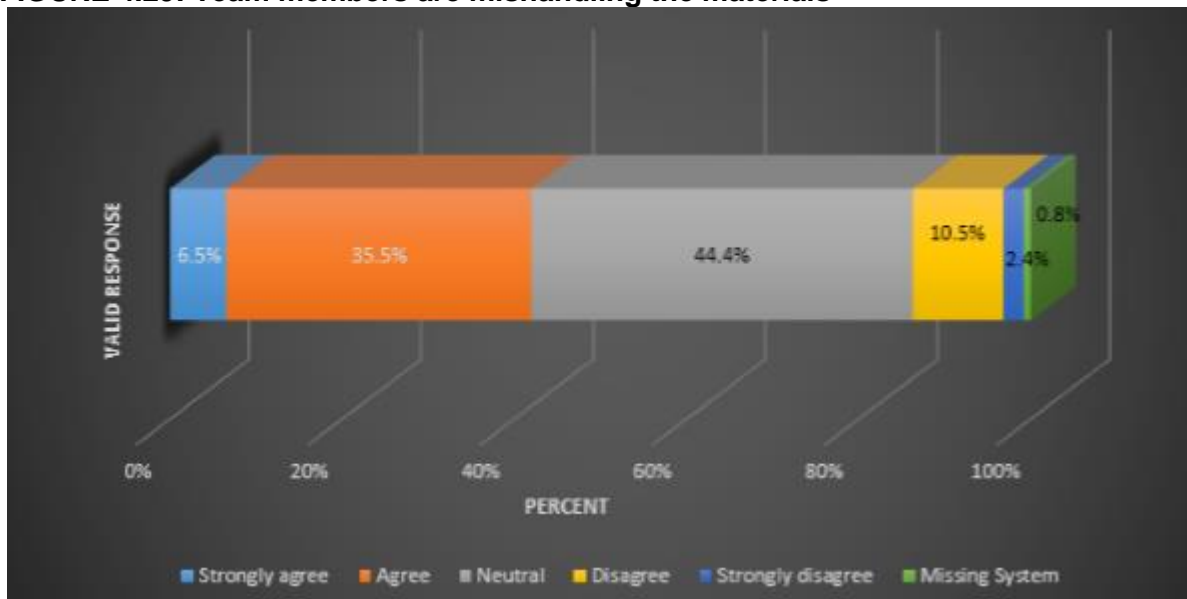
FIGURE 4.28: Sometimes desolate materials are used on construction sites



Question 6.2 Team members are mishandling the materials

The largest group of respondents (44.4%) indicated that they were neutral on the statement that team members were mishandling the materials, while 12.9% indicated that they disagreed and 42% agreed that team members were mishandling the materials. This is an indication that team members are not properly trained to handle project materials, and might be why the respondents did not commit to an answer and rather settled for a neutral one. There is a lack of care among site operatives, regarding the use of materials on site. It is therefore recommended that site operatives should be properly supervised during site operations. Team members should be instructed on how to handle materials with care during transportation. For example, bricks should not be dumped from wheelbarrows during off-loading. This practice often results in breakage or chipping of the edges of the bricks.

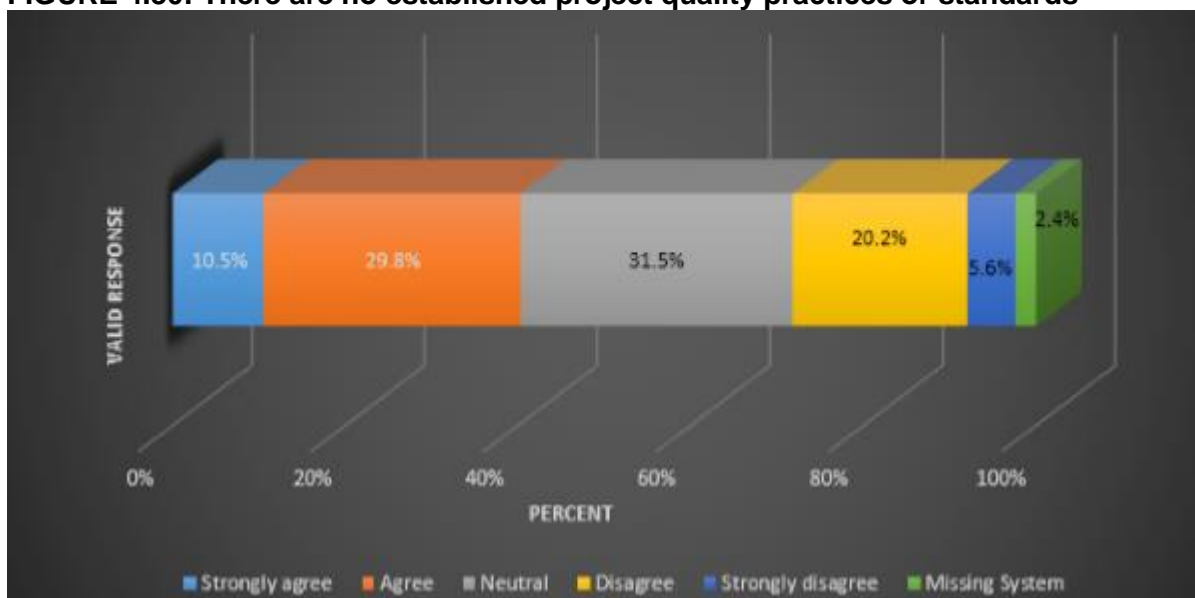
FIGURE 4.29: Team members are mishandling the materials



Question 6.3 There are no established project quality practices or standards

The majority (40.3%) of the respondents agreed with the statement that there were no established project quality practices or standards. A total of 31.5% indicated that they were neutral and 25.8% disagreed with the statement.

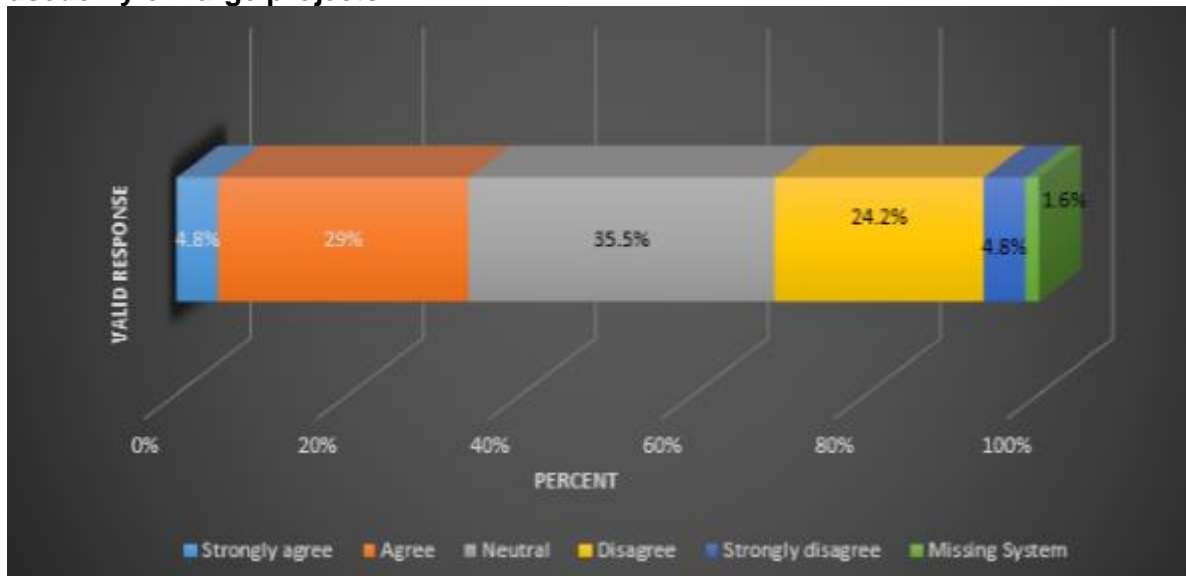
FIGURE 4.30: There are no established project quality practices or standards



Question 6.4 A basic organizational project quality management process is usually used only on large projects

Respondents were requested to respond to the following statement, a basic organizational project quality management process is usually used only on large projects, and a total of 29% disagreed, 35.5% remained neutral and 33.8% agreed.

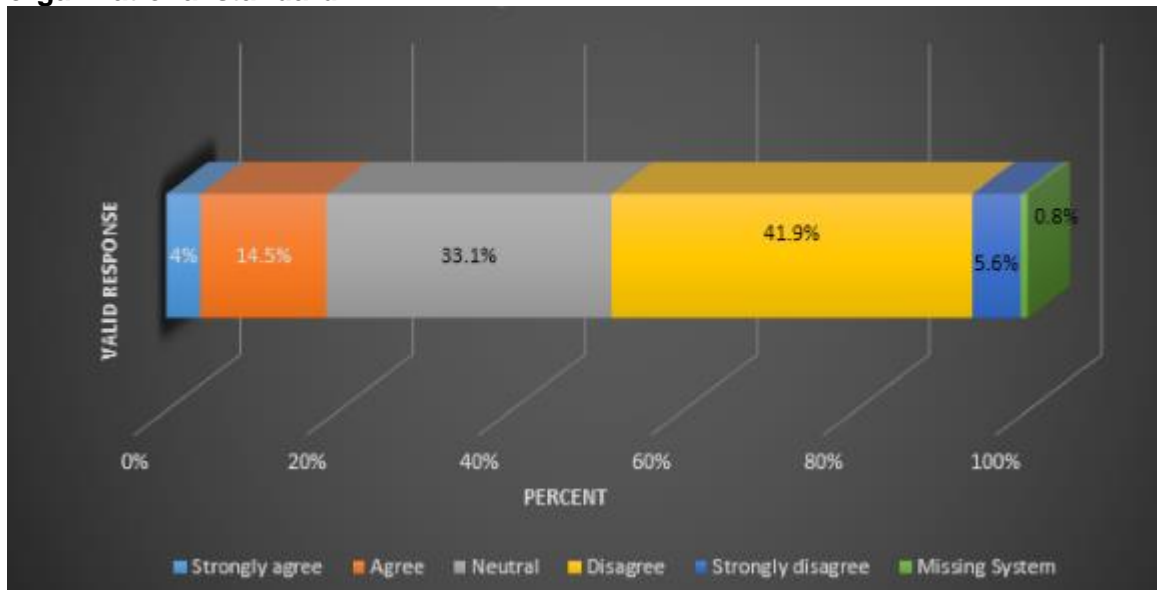
FIGURE 4.31: A basic organizational project quality management process is usually used only on large projects



Question 6.5 The quality management process is well documented and is an organizational standard

On this item, the responses were overall negative, except for 18.5% of the respondents who agreed with the statement that the quality management process is well documented and is an organizational standard. A total of 47.5% indicated that they disagreed with the statement whilst 33.1% remained neutral.

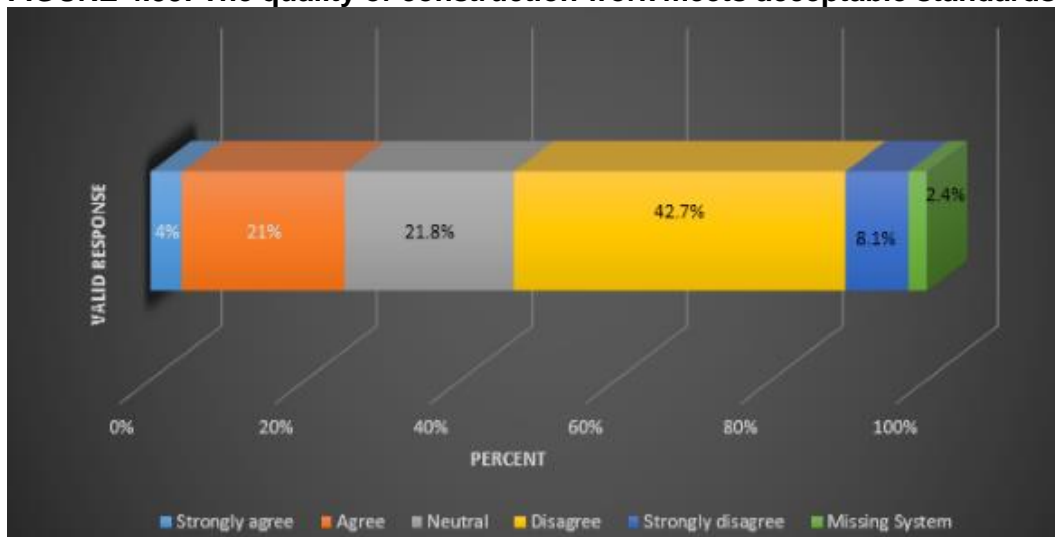
FIGURE 4.32: The quality management process is well documented and is an organizational standard



Question 6.6 The quality of construction work meets acceptable standards

More than half (50.8%) of the stakeholders disagreed with the statement: Quality of construction work meets acceptable standards. A total of 21.8% were neutral and 25% agreed with the statement. It seems that total quality management is a big concern on projects.

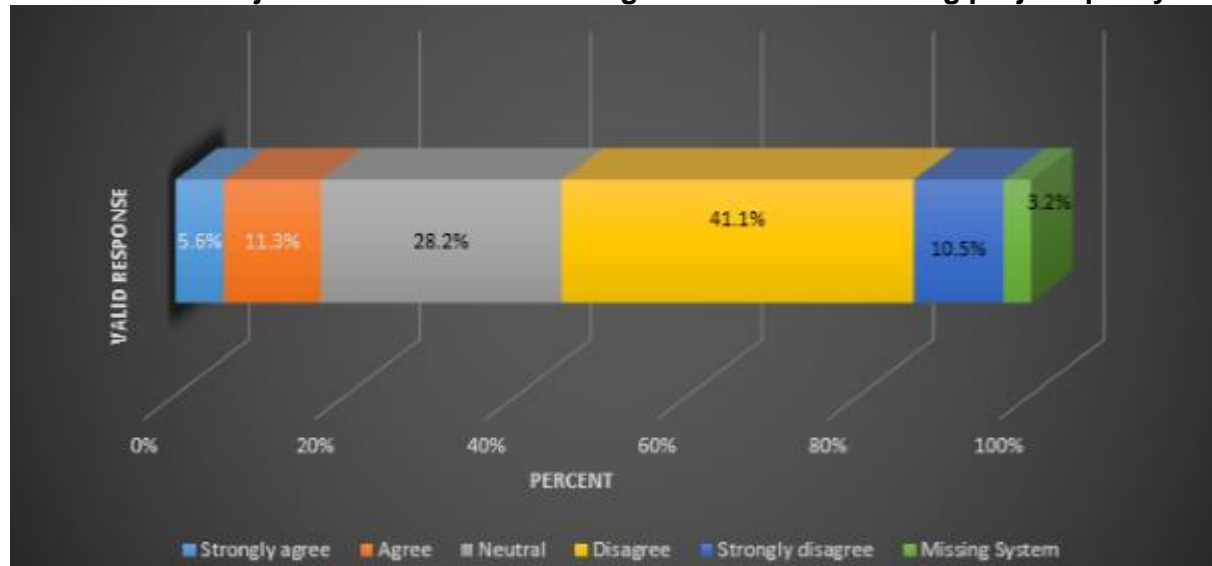
FIGURE 4.33: The quality of construction work meets acceptable standards



Question 6.7 Project members are knowledgeable about controlling project quality

More than half (51.6%) of the stakeholders disagreed with the statement: Project members are knowledgeable about controlling project quality. A total of 28.2% were neutral and 16.9% agreed with the statement.

FIGURE 4.34: Project members are knowledgeable about controlling project quality



Question 7

Six questions were asked on the topic of managing project quality. The table below summarizes the responses.

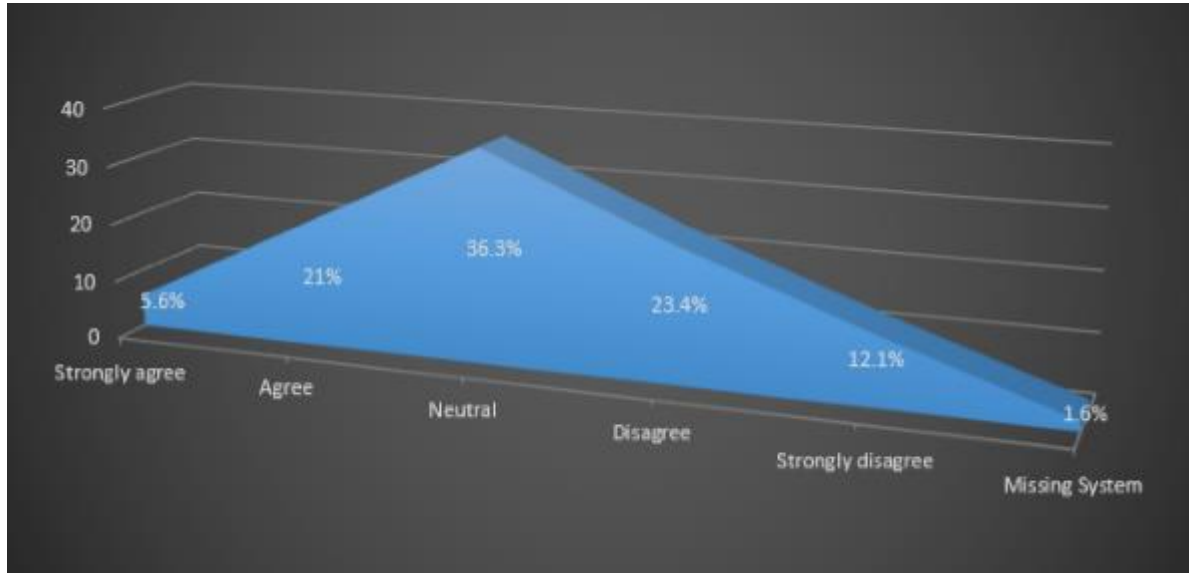
Questions	Agree	Neutral	Disagree
7.1	26.6%	36.3%	35.5%
7.2	24.2%	29.8%	45.2%
7.3	37.1%	37.1%	27.2%
7.4	30.7%	42.7%	25.8%
7.5	17.7%	54.8%	25.8%
7.6	22.5%	41.1%	33.9%

Question 7.1 New project managers are subject to a variety of project training and orientation methods

Most of the respondents (36.3%) remained neutral on this matter, 35.5% disagreed with the statement and only 26.6% agreed that new project managers are subject to a variety of project training and orientation methods. This is an indication that the

department does not have an orientation or training programme for new project managers.

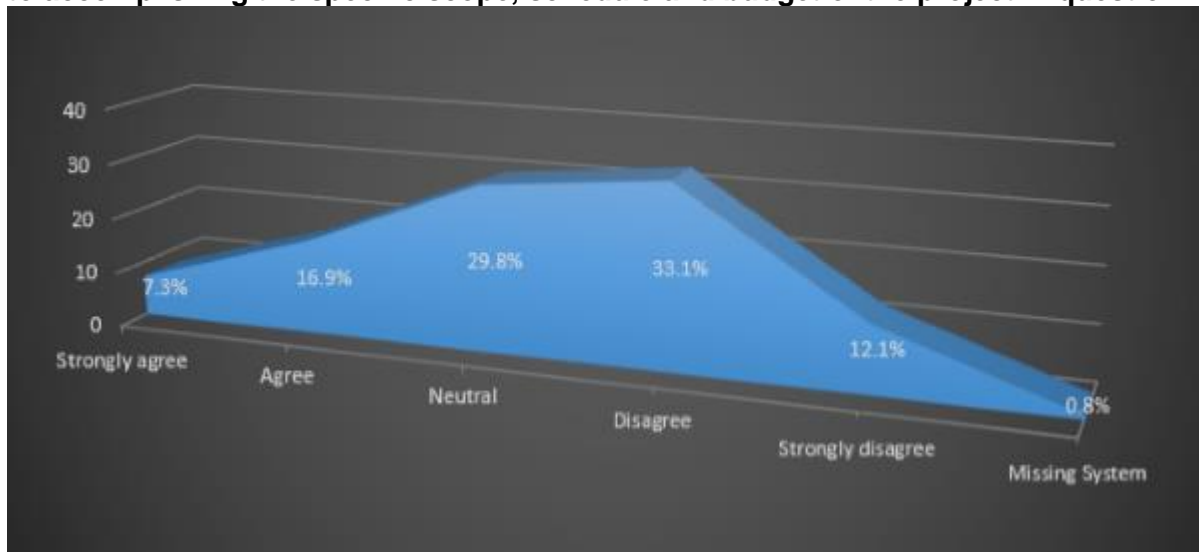
FIGURE 4.35: New project members are subject to a variety of project training and orientation methods



Question 7.2 The department strives to select and hire architects, engineers and construction managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question

On this item, the responses were overall negative (45.2%), except for 24.2% of the respondents who agreed with the statement that: The department strives to select and hire specialists such as architects, engineers and construction managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question. A total of 45.2% indicated that they disagreed with the statement, whilst 29.8% remained neutral.

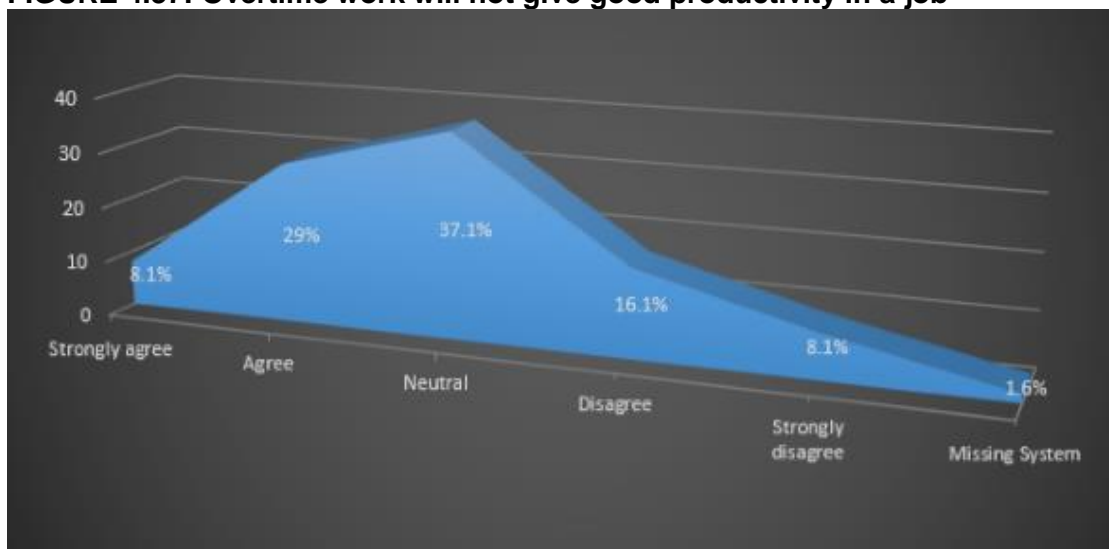
FIGURE 4.36: We strive to select and hire managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question.



Question 7.3 Overtime work will not give good productivity in a job

A total of 37.1% of the respondents were of the opinion that overtime work will not result in good productivity in a job, whereas 27.2% disagreed with the statement and 37.1% of the respondents remained neutral. This is an indication that paying team members for overtime worked will not increase productivity. Team members might fall behind the schedule intentionally so that they can claim for overtime worked. This might increase project costs if not managed properly.

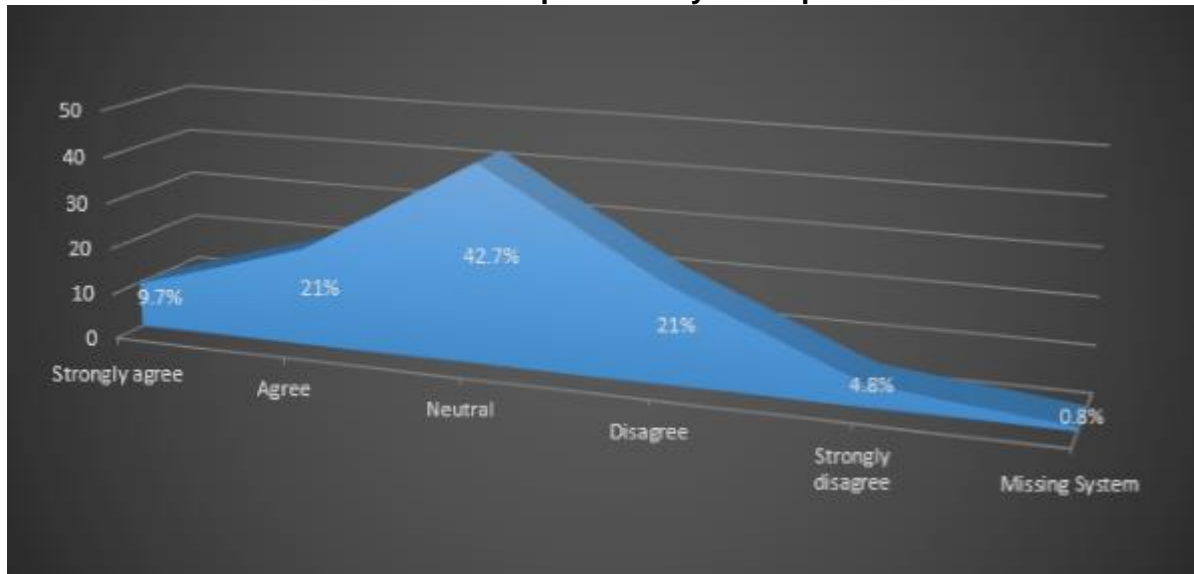
FIGURE 4.37: Overtime work will not give good productivity in a job



Question 7.4 Financial incentives are provided by the department

When respondents were requested to respond to the following statement, financial incentives are provided by the department, a total of 25.8% disagreed, 42.7% remained neutral, and 30.7% agreed. The financial incentive might be paid to team members who performed beyond expectations, which might motivate the team to perform exceptionally well.

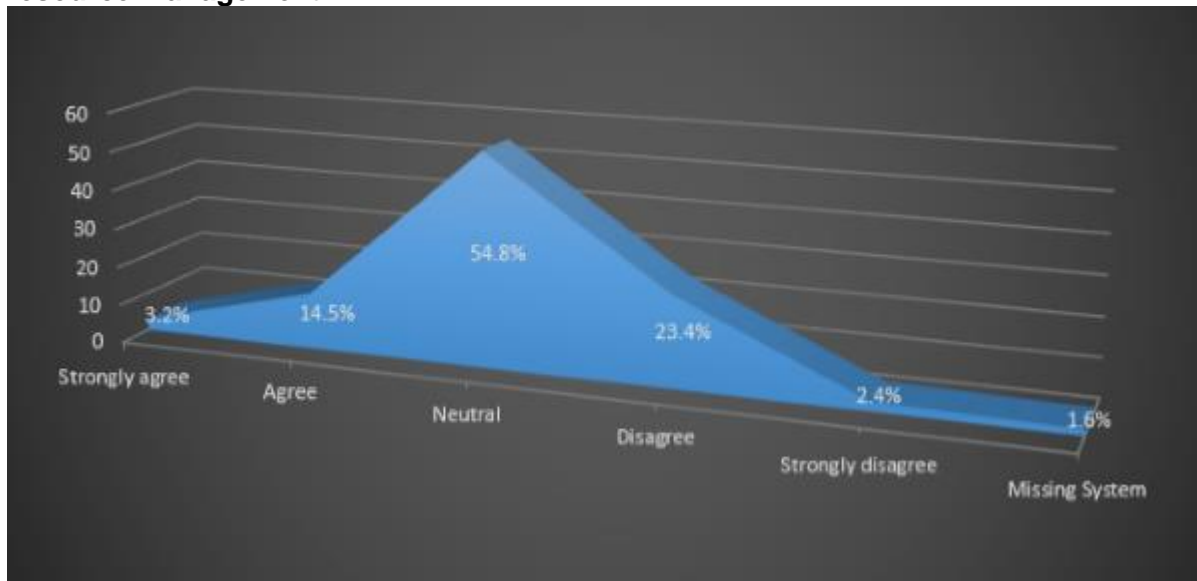
FIGURE 4.38: Financial incentives are provided by the department



Question 7.5 There is a documented, repeatable process in place for project human resource management

The largest group of respondents (54.8%) indicated that they were neutral on the statement, while 25.8% indicated that they disagreed, and only 17.7% agreed with the statement. This is an indication that departments do not have processes and policies for project human resource management or that team members are not aware of such processes and policies.

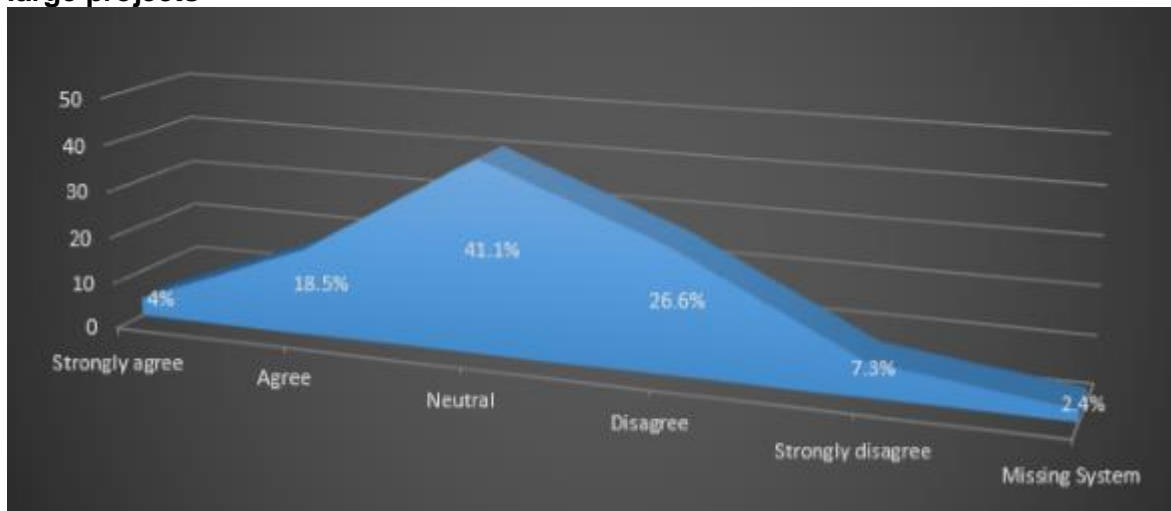
FIGURE 4.39: There is a documented, repeatable process in place for project human resource management



Question 7.6 A human resource plan is prepared and performance is monitored on large projects?

The largest group of respondents (41.1%) indicated that they were neutral on the statement that a human resource plan is prepared and performance is monitored on large projects, while 33.9% indicated that they disagreed and 22.5% agreed with the statement.

FIGURE 4.40: A human resource plan is prepared and performance is monitored on large projects



Question 8

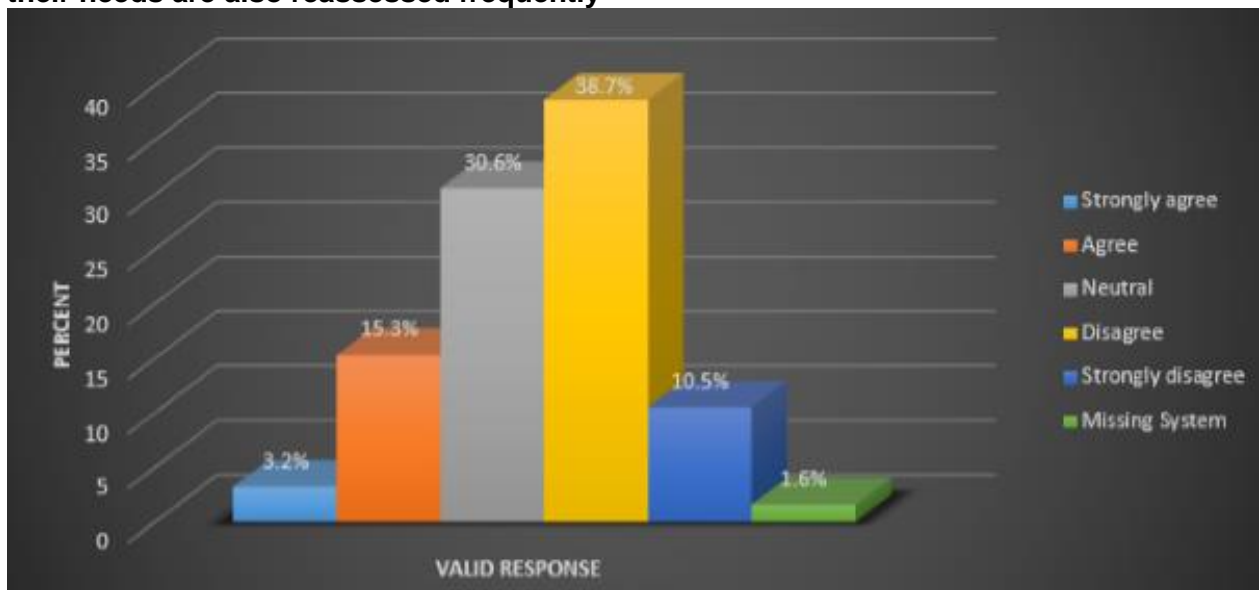
Seven questions were asked on the topic of managing project communication. The table below summarizes the responses.

Questions	Agree	Neutral	Disagree
8.1	18,5%	30,6%	49,2%
8.2	23,3%	27,4%	48,4%
8.3	16,9%	31,5%	49,2%
8.4	13,7%	35,5%	50%
8.5	16,1%	37,1%	46%
8.6	20,9%	31,5%	46,8%
8.7	12,1%	34,7%	52,4%

Question 8.1 Project reviews are frequently communicated to the stakeholders and their needs are also reassessed frequently

A total of 49.2% of the respondents were of the opinion that project reviews are not communicated to the stakeholders, only 18.5% (a small relative percentage) agreed that project reviews are frequently communicated to the stakeholders and their needs are also reassessed frequently, while 30.6 % of the respondents remained neutral.

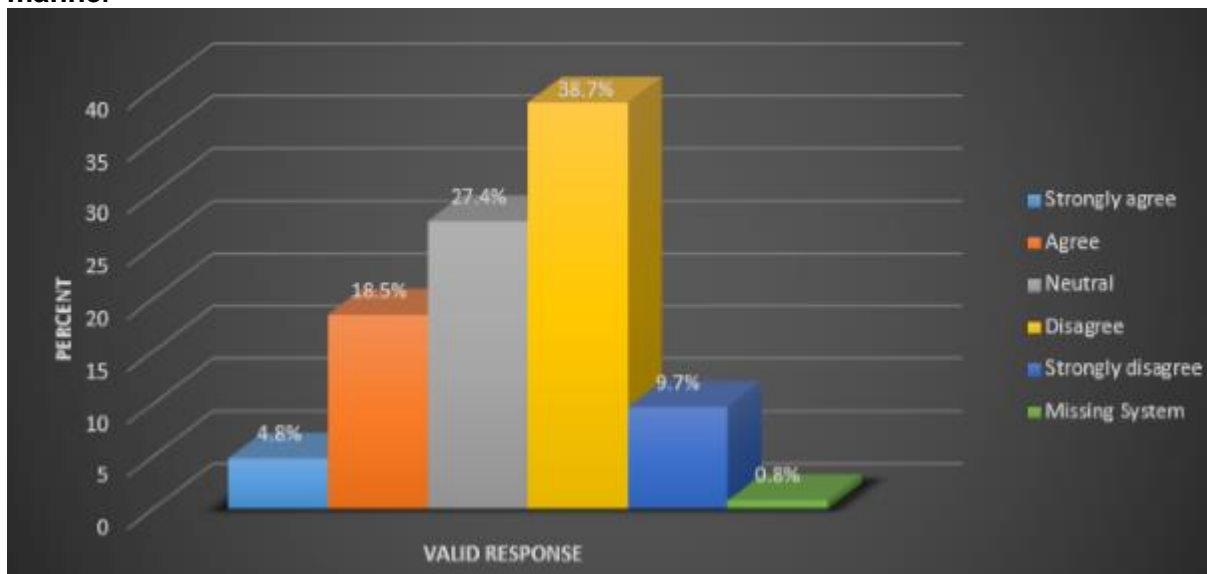
FIGURE 4.41: Project reviews are frequently communicated to the stakeholders and their needs are also reassessed frequently



Question 8.2 Project managers respond to client needs in a timely and effective manner

A total of 48.4% of the respondents were of the opinion that project managers do not respond to client needs in a timely and effective manner, whereas 23.3% agreed that project managers respond to client needs in a timely and effective manner, and 27.4% of the respondents remained neutral. This is a big concern, namely that project sponsors might not be satisfactory with project managers' turnaround time in addressing their needs.

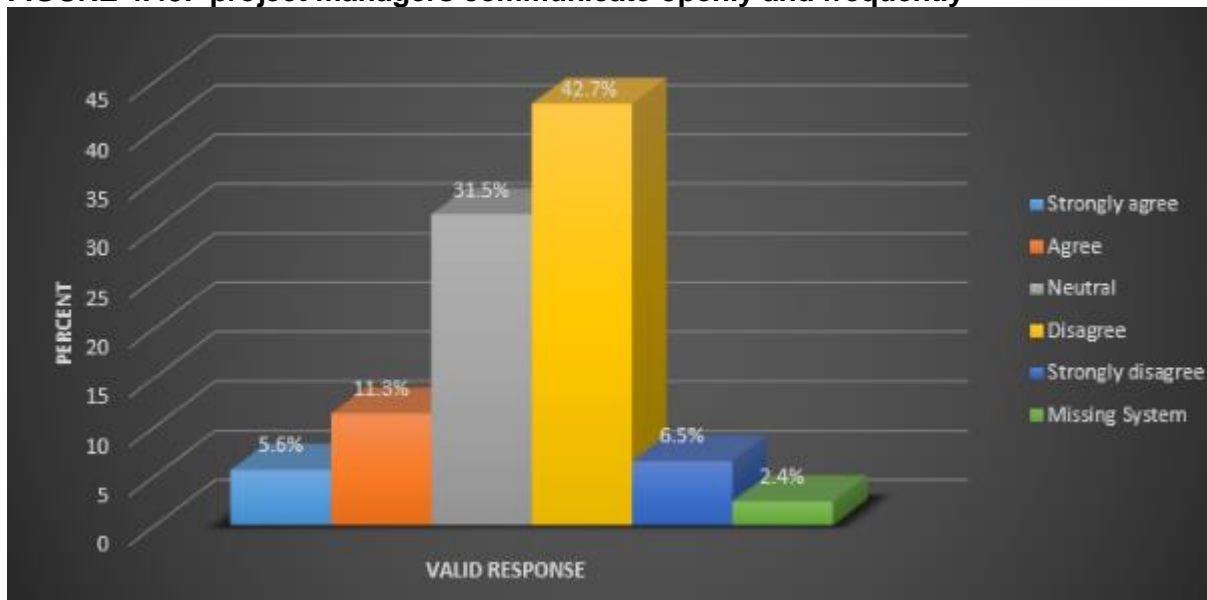
FIGURE 4.42: Project managers respond to the client needs in a timely and effective manner



Question 8.3 Project manages communicates openly and frequently

A total of 16.9% of the respondents indicated that they agreed that there is open communication, whereas 49.2% disagreed that project managers communicate openly and frequently, and 31.5% of the respondents remained neutral.

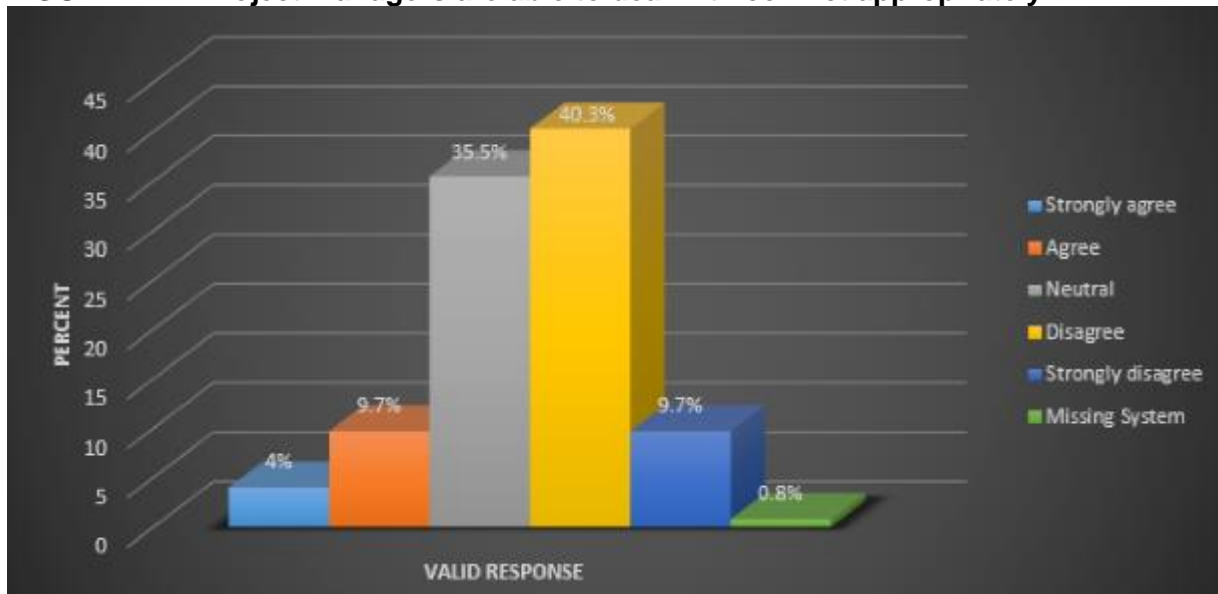
FIGURE 4.43: project managers communicate openly and frequently



Question 8.4 Project managers are able to deal with conflict appropriately

Half (50%) of the respondents disagreed with the statement that project managers are able to deal with conflict appropriately while 35.5% remained neutral and a total of 13.7% (a very small percentage indeed) agreed with the statement.

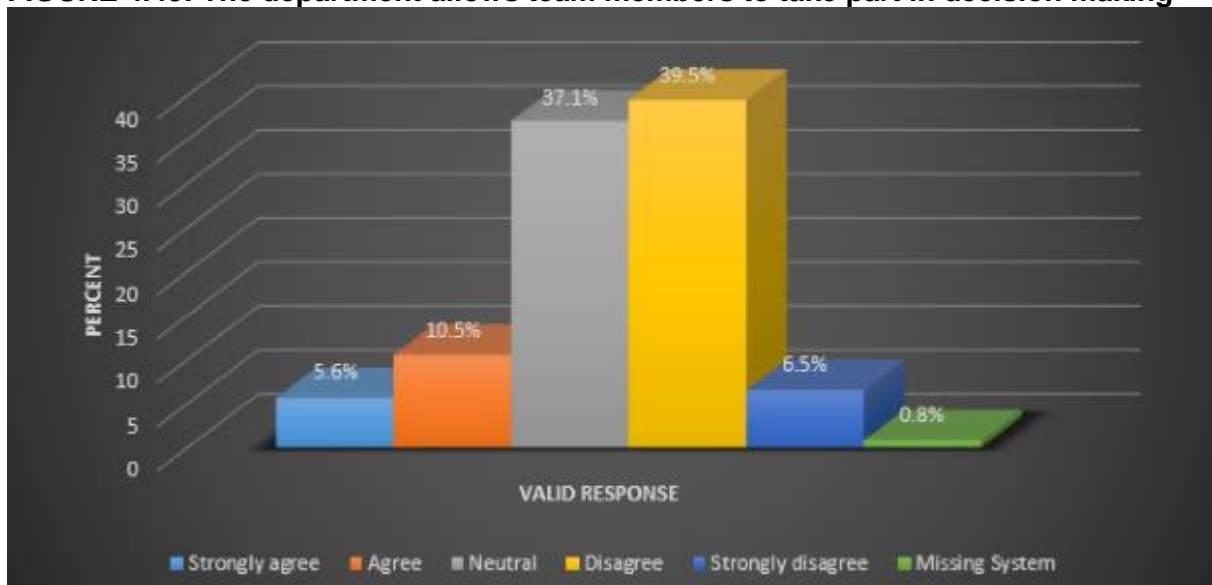
FIGURE 4.44: Project managers are able to deal with conflict appropriately



Question 8.5 The department allows team members to take part in decision making

Respondents were requested to respond to the following statement: The department allows team members to take part in decision making. A total of 46% disagreed, 37.1% remained neutral and only 16.1% agreed.

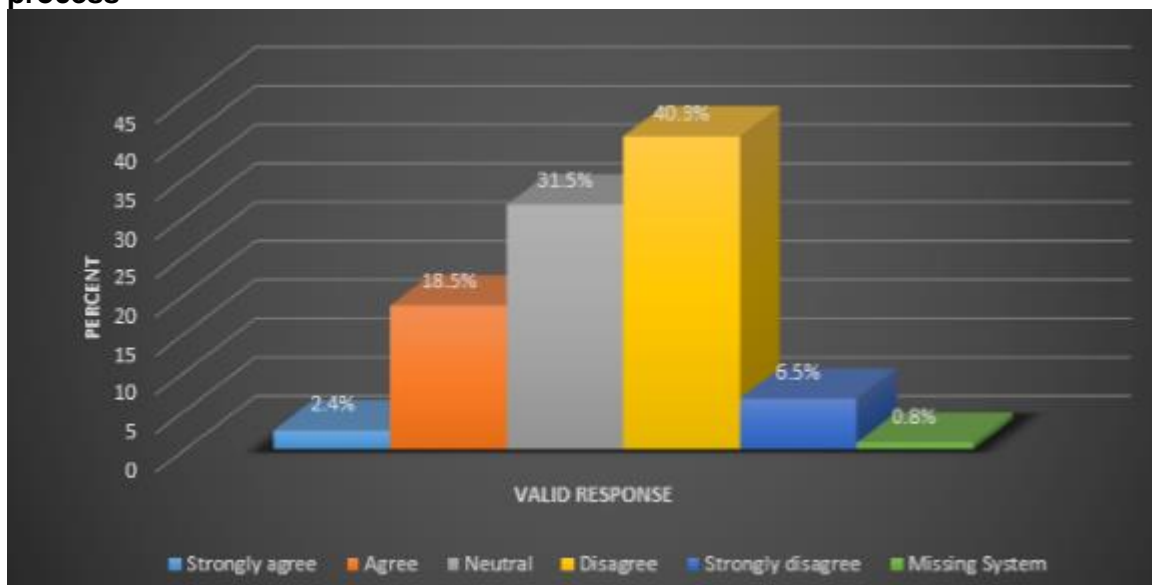
FIGURE 4.45: The department allows team members to take part in decision making



Question 8.6 There is a formal, documented and clear communication management process

When respondents were requested to respond to the following statement that there is a formal, documented and clear communication management process, a total of 46.8% disagreed, 31.5% remained neutral and only 20.9% agreed.

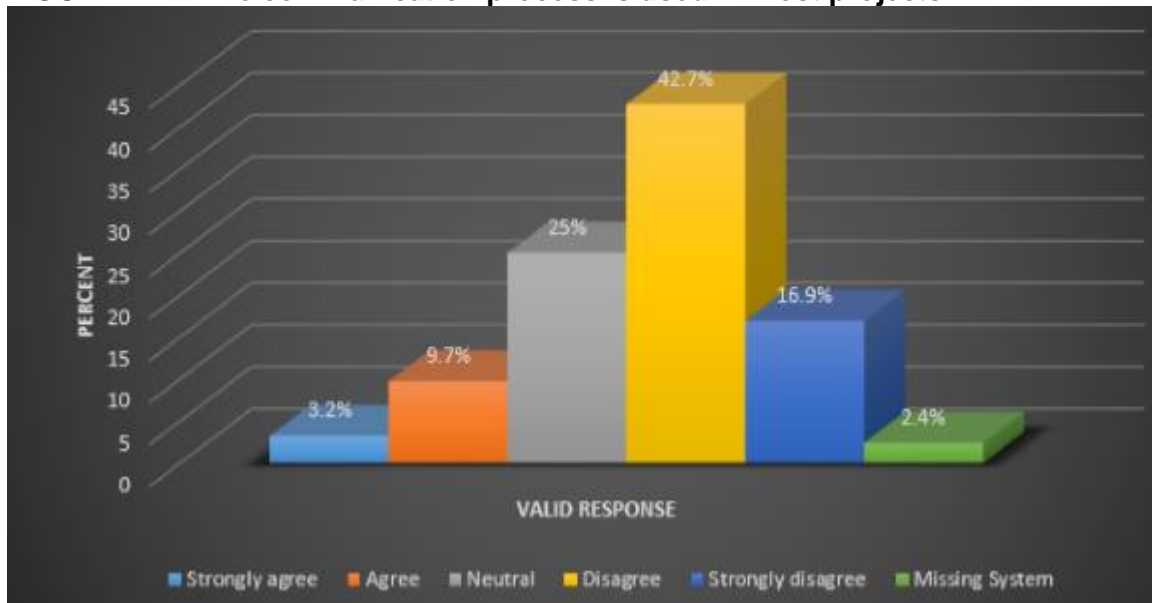
FIGURE 4.46: There is a formal, documented and clear communication management process



Question 8.7 The communication process is used in most projects

When respondents were requested to respond to the following statement: The communication process is used in most projects, a total of 52.4% disagreed, 34.7% remained neutral and only 12.1% agreed.

FIGURE 4.47: The communication process is used in most projects



Question 9

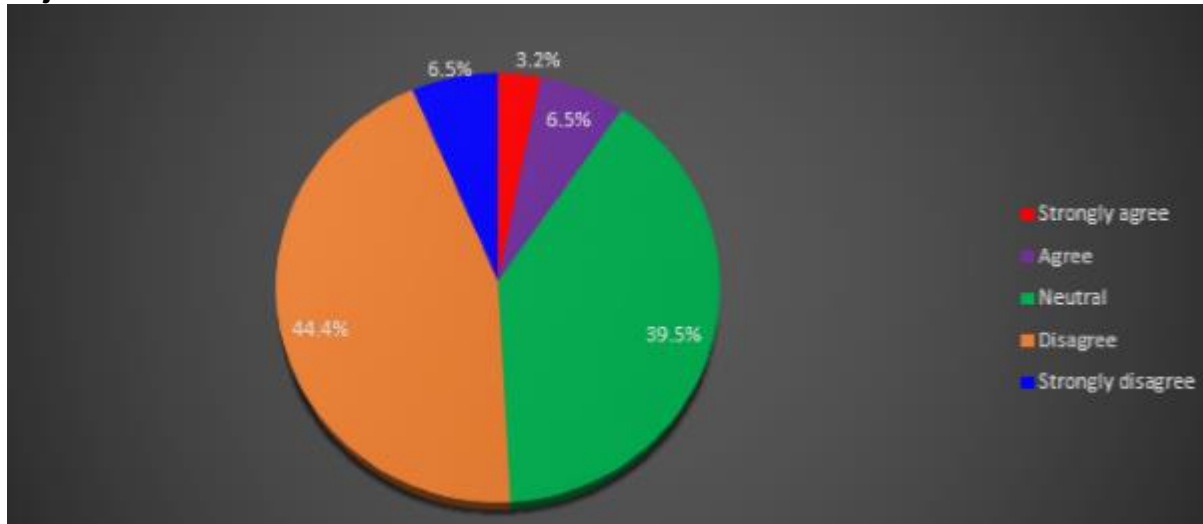
Six questions were asked on the topic of managing project risks. The table below summarizes the responses.

Questions	Agree	Neutral	Disagree
9.1	9.7%	39.5%	50.9%
9.2	18.5%	39.5%	41.9%
9.3	21.0%	36.3%	40.3%
9.4	23.4%	35.5%	41.1%
9.5	19.3%	29.0%	51.6%
9.6	30.6%	44.4%	23.4%

Question 9.1 Project outcomes support the achievement of clearly defined strategic objectives.

Outcomes should relate clearly to an institution's strategic goals, but more than half (50.9%) of the stakeholders disagreed with the statement that project outcomes support the achievement of clearly defined strategic objectives, whereas 39.5% were neutral and only 9.7% agreed with the statement.

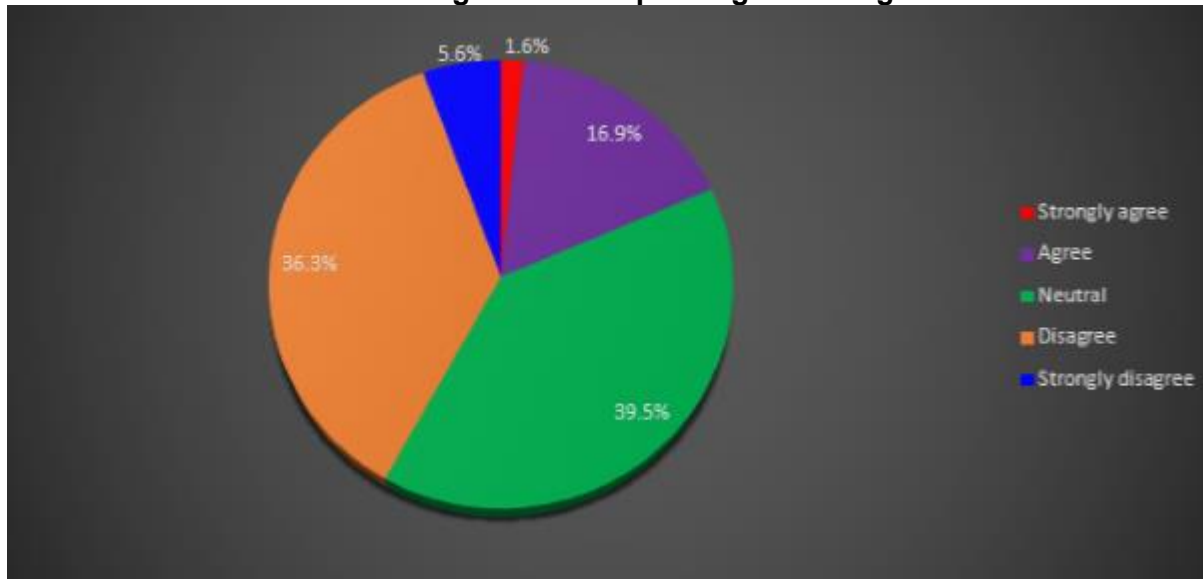
FIGURE 4.48: Project outcomes support the achievement of clearly defined strategic objectives



Question 9.2 Team size is enough for accomplishing the task given

On this item, the responses were overall negative, except for 18.5% of the respondents who agreed with the statement that team size is enough for accomplishing the task given. A total of 41.9% indicated that they disagreed with the statement, whilst 39.5% remained neutral.

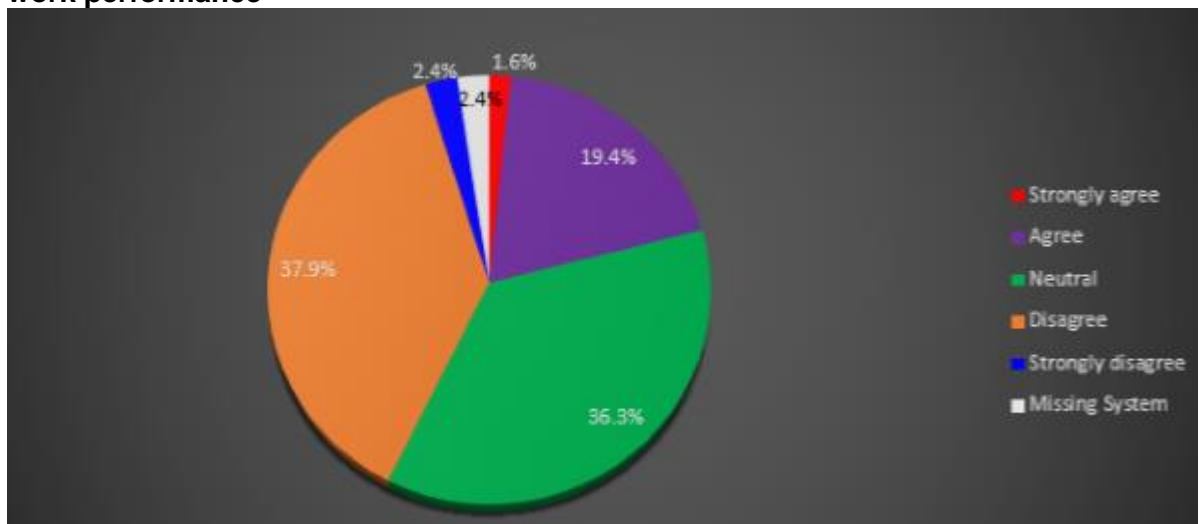
FIGURE 4.49: Team size is enough for accomplishing the task given



Question 9.3 Sufficient provision is made for climatic conditions, and it will affect work performance

Most of the respondents (40.3%) indicated that no provision was made for climatic conditions, and this will affect work performance, while 36.3% remained neutral on this matter and only 21% agreed with the statement.

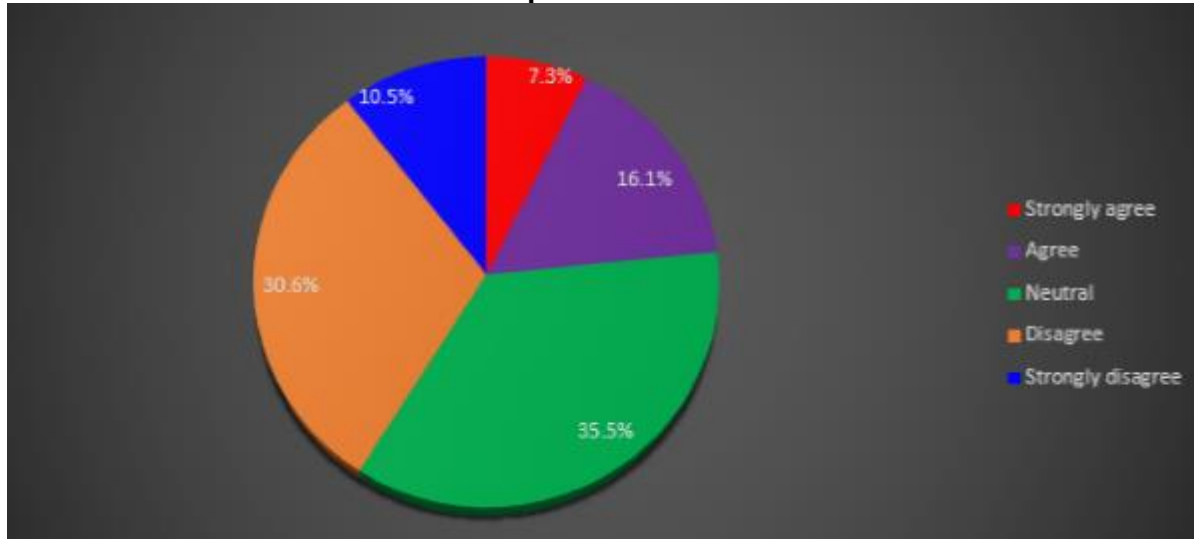
FIGURE 4.50: Sufficient provision is made for climatic conditions, and it will affect work performance



Question 9.4 Political/Governmental problems often arise on site

When requested to indicate the extent to which they agreed or disagreed with the statement: Political/Governmental problems often arise on site, the majority (41.1%) disagreed, while 35.5% remained neutral and only 23.4% agreed.

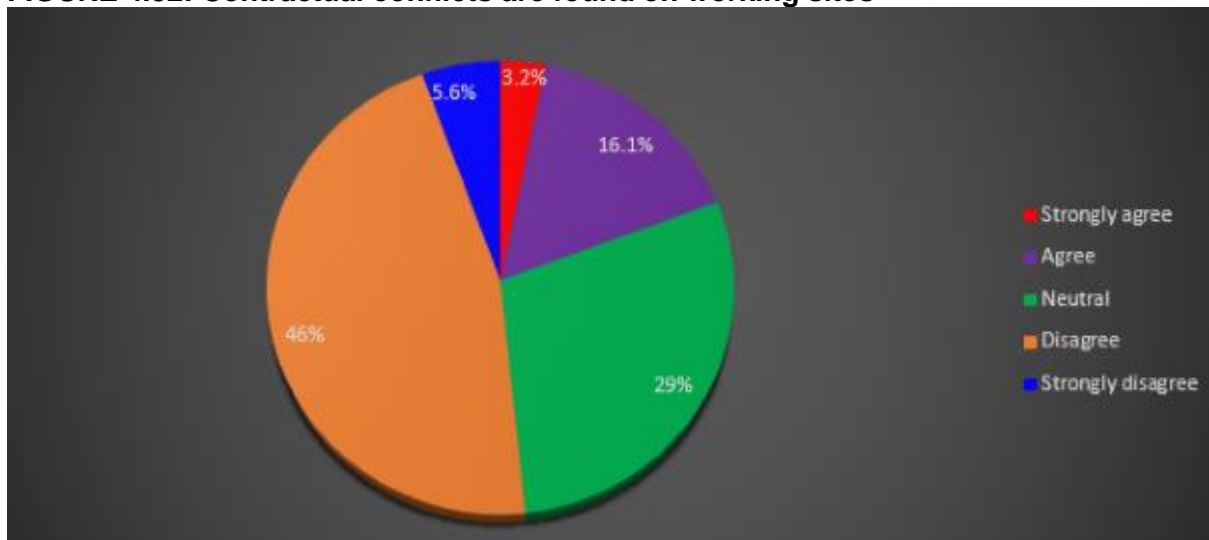
FIGURE 4.51: Political/Governmental problems often arise on site



Question 9.5 Contractual conflicts are found on working sites

When requested to indicate the extent to which they agreed or disagreed with the statement: Contractual conflicts (for example errors and omissions in design, double meaning on specifications) are found on working sites, the majority (51.6%), disagreed, 29% remained neutral, and only 19.3% agreed.

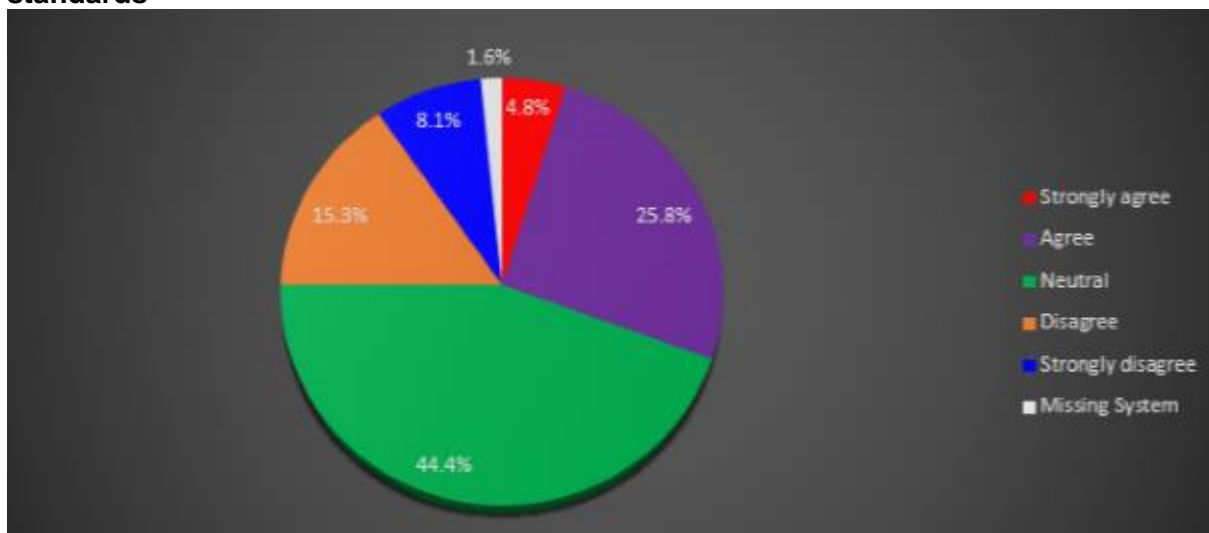
FIGURE 4.52: Contractual conflicts are found on working sites



Question 9.6 There are no established project risk management practices or standards

When requested to indicate the extent to which they agreed or disagreed with the statement: There are no established project risk management practices or standards, 23.4% disagreed, 44.4% remained neutral and almost a third (30.6%) agreed.

FIGURE 4.53: There are no established project risk management practices or standards



Question 10

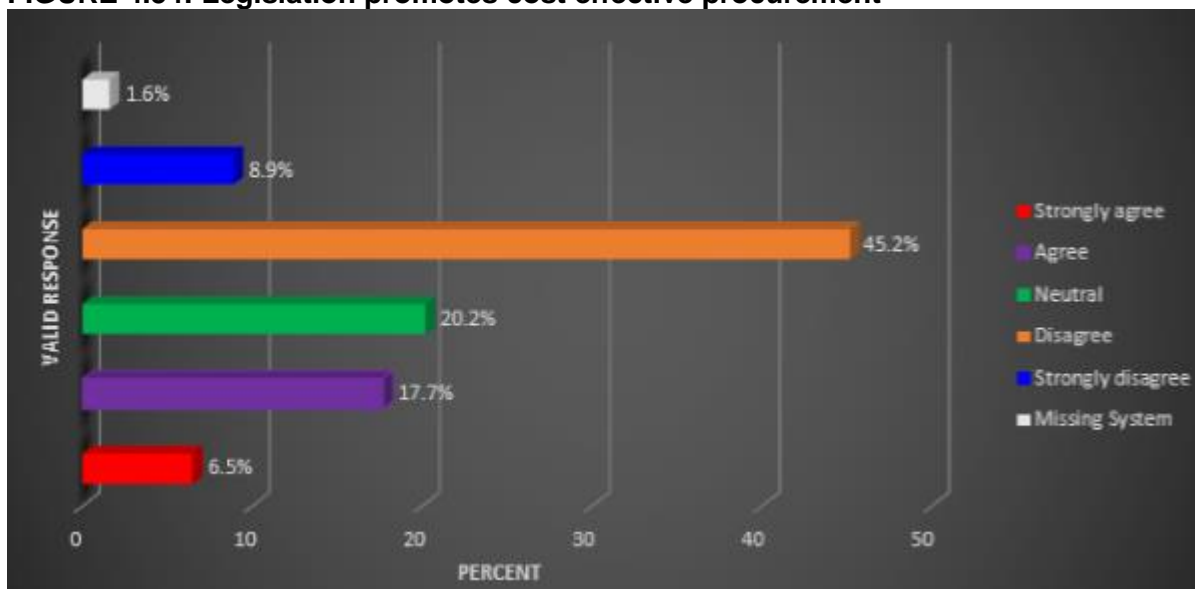
A total of six questions were asked on the topic of managing project procurement. The table below summarizes the responses.

Questions	Agree	Neutral	Disagree
10.1	24,2%	20,2%	54,1%
10.2	33,9%	34,7%	31,4%
10.3	16,9%	24,2%	58,1%
10.4	14,5%	22,6%	62,1%
10.5	17,7%	25%	57,3%
10.6	18,5%	37,9%	43,5%

Question 10.1 Legislation promotes cost effective procurement

More than a half (54.1%) of the respondents disagreed with the statement (Question 10.1), whereas 20.2% were neutral and almost a quarter (24.2%) agreed with it. This is an indication that procurement regulations do not promote value for money.

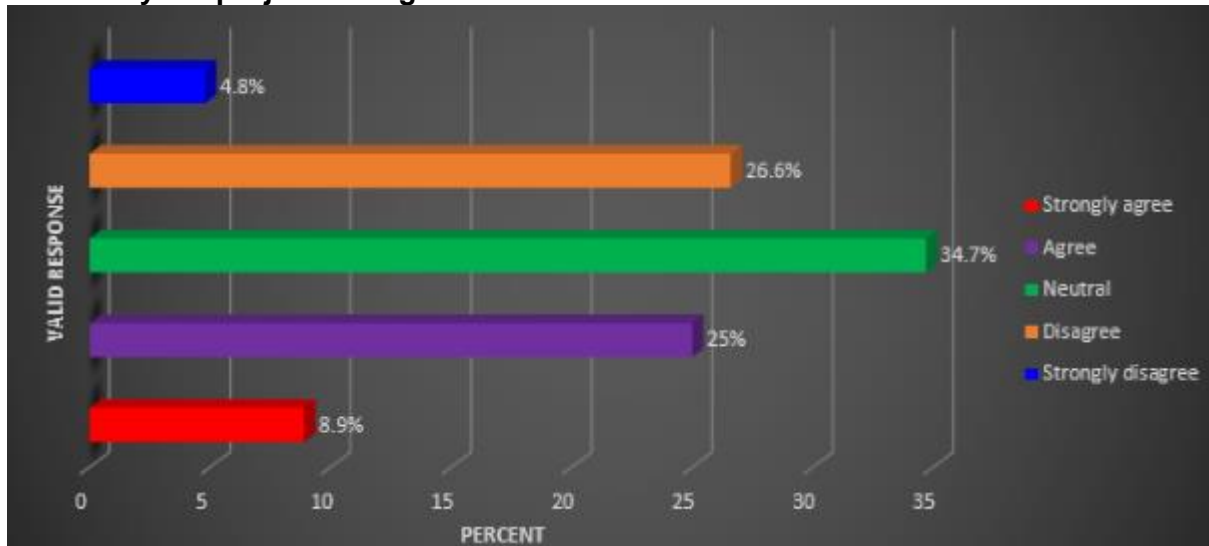
FIGURE 4.54: Legislation promotes cost effective procurement



Question 10.2 Project resources or financial resources are managed in an improper manner by the project manager

A total of 31.4% of the stakeholders disagreed with the statement, while 34.7% were neutral and only 33.9% agreed with it. This is a sensitive issue and the researcher speculates that most respondents did not want to commit to an answer and that is why they chose to remain neutral.

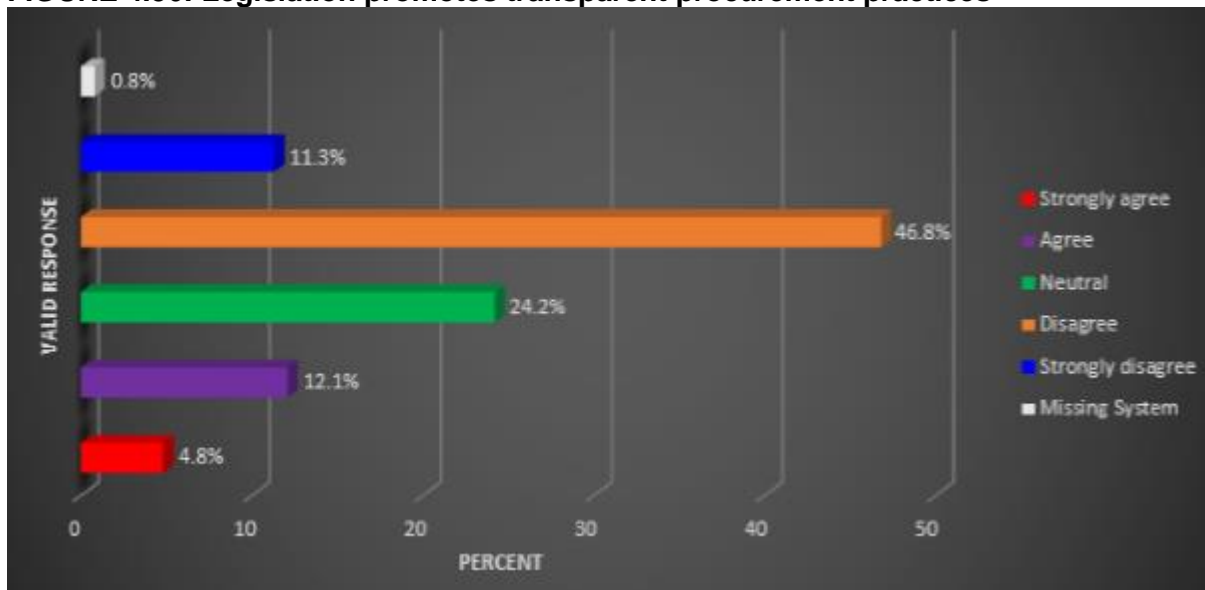
FIGURE 4.55: Project resources (financial resources) are managed in an improper manner by the project manager



Question 10.3 Legislation promotes transparent procurement practices?

More than half (58.1%) of the stakeholders disagreed with the statement, 24.2% were neutral and only 16.9% agreed with the statement. This is a serious concern because respondents indicated that procurement regulations do not promote transparency as required by the Constitution of the Republic.

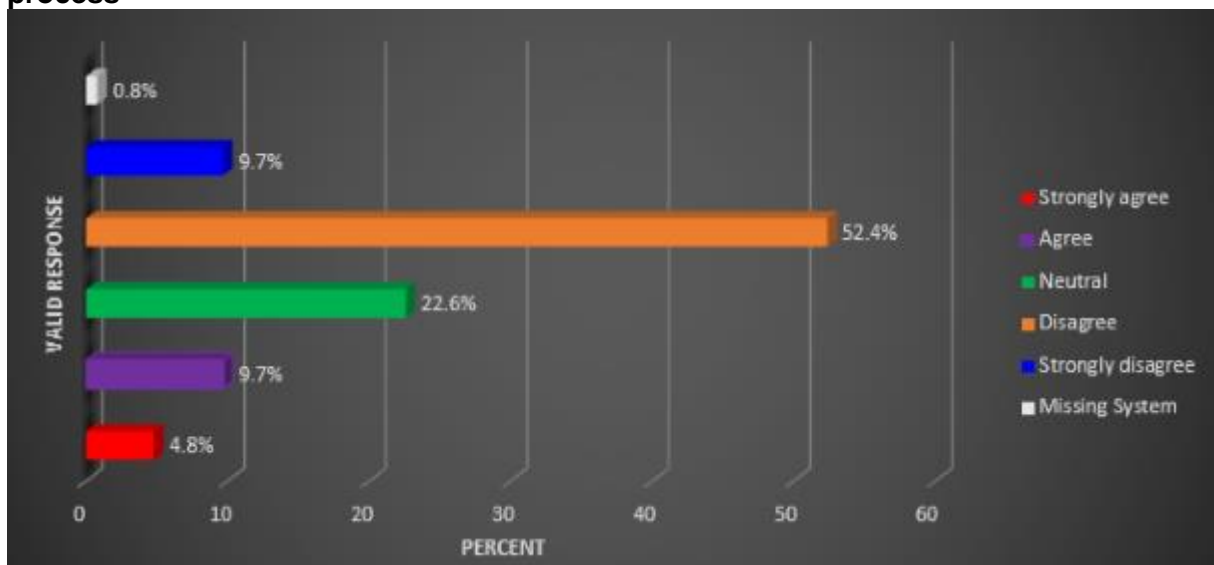
FIGURE 4.56: Legislation promotes transparent procurement practices



Question 10.4 There is a well-documented standard procurement management process

More than half (62.1%) of the stakeholders disagreed with the statement, 22.6% were neutral and only 14.5% agreed with it. This is an indication that there is a lack of standard procurement processes in the department.

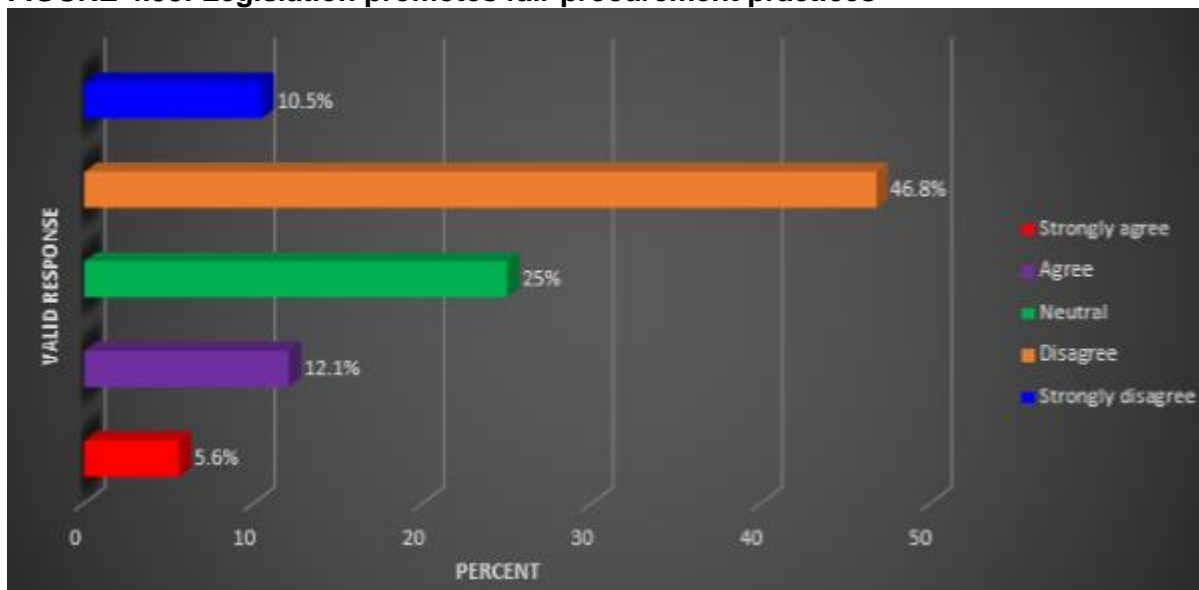
FIGURE 4.57: There is a well-documented standard procurement management process



Question 10.5 Legislation promotes fair procurement practices

More than half (57.3%) of the stakeholders disagreed with the statement, 25% were neutral and only 17.7% agreed with the statement. This is an indication that departmental procurement regulations do not promote fair procurement practices, or maybe stakeholders are not aware of the regulations that promote fairness within the department's procurement systems.

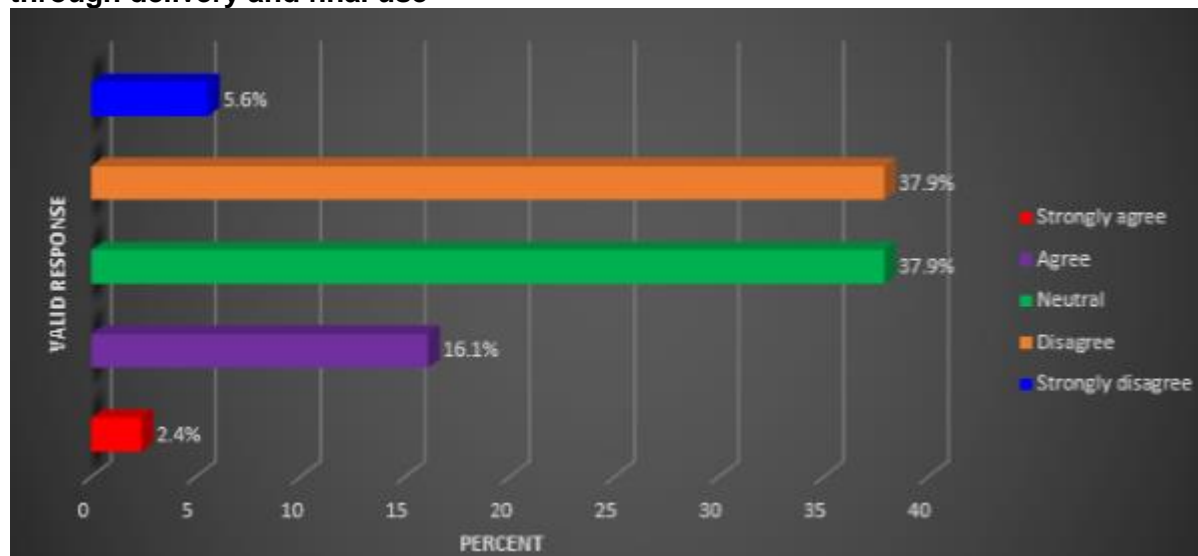
FIGURE 4.58: Legislation promotes fair procurement practices



Question 10.6 There is a defined process for managing materials, from planning through delivery and final use

A total of 43.5% of the stakeholders disagreed with the statement, while 37.9% were neutral and only 18.5% agreed with it.

FIGURE 4.59: There is a defined process for managing materials, from planning through delivery and final use



Question 11

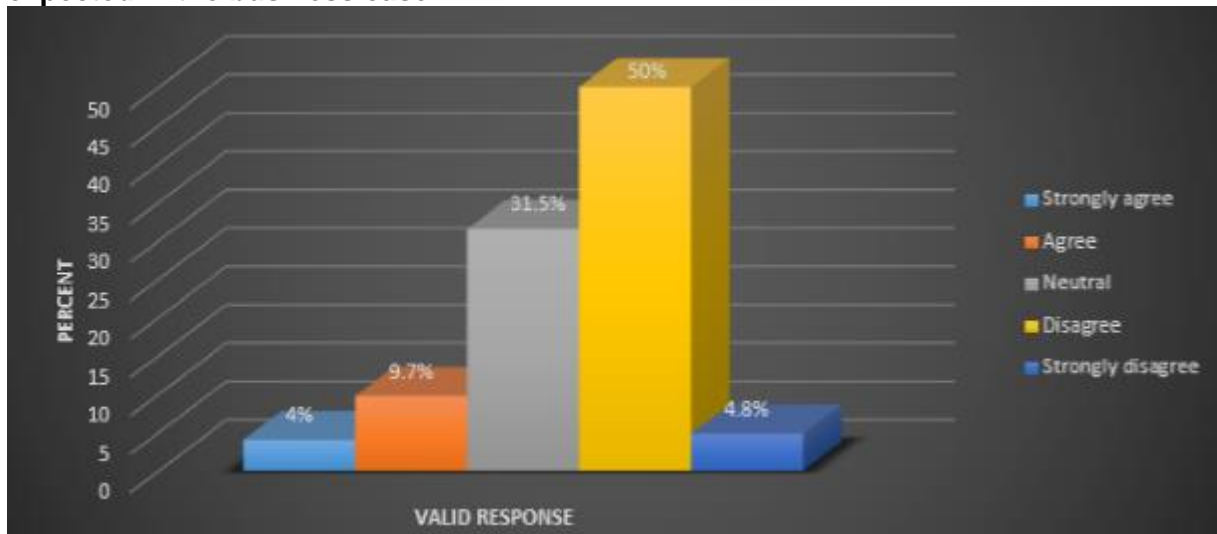
Six questions were asked on the topic of managing project stakeholders. The table below is the summary of the responses.

Questions	Agree	Neutral	Disagree
11.1	13.7%	31.5%	54.8%
11.2	11.3%	37.1%	51.6%
11.3	25.8%	39.5%	33.0%
11.4	26.6%	36.3%	36.3%
11.5	16.9%	41.1%	41.1%
11.6	27.4%	37.1%	35.4%

Question 11.1 Project outcomes are monitored by the department or client (sponsor) after project closure, in order to ensure the achievement of all benefits (deliverables) expected in the business case

In this item, the least number of the respondents (13.7%) agreed with the statement, while a total of 54.8% disagreed with the statement. A large percentage of the respondents 31.5% remained neutral, neither agreeing nor disagreeing.

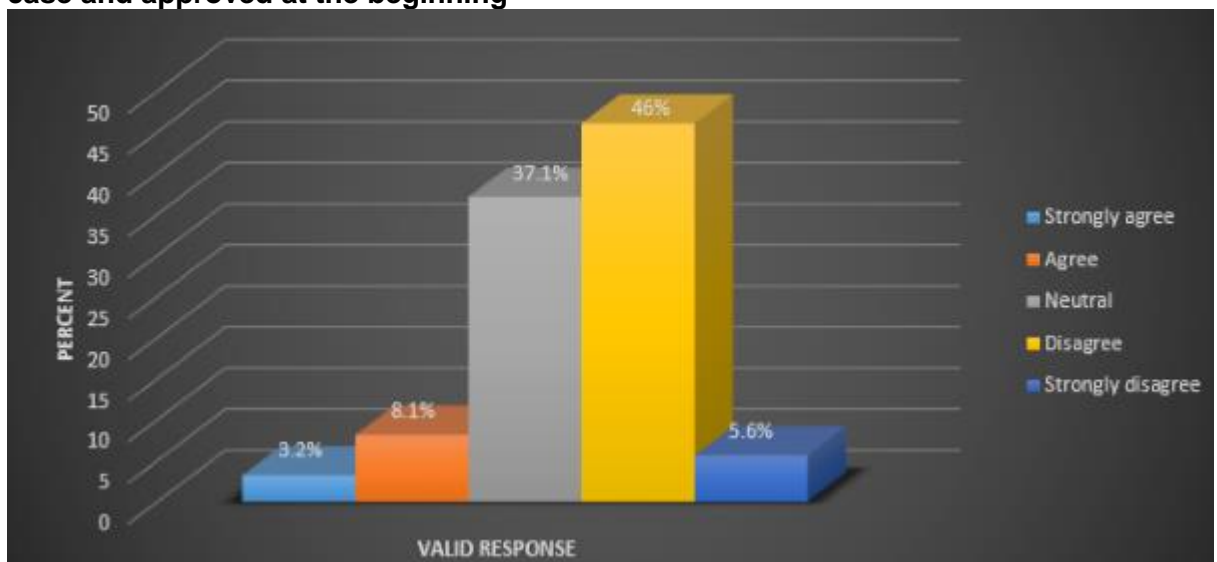
FIGURE 4.60: Project outcomes are monitored by the department or client (sponsor) after project closure, in order to ensure the achievement of all benefits (deliverables) expected in the business case



Question 11.2 Expected outputs, outcomes and benefits are described in the business case and approved at the beginning

In this item the least number of the respondents (11.3%) agreed with the statement and a total of 51.6% disagreed with the statement. A large percentage of the respondents (37.1%) remained neutral, neither agreeing nor disagreeing.

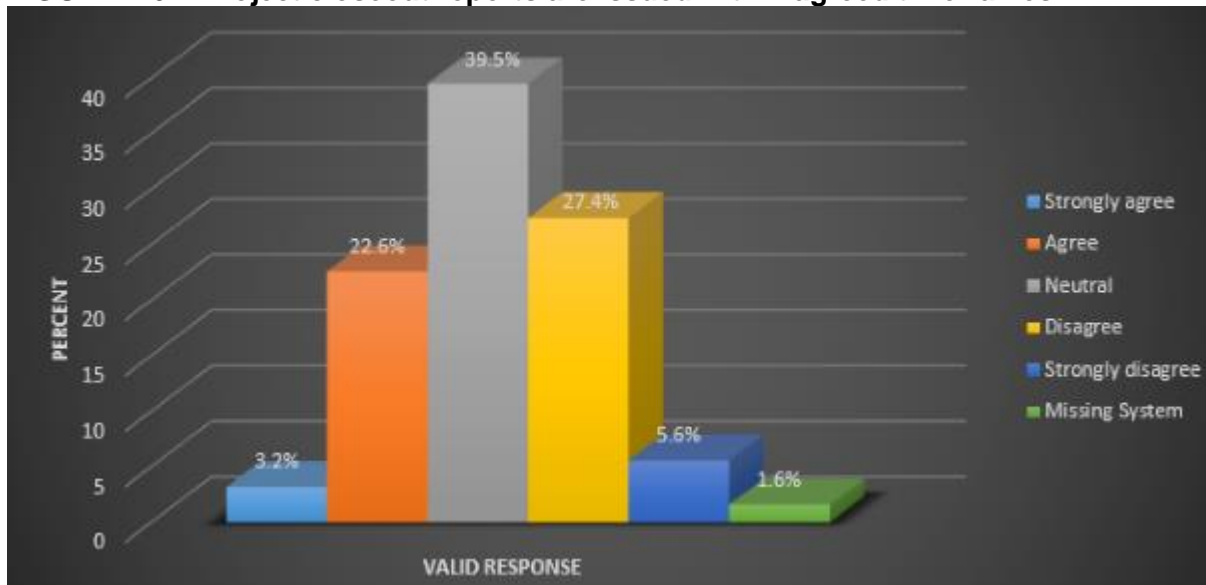
FIGURE 4.61: Expected outputs, outcomes and benefits are described in the business case and approved at the beginning



Question 11.3 Project closeout reports are issued within agreed time frames

Just over a third of respondents (39.5%) were neutral to this question, while almost a third of the respondents disagreed (33%) that project closeout reports are issued within agreed time frames. Only 25.8% agreed with the statement.

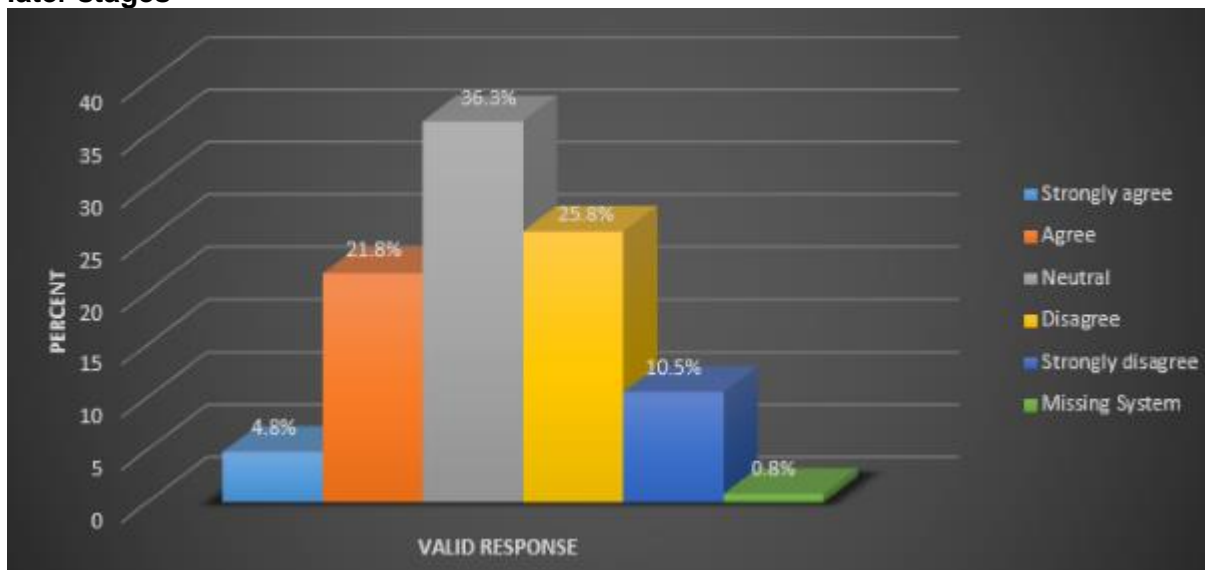
FIGURE 4.62: Project closeout reports are issued within agreed timeframes



Question 11.4 Stakeholders change project requirements and have second thoughts at later stages

Just over a third of respondents (36.3%) were neutral and the same number of respondents disagreed with this question, while a total of 26.6% respondents agreed that stakeholders change project requirements and have second thoughts at later stages.

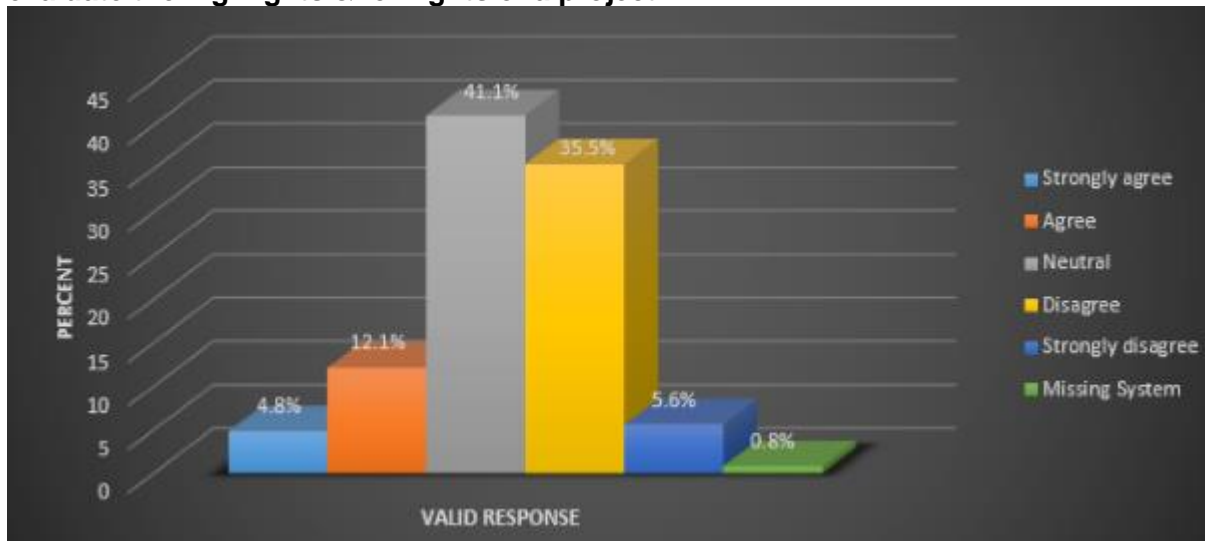
FIGURE 4.63: Stakeholders change project requirements and have second thoughts at later stages



Question 11.5 At the conclusion of a project, the team of the project manager, superintendent, estimator and a senior executive conduct a “job closeout meeting” to evaluate the highlights and lowlights of a project?

In this item, the least number of the respondents (16.9%) agreed with the statement that at the conclusion of a project, all stakeholders conduct a “job closeout meeting” to evaluate the highlights and lowlights of a project, and a total of 41.1% disagreed with the statement. A large percentage of the respondents (41.1%) remained neutral, neither agreeing nor disagreeing.

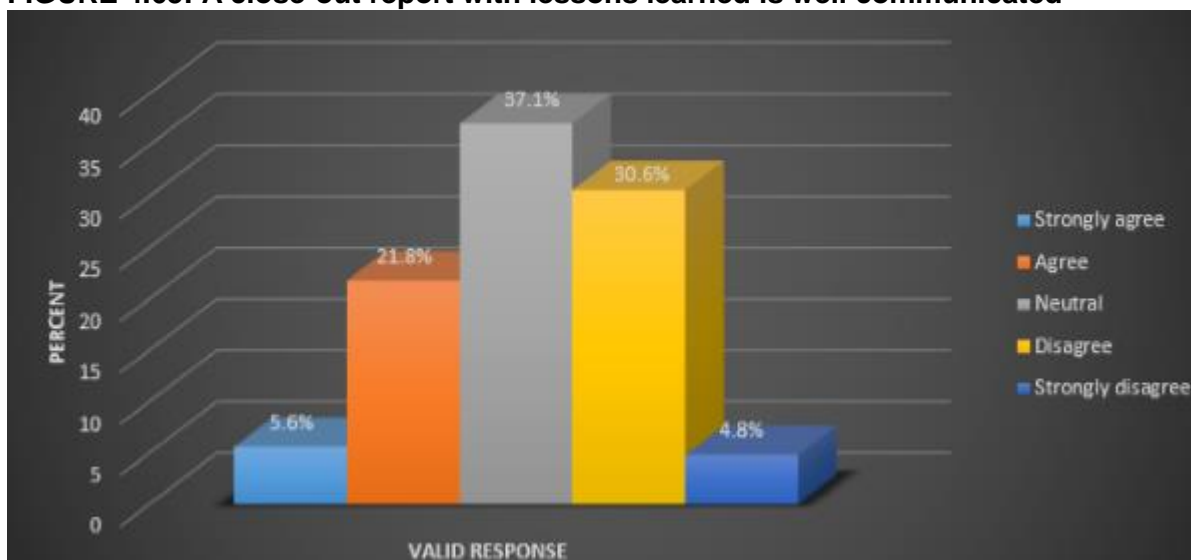
FIGURE 4.64: At the conclusion of a project, the team of the project manager, superintendent, estimator and a senior executive conduct a “job closeout meeting” to evaluate the highlights & lowlights of a project



Question 11.6 A close-out report with lessons learned are well communicated?

Just over a third of the respondents (37.1%) were neutral to this question, only 27.4% agreed with the statement, while just over a third of the respondents (35.4%) indicated that a close-out report with lessons learned are not well communicated. The lack of effective communication and the application of communication skills in construction project management may lead to project outcomes that do not meet project objectives

FIGURE 4.65: A close-out report with lessons learned is well communicated



4.3 DEMOGRAPHIC DIFFERENCES IN THE VARIABLES.

For this study, MANOVA and ANOVA were used to determine if there are differences between demographic groups managing project costs, procurement, integration, scope, time, communication, risk, and stake holders. Demographic characteristics, such as gender, qualifications, age and race were considered for these analyses.

TABLE 4.2: Age

Age	18-30		31-40		41-50		51+	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.18	.704	3.37	.735	3.23	.825	3.37	.667
Managing project procurement	3.58	.892	3.61	.621	3.32	.686	3.24	.816
Managing project integration	3.44	.473	3.51	.591	3.54	.784	3.42	.797
Managing project scope	3.32	.700	3.51	.641	3.54	.678	3.60	.714
Managing project time	3.47	.586	3.47	.576	3.28	.795	3.35	.851
Managing project communication	3.55	.743	3.45	.671	3.29	.831	3.20	.829
Managing project risk	3.45	.402	3.30	.416	3.28	.625	3.19	.849
Managing project stakeholders	3.34	.713	3.40	.531	3.20	.573	3.11	.906

Age throughout the eight variables indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Between ages 18-30, managing project procurement and managing project communication variables clustered around point four (Disagree). Between ages 31-40, managing project procurement, managing project integration and managing project scope variables clustered around point four (Disagree). Between ages 41-50, managing project integration and managing project scope variables clustered around point four (Disagree). For the group, ages 50+, mManaging project scope variables clustered around point four (Disagree). It however appeared that for most of the variables the responses did not vary around the mean scores (standard deviation scores lower than one).

TABLE 4.3: Race

Race	Black		White		Coloured	
	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.33	.765	3.38	.728	3.30	.751
Managing project procurement	3.56	.762	3.37	.722	3.41	.630
Managing project integration	3.53	.682	3.35	.767	3.58	.557
Managing project scope	3.46	.674	3.31	.631	3.74	.669
Managing project time	3.50	.613	3.42	.731	3.32	.783
Managing project communication	3.45	.806	3.46	.782	3.26	.674
Managing project risk	3.30	.526	3.29	.612	3.35	.555
Managing project stakeholders	3.39	.597	3.22	.820	3.23	.615

All races throughout the eight variables indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Amongst black respondents, managing project procurement, managing project integration and managing project time variables, clustered around point four (Disagree). Amongst coloured respondents, managing project scope and managing project integration variables clustered around point four (Disagree). However it seems that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one).

TABLE 4.4: Gender

Gender	Male		Female	
	Mean	SD	Mean	SD
Managing project costs	3.29	.768	3.30	.697
Managing project procurement	3.40	.663	3.55	.866
Managing project integration	3.50	.687	3.44	.685
Managing project scope	3.51	.648	3.52	.726
Managing project time	3.39	.624	3.36	.821
Managing project communication	3.32	.771	3.51	.715
Managing project risk	3.33	.566	3.21	.572
Managing project stakeholders	3.27	.599	3.26	.745

Both genders throughout the eight variables indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Amongst males, managing project integration and managing project scope variables clustered around point four (Disagree). Amongst females, managing project procurement, managing project scope and managing project communication variables clustered around point four (Disagree). However it appears that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one).

TABLE 4.5: Years of experience

Years of Experience	0-3		4-6		7-10		11-15		16-25		26+	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.30	0.755	3.41	0.602	3.01	0.744	3.44	0.836	3.34	0.778	3.35	0.722
Managing project procurement	3.46	0.750	3.70	0.679	3.73	0.683	3.40	0.770	3.26	0.637	3.10	0.867
Managing project integration	3.38	0.487	3.67	0.626	3.56	0.610	3.25	0.736	3.38	0.840	3.50	0.762
Managing project scope	3.28	0.707	3.80	0.545	3.51	0.551	3.34	0.752	3.43	0.740	3.60	0.704
Managing project time	3.57	0.539	3.58	0.530	3.29	0.717	3.39	0.559	3.29	0.588	3.31	1.008
Managing project communication	3.70	0.767	3.56	0.562	3.28	0.783	3.21	0.625	3.35	0.849	3.16	0.741
Managing project risk	3.34	0.491	3.54	0.509	3.30	0.504	3.27	0.351	3.17	0.599	3.28	0.820
Managing project stakeholders	3.26	0.485	3.62	0.570	3.39	0.722	3.06	0.386	3.30	0.519	2.98	0.892

Number of years of experience throughout the eight variables indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Between 0-3 years of experience, managing project time and managing project communication variables clustered around point four (Disagree). Between 4-6 years of experience, managing project procurement, managing project integration, managing project scope, managing project time, managing project communication, managing project risk and managing project stakeholders variables, clustered around point four (Disagree). Between 7-10 years of experience, managing project procurement, managing project integration and managing project scope variables clustered around point four (Disagree). At 26+ years of experience, managing project integration and managing project scope variables clustered around point four (Disagree). It however appears that for most of the variables the responses did not

vary to some extent around the mean scores (standard deviation scores lower than one).

TABLE 4.6: Formal project qualifications

Formal Project Qualifications	Yes		No	
	Mean	SD	Mean	SD
Managing project costs	3.27	.545	3.25	.791
Managing project procurement	3.30	.801	3.43	.737
Managing project integration	3.55	.490	3.45	.655
Managing project scope	3.62	.409	3.45	.712
Managing project time	3.38	.555	3.33	.704
Managing project communication	3.32	.660	3.32	.762
Managing project risk	3.32	.427	3.25	.605
Managing project stakeholders	3.12	.740	3.24	.627

Participants who indicated that they have formal project management qualifications indicated the mean value, clustered around point three (Neutral) for most of the variables, apart from managing project integration and managing project scope variables which clustered around point four (Disagree). However, it appears that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one).

TABLE 4.7: Education qualities

Education qualities	Matric		Certificate		Diploma		Degree		Post Grad	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.13	.804	3.43	.704	3.45	.688	3.34	.717	2.84	.608
Managing project procurement	3.23	.549	3.48	.790	3.48	.741	3.73	.765	3.01	.818
Managing project integration	3.18	.806	3.45	.676	3.54	.563	3.51	.647	3.62	.595
Managing project scope	3.19	.669	3.56	.618	3.59	.691	3.46	.513	3.74	.609
Managing project time	3.19	.669	3.57	.714	3.35	.623	3.50	.634	3.24	.633
Managing project communication	3.23	.865	3.42	.793	3.31	.652	3.49	.690	3.17	.820
Managing project risk	3.17	.552	3.52	.445	3.38	.494	3.16	.619	3.41	.556
Managing project stakeholders	3.06	.570	3.16	.772	3.38	.468	3.50	.591	3.04	.909

Education qualifications throughout the eight variables indicated that the mean values tended to cluster around point three (Neutral) for most of the variables. Participants with a certificate qualification, according to their responses in relation to managing project scope, managing project time and managing project risk variables, were clustered around point four (Disagree).

The variables for participants with diploma qualifications, according to their responses in relation to managing project integration, were clustered around point four (Disagree). Variables for participants with degree qualifications, according to their responses in relation to managing project integration, managing project time and managing project stakeholders, were clustered around point four (Disagree). Variables for participants with post graduate qualifications, according to their responses in relation to managing project integration, were clustered around point four (Disagree). It however appears that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one).

TABLE 4.8: Types of projects

Type of Projects	Office		Factories		Mall		Residential		Engineering	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.21	.747	2.37	.433	2.16	.144	3.05	.822	3.42	.781
Managing project procurement	3.46	.823	1.95	.619	2.06	.702	3.12	.812	3.40	.691
Managing project integration	3.41	.702	2.81	.904	3.08	.886	3.46	.594	3.57	.595
Managing project scope	3.46	.635	3.14	1.08	3.42	1.13	3.41	.628	3.60	.597
Managing project time	3.33	.790	2.60	.995	2.35	1.06	3.12	.746	3.40	.696
Managing project communication	3.33	.758	2.33	.781	2.00	.500	3.11	.910	3.31	.748
Managing project risk	3.36	.656	3.15	.789	3.46	.577	3.27	.651	3.46	.416
Managing project stakeholders	3.16	.736	2.10	.824	1.86	.832	3.15	.804	3.18	.649

Responses based on types of projects, calculated throughout the eight variables, indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Participants with engineering type of project experience, according to their responses in relation to managing project scope variables (the highest mean), were clustered around point four (Disagree). It however appears that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one), apart from managing project scope within the factory and mall and managing project time in the mall.

TABLE 4.9: Years of project experience

Years of Projects Experience	0-3		4-6		7-10		10+	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Managing project costs	3.29	.848	3.44	.706	3.27	.628	3.25	.681
Managing project procurement	3.48	.712	3.55	.770	3.36	1.02	3.33	.784
Managing project integration	3.49	.678	3.59	.666	3.62	.714	3.56	.599
Managing project scope	3.43	.693	3.50	.706	3.51	.545	3.70	.559
Managing project time	3.44	.609	3.67	.722	3.59	.542	3.21	.764
Managing project communication	3.51	.697	3.52	.649	3.40	.672	3.30	.733
Managing project risk	3.27	.573	3.55	.440	3.46	.340	3.32	.626
Managing project stakeholders	3.37	.534	3.50	.643	3.26	.859	3.05	.774

Number of years of project experience throughout the eight variables indicated that the mean values tend to cluster around point three (Neutral) for most of the variables. Between 0-3 years of project experience, managing project communication variables clustered around point four (Disagree).

Between 4-6 years of project experience, managing project procurement, managing project integration, managing project scope, managing project time, managing project communication, managing project risk and managing project stakeholders variables clustered around point four (Disagree). Between 7-10 years of project experience, managing project integration, managing project scope and managing project time variables clustered around point four (Disagree). For the group 10+ years of project experience, managing project integration and managing project scope variables clustered around point four (Disagree). It however appears that for most of the variables the responses did not vary to some extent around the mean scores (standard deviation scores lower than one), apart from managing project

scope and managing project integration, as reported by participants who have 10+ years of project experience.

4.4 CHAPTER SUMMARY

Chapter four presents the research data, the analyses of the data, and discusses the outcome of the analysis. This chapter covered a presentation of the analyses of the data, namely the descriptive statistics, including frequencies and factor analyses. Secondly the study investigated the correlation between the measured constructs, regression analysis and multiple analyses of variance. Lastly it presented the content analyses of the questions related to the challenges facing the project managers, and commented pertaining to project management practices in the Northern Cape Province.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter draws conclusions regarding the literature review and the empirical study, followed by the limitations of the research. Lastly, recommendations to solve research problems for future research are also presented in this chapter.

5.2 MAIN FINDINGS

To enhance service delivery within government institutions, government construction projects need to be managed with efficiency, because infrastructure development is central to the development of any country. Public facilities satisfy specific community needs - including safety and security, communication, recreation, sport, education, health, public administration, religious, cultural as well as social responsibilities. Public facilities, as the name implies, are generally regarded as the responsibility of government, whether central, regional or local, and more often than not are provided by government institutions. For example, townships need more police stations in order for the South African Police Service (SAPS) to do a better job of attending to community concerns and bringing crime under control; communities need hospitals that provide world-class health facilities and the very best medical care around the clock, to mention but a few government institutions.

5.2.1 Literature review

The following findings were noted on the project management of infrastructure projects:

- Inadequate management information for the evaluation and monitoring of projects to identify, avoid and address delays and/or overspending on projects. A high number of variation orders to change scope of projects resulting in potential fruitless and wasteful expenditure.
- Non-compliance with Supply Chain Management (SCM) legislation in the appointment of contractors.

- Project managers are not registered with the South African Council for Project and Construction Management Professions (SACPCMP). Contractors are not registered with Construction Industry Development Board (CIBD) as required by the CIBD Act.
- Construction contractors do not provide for penalties for late completion/penalties waived without valid reasons. Adequate action is not taken against non-performing contractors.
- Delays and disruptions, poor site management, time and cost variations, skills and competence issues and a lack of worker participation are among the challenges faced in the course of executing construction projects.
- Contractors generally pay no attention to the legal requirements for employing project managers who are registered with the South African Council for Project and Construction Management Professions (SACPCMP).
- The construction industry is extremely complex, which is intensified by the continued price increases in building material and labour problems. Even the slightest mistake in the tender estimates may cause a project to fail, which may in turn have extreme consequences for the department.

5.2.2 Empirical investigation

Findings which negatively influence project delivery time in the Northern Cape Province include the following: a lack of adequate planning; poor management style; a lack of constructability reviews of designs; inadequate motivation of workers; economic policies; a lack of prompt payment to contractors and low quality of management during design and construction. Findings revealed that inadequate planning; changes in project design; poor project management; inadequate financial provision; and inaccurate estimates were the major causes of construction project failures. Furthermore the study also showed that the causes of construction projects schedule overruns in the Northern Cape Province, included delays in approving changes in the scope of work; delays in material delivery; shortage of skilled team members; and a low productivity level of workers.

Additionally, it was observed that construction project delays, increased project costs due to extension of time, liability of companies for bad debt, and project

abandonment also play vital roles. Delays in payments from clients was also amongst the major causes for project failures because the respondents said that service providers are not always paid on time and had cash flow problems which led to heavy debts with their suppliers.

The findings discovered that the roles and responsibilities of the team members and the project manager had been confused. This confusion had resulted in a conflict of accountability which ultimately ended in project failure. The study also revealed that extension of time, costs, disputes and poor quality of work due to hurrying the project along, were the major effects of construction projects' schedule overruns. Likewise, the study revealed that adequate planning, proper pre-contract planning, proper project implementation and management, as well as good workmanship were the most effective ways of minimizing construction project costs.

Project failures caused by poor project scope management can be attributed to poor scope definition, poor translation of scope into design and documentation by the professional team. With respect to the subject, projects that have failed as a result of poor project quality management, it should be noted that clients/sponsors and the general public deserve to get value for money and each project which fails as a results of poor workmanship, represents wasteful and/or fruitless expenditure and ultimately unnecessary costs to the tax payers.

The findings of the study revealed that poor communication between design consultants and clients was the major factor contributing to project delays. This may imply that there is not much interaction between clients and the design team consultants to ensure that the clients' ideas are communicated properly. The predominant factor suggested by respondents was that changes were made at the request of the client. This may imply that most clients lack experience with regard to the design process and because of this, their ideas might not be feasible during the design.

The results revealed that proper project planning and scheduling, effective strategic planning, site management and supervision, frequent coordination of the construction team, availability of clear information, and communication channels, were the most effective ways of minimizing construction projects' schedule overruns

in the Northern Cape Province. It is recommended that all members of construction teams be trained and educated on the factors that cause projects to fail, in order to minimize these failures.

During a comparison of the NDPW conventional project management approach with the modern business approach (PMBOK), gaps and inconsistencies in the project management approach were identified, which could be the root causes of major capital projects' failure within the NDPW. These included the following in ranking order of seriousness:

1. The appointment of the project manager during the tender award stage instead of the conceptual stage, in order to get the buy-in and commitment from the project manager, which is the normal practice in project management.
2. The non-involvement of the project manager in the project selection process.
3. The non-adherence to principles of project management when managing capital projects by failure to undertake pre-feasibility and feasibility studies, which is normal practise followed by the project lifecycle.
4. Undefined project deliverables by the project sponsor could be the reason that some of major capital projects are cancelled mid-way, resulting in irregular and fruitless or wasteful expenditures.
5. The general lack of leadership, support and commitment from the project owner ensures that major capital projects are almost doomed to fail from the start.

Finally the results revealed that most respondents did not make a definite decision (agree or disagree), most rather chose option 3 (Neutral) in the questionnaire. The unwillingness of the respondents to provide honest answers could stem from the participants' natural desire to provide socially acceptable answers in order to avoid embarrassment or please the organization conducting the study. This could also be due to various other reasons, but most often respondents provide "*inaccurate*" responses due to unfamiliarity, respondent fatigue, a faulty recall, question format, and question context.

5.3 EVALUATION OF THE STUDY

The primary research objective was to evaluate the effect of the delivery of government projects in the Northern Cape, in order to determine the root causes of

the failure of government projects managed the by NDPW in the Northern Cape Province. The study also investigated why government projects were not completed within the agreed schedule, within budget and according to the specifications and needs of the client departments (project sponsor).

5.3.1 Secondary objectives

- To determine governance issues that led to the unsuccessful completion of capital projects;
- To evaluate and analyse the project failures and operational deficiencies within the Northern Cape Province.
- To determine possible procurement and contracting options that will maximize value-for-money, deal with capacity constraints and ensure long-term sustainability.
- To make recommendations on how to resolve the prevailing failures, operational deficiencies and governance issues.
- To investigate the project management practices in the public sector, and explore the issues that hinder the successful implementation of these practices.

This study focused on projects that were managed and controlled by the NDPW in the Northern Cape Province between 1995 and 2014. In order to get to the root causes of the problems experienced in the delivery of government projects in the Northern Cape Province, it was necessary to do research on current and previous projects, processes, and the operating behaviour of subjects. This study evaluated and analysed the project failures and operational deficiencies. The main findings were discussed in paragraph 5.2 and the recommendations are discussed in paragraph 5.5 in this chapter.

Overall, the reasons for capital project failures have a wide range of root causes. The causes range from failure to implement best practises to no clear link between the project and the department's key strategic objectives. There is a lack of constraint and an unlimited scope as far as the reasons for project failure. A project is a complex, non-routine, one-time effort limited by time, resources, as well as performance specifications design, so as to meet customer needs. Project

management is a set of tools, techniques and knowledge that, when applied, helps to achieve the three main constraints of scope, cost and time

5.4 LIMITATIONS

This research was limited to a single province, namely the Northern Cape Province, which means that it might not be applicable to other provinces, given their unique problems and characteristics. The gender and race issues also represented a limitation, because the majority of the respondents were male and black. Because the questionnaire was only distributed in English, some of the respondents might not answer the questions correctly. The research focused only on big public sector projects that were worth more than R10 million.

5.5 RECOMMENDATIONS

Recommendations for the management of the department and for future research were made in this section. It is difficult to provide recommendations on a subject like the application of project management on government projects and critical success factors for projects, especially construction projects. The key reason is that every project is different, every department is different and the business operating environment is also always different. Geography, society, regulations and other factors come into play as well. What is important for the project manager is to assess the project critically, and to identify the relevant critical factors which will guide the execution of the project.

5.5.1 Recommendations for the department

- It is recommended that the department should employ highly skilled estimators and quantity surveyors to prepare their tender documents. The department should be careful not to make tender awards where the price of the recommended tender is below the professional quantity surveyors' pre-tender estimates. Pre-tender estimates must be accurately prepared so as to serve as a baseline on which to evaluate and adjudicate tenders.
- It is recommended that the utilization of only project managers who are registered with the South African Council for Project and Construction Management Professions (SACPCMP), be made a condition on the tender

documents. Should the contractor fail to meet this condition his/her tender should be disqualified.

- It is recommended that quality management should not be practiced in isolation from the other initiatives, but should form an integral part of the department strategy. It is crucial for the government to take a strategic view on quality management and adhere to minimum standards based on a zero tolerance policy.
- Project failures caused by poor project scope management can be attributed to poor scope definition, poor translation of scope into design and documentation by the professional team. The National Department of Public Works and its clients must improve on the quality of the scope statement and must ensure that it is completed before issuing the same to the professional team. Consultants must play their role as professionals and in accordance with the standards laid down by their councils, by translating the scope statement issued by the clients into quality design and tender documents. All stakeholders must be involved at the initiation stage, to avoid later changes to the scope.
- During the evaluation of the subject project, it was discovered that the roles and responsibility of the programme manager and the project manager had been confused. This confusion resulted in a conflict of accountability which ultimately ended in project failure. The roles, accountabilities and responsibilities of the professional team and that of the contractor must be clarified up front in writing, signed by all and recorded in the conditions of the contracts with the departmental project manager, who will be assuming overall accountability for the successful project delivery.
- All developed departments have some form of project governance. Those with effective governance have actively designed a set of project governance mechanisms (committees, budgeting processes, approvals) that encourage behaviour consistent with the organization's mission, strategy, values, norms, and culture. The objective of project governance is to establish clear levels of authority and decision making, including the planning, influencing and conducting of the policy and affairs of the project. This involves the people,

policies and processes that provide the framework within which project managers make decisions and take actions to optimize outcomes related to their areas of responsibility.

- This is achieved by defining and identifying the roles, responsibilities and accountability of all people involved in a project, including their interaction and level of coordination with internal and external dependencies. The organization's management team is responsible for setting up and supporting the governance structure before the project initiates its activities, so as to ensure that all key decisions are made at the right time.
- It is also advised to improve employee motivation and satisfaction by increasing the number of skills that individuals use while performing work; enabling people to perform a job from start to finish; providing work that has a direct impact on the department or its stakeholders; increasing the degree of decision making; the freedom to choose how and when work is done; increasing the amount of recognition for doing a job well; and communicating the results of peoples' work.
- To deal with deliberate transgressions. If, after having followed a proper investigation, the department concludes that the political office bearer or official responsible for making, permitting or authorising irregular/unauthorized/fruitless/wasteful expenditure did not act in good faith, the department must consider instituting disciplinary action and/or criminal charges against the liable person/s. To deal with non-compliance by service providers, they should be blacklisted in a sense that they would find it difficult to do business with government departments again, until such time that they are prepared to come to the party.

5.5.2 Recommendations for future research

Undertaking this research has opened many avenues for further research initiatives.

This research may have opened the doors for researchers to explore the project management practices in the public sector of any other of the government departments in other provinces of South Africa so as to validate the research. Researchers can also research strategies for the public sector organizations to reach

a higher maturity level in project management. To reach higher levels of maturity, it is needed to adopt the PMBOK and use it consistently. This research is limited to a single province, namely the Northern Cape Province hence it would be significant and most desirable to further extend the current study to various provinces across the country to ascertain if similar findings will emerge.

5.6 CONCLUSION

The objective of this work was from the beginning to determine the root causes of failures of government projects managed by the NDPW in the Northern Cape Province, and the reasons why government projects are not completed within the agreed schedule, within budget and according to the specification and needs of the client departments. This objective was partially achieved. This chapter concluded the main findings of the research study and provided recommendations for both the department and for future research. The contributions of the study were discussed as well. Limitations to this study were also noted in this chapter.

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RESEARCH QUESTIONNAIRE



To whom it may concern

The purpose of the questionnaire is to obtain academic information towards completion of qualification with regards to project management practises in the Northern Cape Province.

The questionnaire is confidential and you as the respondent will be treated as anonymous. All that is needed is an honest response to the questions asked. The questionnaire will only take few minutes of your time.

Your kind assistance is requested in completing this questionnaire.

The researcher

In case of any other support you can reach me on the following number: 082 314 3111.

1. DEMOGRAPHIC INFORMATION – SECTION A

1	Age	(1) 18 – 25	(2) 26 – 30	(3) 31 – 40	(4) 41 – 50	(5) 51 – 60	(6) Above 60	
2	Race	(1) Black	(2) White	(3) Indian	(4) Coloured	(5) Other		
3	Gender	(1) Male			(2) Female			
4	Your current position (Job Title)							
5	Current employer							
6	City/Town of residence							
7	Years of working experience	(1) 0-3	(2) 4-6	(3) 7-10	(4) 11-15	(5) 16-25	(6) 26-30	(7) Above 30
8	Any formal project management qualification	(1) Yes	(2) No	If “yes” please explain				
9	Your highest qualification(s)	(1) Less than matric	(2) Grade 12	(3) Certificate	(4) Diploma	(5) Degree	(6) Post graduate	
10	Types of projects You have worked on	(1) Offices	(2) Factories	(3) Shopping mall	(4) Residential	(5) Engineering Projects	(6) Other	
11	Years of projects experience	(1) 0-3	(2) 4-6	(3) 7-10	(4) More than 10years			

SECTION B

Please rate the extent to which you agree or disagree with the following statements by making an “X” over the appropriate number on the 1 to 5 point scale next to the statement. Please take note that 1 = Strongly agree and 5 = Strongly disagree.

	1 = Strongly Agree	2 = Agree	3 = Neutral	4 = Disagree	5 = Strongly disagree
2. MANAGING PROJECT INTEGRATION					
	STATEMENT				
2.1	There's a true integration of project plans and business plans				5
2.2	Project planning process is fully documented and implemented				5
2.3	Each project manager has his/her own version of project plan?				5
2.4	A scope statement is prepared at the discretion of the project manager				5
2.5	Project plan includes cost summary estimates				5
2.6	Milestones with scheduled dates are part of the project plan				5
2.7	The design of the project meets users' practical needs				5
2.8	Sketch plan approvals are granted within mutually agreed time frames				5
3. MANAGING PROJECT SCOPE					
	STATEMENT				

3.1	Project's scope includes activities aiming to ensure the integration of project outputs	1	2	3	4	5
3.2	Project outcomes adhere to the expected outcomes planned in the business case.	1	2	3	4	5
3.3	Project are often informally initiated by client department (sponsor)	1	2	3	4	5
3.4	The client sponsor does not have a formal statement of requirements but rather a general statement of intent	1	2	3	4	5
3.5	Project scopes are sufficiently documented on the Bills Of Quantities and Drawings	1	2	3	4	5
3.6	The project team is involve in the definition, documentation, and approval of all technical requirements	1	2	3	4	5
3.7	Users are consulted at design stage	1	2	3	4	5
4. MANAGING PROJECT TIME / SCHEDULE						
	STATEMENT					
4.1	Enough Information is given during design and construction stages on deliverables	1	2	3	4	5
4.2	The whole project team prior to the start of construction are involved	1	2	3	4	5
4.3	Projects are completed within the agreed time frames	1	2	3	4	5
4.4	Scope variations are adequately managed	1	2	3	4	5
4.5	Time period of performing a project activity is given in an optimum manner by the project manager	1	2	3	4	5
4.6	The WBS is always used as the basis for determining project activities	1	2	3	4	5
5. MANAGING PROJECT COSTS						
	STATEMENT					
5.1	Projects are completed within the allocated budget	1	2	3	4	5
5.2	Cost estimating, reporting, and performance measurement are on projects management.	1	2	3	4	5
5.3	There is a defined and documented cost management process that is standard to the department.	1	2	3	4	5
5.4	Service providers are paid within 30 days of submission of an invoice	1	2	3	4	5
5.5	Progress payments for contractors are paid monthly	1	2	3	4	5
5.6	Projects lack control mechanisms to track costs and project expenditure.	1	2	3	4	5
6. MANAGING PROJECT QUALITY						
	STATEMENT					
6.1	Sometimes desolate materials are used in construction site	1	2	3	4	5

6.2	Team members are mishandling the materials	1	2	3	4	5
6.3	There are no established project quality practices or standards.	1	2	3	4	5
6.4	A basic organizational project quality management process is used usually only on large projects.	1	2	3	4	5
6.5	Quality management process is well documented and is an organizational standard.	1	2	3	4	5
6.6	Quality of construction work meets acceptable standards	1	2	3	4	5
6.7	Project members are knowledgeable about controlling project quality	1	2	3	4	5
7. MANAGING HUMAN RESOURCES ON PROJECTS						
	STATEMENT					
7.1	New project managers are subject to a variety of project training and orientation methods	1	2	3	4	5
7.2	We strive to select and hire architects, engineers and construction managers whose qualifications best relate to accomplishing the specific scope, schedule and budget of the project in question	1	2	3	4	5
7.3	Over time work will not give good productivity in a job?	1	2	3	4	5
7.4	Financial Incentives are provided by the department.	1	2	3	4	5
7.5	There is a documented, repeatable process in place for project human resource management.	1	2	3	4	5
7.6	Human resource plan is prepared and performance is monitored in large projects.	1	2	3	4	5
8. MANAGING PROJECT COMMUNICATION						
	STATEMENT					
8.1	Project reviews are frequently communicated to the stakeholders as well as their needs are frequently reassessed.	1	2	3	4	5
8.2	Project Manager respond to client needs in a timely and effective manner	1	2	3	4	5
8.3	Project Manager communicate openly and frequently	1	2	3	4	5
8.4	Project Manager able to deal with conflict appropriately	1	2	3	4	5
8.5	Department is allowing team members to take part in decision making	1	2	3	4	5
8.6	There is a formal, documented and clear communication management process.	1	2	3	4	5
8.7	The communication process is used in most projects.	1	2	3	4	5
9. MANAGING PROJECT RISKS						
	STATEMENT					
9.1	Project outcomes support the achievement of clearly defined strategic objectives.	1	2	3	4	5
9.2	Team size is enough for accomplishing the task given	1	2	3	4	5
9.3	Sufficient provision is made for climatic conditions and will affect work	1	2	3	4	5

	performance?					
9.4	Political / governmental problems often arise on site	1	2	3	4	5
9.5	Contractual conflicts are found on working site	1	2	3	4	5
9.6	There are no established project risk management practices or standards.	1	2	3	4	5
10. MANAGING PROJECT PROCUREMENT						
	STATEMENT					
10.1	Legislation promotes cost effective procurement	1	2	3	4	5
10.2	Project resources or financial resources are managed in an improper manner by the project manager	1	2	3	4	5
10.3	Legislation promotes transparent procurement practices	1	2	3	4	5
10.4	There is a well-documented standard procurement management process.	1	2	3	4	5
10.5	Legislation promotes fair procurement practices	1	2	3	4	5
10.6	There is a defined process for managing materials from planning through delivery and final use	1	2	3	4	5
11. MANAGING PROJECT STAKEHOLDERS						
	STATEMENT					
11.1	Project outcomes are monitored by the department or client (sponsor) after project closure in order to ensure the achievement of all benefits (deliverables) expected in the business case.	1	2	3	4	5
11.2	Expected outputs, outcomes and benefits are described in the business case and approved at the beginning.	1	2	3	4	5
11.3	Project close out reports are issued within agreed time frames	1	2	3	4	5
11.4	Stakeholders change project requirements and have second thoughts at later stages	1	2	3	4	5
11.5	At the conclusion of a project, the team of the project manager, superintendent, estimator and a senior executive conduct a "job closeout meeting" to evaluate the highlights and lowlights of a project.	1	2	3	4	5
11.6	A close – out report with lessons learned are well communicated	1	2	3	4	5

SECTION C: General

12.1. What in your view are the main challenge facing the Project Managers?

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12.2. Any general comments pertaining to project management practices in the Northern Cape?

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.....

Thank you.

Ms Wilma Pretorius

PO Box 5206

Potchefstroom

2523

18 November 2015

To whom it may concern

LANGUAGE EDITING

I, Wilma Pretorius, hereby confirm that I did the language editing of the dissertation of mr P Mathinye 12930369).

Thank you,

Ms W Pretorius

BA Languages (University of the Free State)

Translation (NWU)