The effectiveness of Quality Management Systems in Project Management: The Case of Transnet Group Capital

By

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The effectiveness of Quality Management Systems in Project Management: The Case of Transnet Group Capital

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DECLARATION

I, Duduzile Kumalo wish to declare that this dissertation is my own work and it has not been submitted for any other qualification to any other higher education institution except at the Durban University of Technology. All sources used in this study were acknowledged.

……

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APPROVAL FOR SUBMISSION

I certify that this dissertation entitled **The effectiveness of Quality Management Systems in Project Management: The Case of Transnet Group Capital** was prepared by Duduzile Emmah Kumalo and has met the required standard for submission in fulfilment of the requirements for the award of Master of Philosophy (M. Phil) Quality Management at the Durban University of Technology.

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Signature

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Date : 4/10/21

DEDICATION

This dissertation is dedicated to my Sons:

Sthembiso and Sipho Kumalo

You are my source of inspiration!!!

“It wasn't easy, but it was worth it”

I endured sleepless nights, many times I thought of giving up, but your abundant grace and mercy carried me. What shall I render to You Lord God Almighty!!!

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- My supervisor, Dr M. Ramchander for the patience, guidance, and support during the writing of the proposal and dissertation.

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ABSTRACT

Transnet's infrastructure development projects foster economic growth through the country's ports, pipelines, and rail networks expansion and modernisation. To this end, Transnet has taken up several capital expansion projects across all its operating divisions to develop and expand its infrastructure. However, the reported figures on compensation events in rail project execution, comprising defects and double handling was found to be notably high. The study aimed to assess the effectiveness of project quality management systems within the life cycle of projects implemented by Transnet Group Capital.

The study was cross sectional in nature and a quantitative research design was adopted involving both primary and secondary research. A questionnaire was used to collect primary data based on a stratified random sampling technique. The data was collected at Transnet Group Capital (TGC). The statistical programme, SPSS version 26.0 was used to analyse data. The secondary data was obtained from TGC management information systems (Primavera databases), wherein a repository of the required documentation is maintained. The secondary data was analysed using quantitative content analysis.

It was found that gender parity has not been achieved throughout all the disciplines. Overall, women's representation remains lower than men. On a positive note, Transnet Group Capital projects are selected in line with business goals. This further confirms that the projects are subjected to an independent Gate Review as specified in the Project Lifecycle Process methodology and as per the project's classification outcome.

Findings indicate that the end users are not consulted throughout the construction processes and project timelines are prolonged. This is coupled by an unclear scope which is not adequately communicated to all stakeholders, incapacitated project managers, as well as lack of quality assurance and control processes.

The document analysis presented the impact of compensation events at an average of 4% of the contract value. These findings give Transnet Group Capital a reason to

improve their project execution and the monitoring process. The study recommends that gender equity be prioritised. There should be agreements on the expected outcomes of the project to allow each milestone of the project to stay on target. An emphasis of core values is also necessary to transcend differences in culture. There is a need to institutionalise quality awareness and to implement a risk mitigation plan.

Keywords: Project quality management, Risk management, Project life cycle, Quality control and Quality assurance.

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LIST OF DEFINITIONS

i. Compensation events

Evans (2017: 101) defines compensation events are events which change the cost of the work. These costs can be associated with time losses or extension, which lead to more resources being injected in the project. The events may also rise due to other variations and unforeseen expenses. As a result, there will be alterations of the prices, key dates and resources required to complete the project.

ii. Management

Management is the planning, organising, leading, and controlling of human and other resources to achieve organisational goals efficiently and effectively (Jones and George 2018: 5).

iii. Process

A process is a systematic series of activities directed towards causing an end result such that one or more inputs will be acted upon to create one or more outputs.” (Kloppenburg 2014: 297).

iv. Project

Larson and Gray (2018: 6) define a project as a temporary endeavour undertaken to create a unique product, service, or result. It is temporarybecause it has a defined beginning and end in time, and therefore defined scope and resources.

v. Project management

Hyttinen (2017: 13) defines project management as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.

vi. Project managers

Ika and Saint-Macary (2012: 420) define a Project Manager as a competent individual who is responsible for day-to-day management of the project with the accountability of the entire project scope, project team, resources, and the success or failure of the project.

vii. Project Quality Management

PMBOK® Guide (2017: 272) defines Project Quality Management (PQM) as the processes that incorporate the organisation's quality policy regarding planning, managing, and controlling project and product quality requirementsin order to meet stakeholders' objectives.

viii. Project scope

PMBOK® Guide (2017: 131) define the scope as the work performed todeliver a product, service or results with the specified features and functions.

ix. Project sponsors

According to the Project Management Body of Knowledge PMBOK® Guide (2017: 29) the project sponsor is a person or group who provides resources and support for the project, programme or portfolio for enabling success.

x. Quality

Hoyle (2018: 95) Quality: means conformance or conformity to the requirements based on the premise that if a product or service conforms to all the requirements for the product or service, it is a quality product or service.

xi. Quality management

PMBOK® Guide (2017: 271) defines quality management as the process for ensuring that all project activities necessary to design, plan and implement a project are effective and efficient with respect to the purpose of the objective and its performance.

xii. Risk management

Bahamid et al, (2017: 430) defines risk management as organised and comprehensive method tailored towards organizing, identifying andresponding to risk factors in order to achieve project goals.

xiii. Total Quality Management

Total Quality Management (TQM) is an integrated effort designed to improve quality performance at every level of the organisation and it is defined as a management approach that tries to achieve and sustain long-term organisational success by encouraging employee feedback and participation, satisfying customer needs and expectations, respecting societal values and beliefs, and obeying governmental statutes and regulations (Charantimath2017: 63).

xiv. White space risk and integration risk

White space risk is the risk which is not identified. This risk can be the gaps the managers failed to understand, and when all the activities are not considered. The integration risk is when activities do not dovetail as expected at the end of the project (Matta & Ashkenas, 2010:112).

ACRONYMS AND ABBREVIATIONS

CAPIC	Capital Investment Committee
COPEX	Capitalised Operational Expenditure
FEL	Front End Loader
ICPAF	Integrated Capital Project Assurance Framework
ISO	International Organisation for Standardisation
MDS	Market Demand Strategy
Mtpa	Million tons per annum
NDP	National Development Plan
NEC 3	New Engineering Contract 3
OD	Operation Division
Ops	Operations
ORS	Owner Requirements Specifications
PDCA	Plan, Do, Check and Act
PLP	Project Life Cycle Process
PMI	Project Management Institute
QA	Quality Assurance
QC	Quality Control
QMP	Quality Management Practices
QMS	Quality Management System
RSR	Railway Safety Regulator or Regulations
SANS	South African National Standard
SHEQ	Safety, Health, Environment and Quality

SOC	State Owned Company
SOE’s	State Own Enterprise
TGC	Transnet Group Capital
TQM	Total Quality Management

Chapter One
Introduction

1.1 Introduction

In support of government programmes to transform the South African economy, Transnet fosters economic growth of the country's ports, pipelines, and rail networks through the expansion and modernisation them. This is achieved through its infrastructure development projects (Market Demand strategy 2014: 3). This study focuses on the two sampled infrastructure projects. In this chapter the context, the research problem, the intent, and importance of the study will be addressed.

The chapter will further list the general and specific objectives and describe the scope of the study. This is followed by an elucidation of the research paradigm and methodology. The chapter concludes with a description of the outline of each chapter.

1.2 Context of the research

There is a need for developing countries to increase and improve infrastructure to generate economic growth (Mundial 2017: 29) Transnet should play a key role in the global vision for the eradication of poverty, according to Transnet's Chief Executive Officer (Market Demand strategy 2014: 2). Transnet has transformed from being a freight logistics company embracing different segments of economy (Transnet Corporate Report 2018: 8).

According to Transnet Corporate Report (2018: 7), Transnet consist of five operating divisions namely; Transnet Freight Rail, Transnet Engineering, Transnet national Ports Authority, Transnet Port Terminals, and Transnet Pipelines.

Several company-wide specialist units support these divisions, such as Transnet Group Capital (TGC);

i. Transnet Properties (TP); and
ii. Transnet Foundation (TF)

Transnet Group Capital is mandated to deliver Transnet's infrastructure investment projects, through Project Life cycle research, engineering development and studies

as well as managing execution. It uses a hybrid procurement strategy where some work is outsourced, and other projects are delivered jointly with consultants. In some instances, TGC manages critical interfaces such as environmental impact assessments (Transnet Corporate Report 2018: 13).

Voster, Grey and Pinnock (2011: 3) conducted a study to establish a sustainable market for South African (SA) coal exports and to ascertain whether SA's coal reserves could sustainably meet the demand. The study concluded that SA can sustain coal exports of 81 to 83 million tonne per annum (Mtpa) over the next 15 to 20 years (Voster, Grey and Pinnock 2011: 3). This market study resulted in a pre-feasibility study that was conducted to examine the upgrade of the coal line from about 74 Mtpa to 81 Mtpa which identified several work packages along the coal line that would contribute towards increasing capacity and the need to double the 3.9 kilometres Overvaal single-tunnel (Voster, Grey and Pinnock 2011: 3).

This study focuses on measuring the Project Quality Management System (PQMS) effectiveness in all the phases implemented by Transnet within the 81 million tons per annum (Mtpa) programme and the Overvaal Tunnel rail projects. Transnet has adopted New Engineering Contract 3 (NEC3) from the Institution of Civil Engineering (ICE). These contracts promote the implementation of efficient and effective project management principles and practices as well as defined legal relationships. Thisis enough for the procurement of different projects as well as for major framework projects (Jenkinson 2013: 7).

One of the core clauses of NEC3 is Compensation Events (CE) which is defined as events which change the cost of the work. These costs can be associated with time losses or extension, which lead to more resources being injected in the project. The events can also rise due to other variations and unforeseen expenses. As a result, there will be alterations of the prices, key dates and resources required to complete the project (Jenkinson 2013: 15).

The NEC requires the contractors to provide notification of matters that increases the price of the project, delays the completion, and delays the meeting of milestones and such notification of the compensation events are covered under the 61 clauses of NEC. Actions taken to reduce or avoid the risks identified in early warning notices can be compensated. However, parties confuse Early Warning Notices (EWN) with CE's.

According to Mudaly (2017: 7), Transnet has faced challenges in this regard. The company's 2018 project report that was extracted from the Primavera system has a high reported number of compensation events in the execution of its rail projects and quality requirement (Rambau 2018: 12).

The rationale to explore the effectiveness of QMS in project management in the case of Transnet Group Capital stemmed from other relevant studies on the topic as highlighted in literature. Researchers concur that there is a need to have a QMS for construction sites to increase the quality levels in projects, and communication between staff and management (Al-Ani and Al-Adhmawi 2011: 89). Further to this, a quality management forum in a construction company is paramount. The QMS can then be applied either at the site of organisation or at the project site (Mane and Patil 2015: 126).

Kerzner (2010: 39) defines project management as having accomplished the goals of the project on time and cost-effective to fulfil the requirements of the client. Some researchers have shown that the construction industry has not satisfactorily delivered, in a satisfactory manner, as expected by customers in terms of efficiency, quality and quality systems (Ali and Rahmat 2010: 35).

This has indicated that most project managers concentrate on cost and time instead of quality, and yet quality is the considered a significant factor in determining whether a project is successful or not (Carvalho, 2014: 1, Fernande, Sampaio and Carvalho, 2014: 1, Ramlee et al. 2016: 5). In construction projects, more focus should be placed on quality. (Mane and Patil 2015: 127). Evidently, quality is a key component of project success and thus the timeliness of this study to explore the effectiveness of QMS in project management at Transnet.

1.3 Research problem

Project quality management is critical to the achievement of higher quality within projects to ensure project success (Fernande, Sampaio and Carvalho 2014: 1). Neyestani (2016: 1) is of the view that poor workmanship result in high defects, delays, and cost overrun during a project life cycle. The failure of projects would therefore have a negative effect on the country's stability, economic growth, and outlook (Shah 2016: 1).

State-owned enterprises (SOEs) are a vital instrument in the toolbox for the development of social and public benefit by governments. (Pricewaterhousecoopers 2015: 4). Transnet, by the virtue of its size, footprint and representation across the country, involvement in multiple sectors and capital expenditure budget on projects warrants a closer look into project quality management and the role it could play in ensuring the future success of projects.

Like other SOEs, Transnet has a crucial role to play in advancing governments' objectives, including promoting economic growth, job creation, skills development, and key infrastructure development (Gondo 2016: 7). To this end, Transnet has taken up several capital expansion projects across all its operating divisions to develop and expand its infrastructure. Over the past four years, Transnet has invested R124 billion in projects, thereby executing projects in rail, port, and pipelines(Gondo 2016: 4).

However, the reported figures on compensation events in rail project execution comprising defects and double handling was found to be high, amounting to R39 million which is twelve percent of the total rail project value (Mudaly 2017: 7). Hence, this study explores the effectiveness of QMS at Transnet Group Capital with an understanding that project quality management is part of the project activity and should be implemented at the beginning of the project (Project Management Institute 2013: 230). The study also put into consideration that quality plans, procedures, and work instructions, form part of a quality management system, but are not a true reflection of the presence of good operational required to guarantee the delivery of an excellent quality product or service at the end of the project (Varajão *et al.* 2014: 34).

1.4 Purpose of the study

The Purpose of the study is to assess the effectiveness of project quality management systems within the life cycle of projects implemented by Transnet Group Capital. It is anticipated that the research will lead to an improvement in Transnet Group Capital's quality management system within a project environment, not only during the execution phase, but throughout the project life cycle.

1.5 Objectives of the study

The key objectives of the study are as follows:

i. Determine the reasons, number and cost associated with compensation events at the 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects, through document analysis (secondary research).
ii. Ascertain the root cause of poor project quality practices in the project lifecycle through a survey;
iii. Ascertain the impact of poor project quality practices in the project lifecycle through a survey; and
iv. To propose risk mitigation strategies using quality tools.

1.6 Research questions

The research will address the following research questions for this study;

i. What are the reasons, number and cost associated with compensation events in 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects?
ii. What are the factors that contribute towards inferior quality project execution?
iii. What is the impact of poor project quality practices in the project life cycle?
iv. How can quality tools be used to mitigate risks to poor project management?

1.7 Framework of the study

Anfara and Mertz (2014: 139) define theoretical framework as a structure supporting a research study theory. The theory that explains why the research issue under study should be carried out is introduced and identified. The theoretical structure often sets out the orientation of a sample, representing the role of the researcher analysis (Anfara *et al.* 2014: 140).

Based on the research objectives, the following general conceptual framework in Figure 1.1 for quality for construction project success was developed to guide the study. The study will consider both quality management (QM) and project management (PM) theories in terms of the fundamental principles, with the focus on continuous improvement. The philosophies and the processes are described in the literature review.

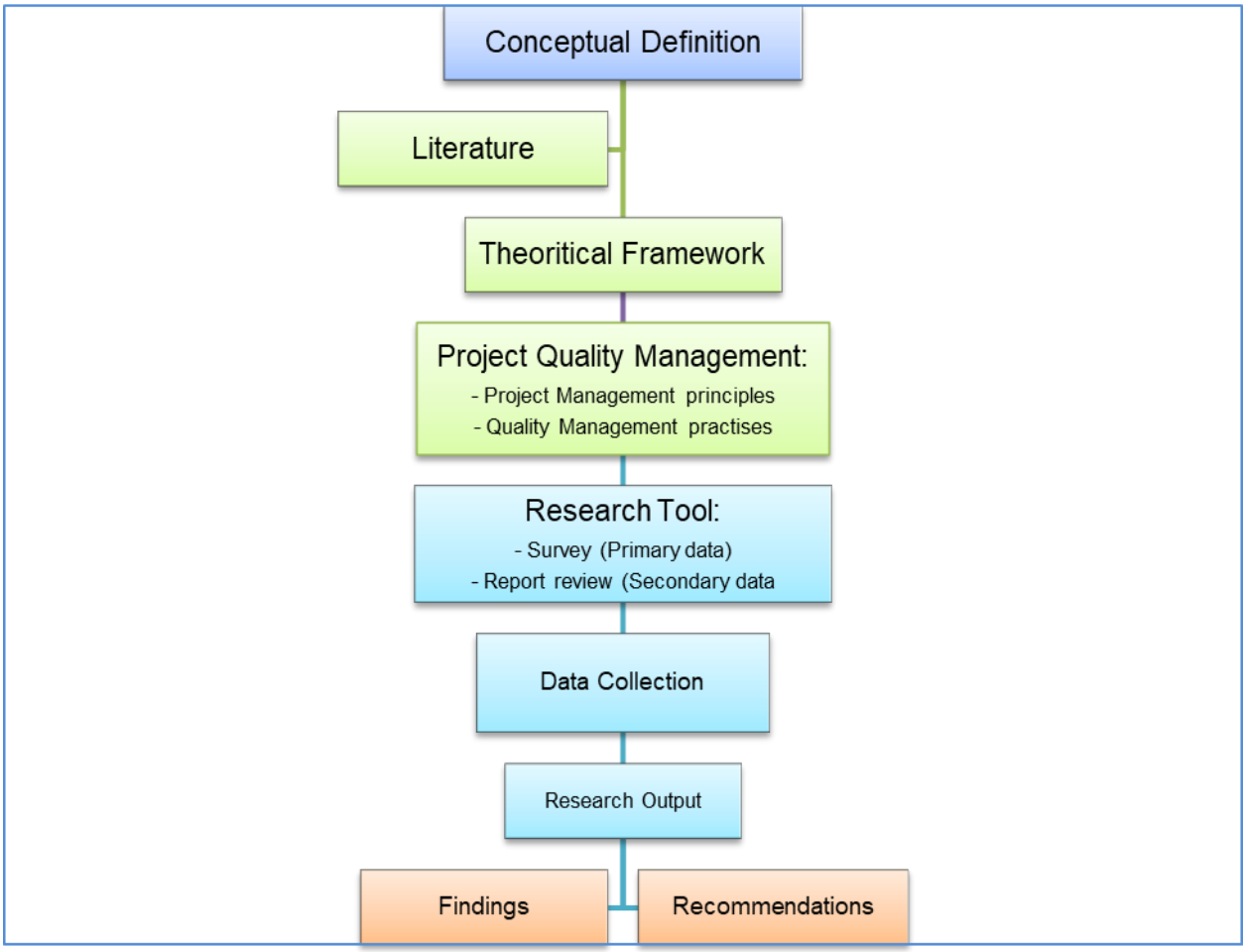


Figure 1.1. Framework of the study

Source: Generated by the researcher

Figure: 1.1 illustrates research process and framework for the study that links the conceptual framework with the various elements that operationalises the variables so that research questions of this study could be answered.

1.8 Research methodology

According to Wilson (2014: 119), defines research methods as various techniques used data collection. This study adopted quantitative approach with the primary data was collected using a questionnaire and secondary data was collected through document content review. The research framework in Figure 1.1. Illustrate the plan followed in the study to achieve research objectives.

1.9 Contributions of study

This study will contribute to the effectiveness of Transnet Group Capital's project management in general, and project quality management to enhance project performance. The effectiveness Transnet Group Capital's project management will be strengthened by:

- adequate representation of gender equity;
- improved planning and monitoring of contract management; and
- Improved and aligned organisational culture.

The project quality management will contribute in Transnet Group Capital's project increasing its competitive position, improving productivity, eliminating defects & waste, improve cost and being sustainable through improved profits.

The findings of this study and the recommendations are expected to bepresented to the Transnet Group Capital executive team. The intent is to have the recommendations implemented after the sign off to ensure continuous improvementin the organisation's project quality management processes.

1.10 Ethical considerations

The aim of research ethics is to ensure that research activities do not harm or adversely affect anyone. (Cooper and Schindler, 2001: 112). To ensure that the interests of the participant are preserved, the researcher attended to the following:

i. A letter of information was given to participants and informed consent was obtained and adequate documentation was kept;
ii. To guarantee anonymity, the questionnaires were coded and none of the respondents were named during the research or in the subsequentdissertation at any time; and
iii. The respondents were chosen without compulsion because of their willingness to participate and no risks.

1.11 Scope of the study

This research was limited only to the Gauteng project management team. The study does not include other Transnet regions. The exclusion of other regions is based on cost and time constrains and the nature of the selected project for the research.

1.12 Structure of dissertation

This research is divided into five chapters, whose content is listed below:

1.12.1 Chapter One:

This chapter presents the introduction, problem statement, purpose, objectives, rationalisation behind the study as well as the limitations of the study.

1.12.2 Chapter Two:

This chapter presented a literature review that provides a summary of previous studies on projects quality management and the different approaches used by quality experts to ensure continuous improvement in the environmental organisation of projects.

1.12.3 Chapter Three:

This chapter discussed the research methodology. It also discussed the research method employed, population and sample size determination, the process, and procedures for administering the research instrument, the data collection and analysis used the justification of the research method.

1.12.4 Chapter Four:

This chapter comprises the analysis and results. It provides a statistical analysis of the data collected through questionnaires and explains the interpreted and relevant effects of the data that the reader can interpret and understand.

1.12.5 Chapter Five:

This is the last chapter of the study and it presents the conclusions to be taken from the findings and the numerous recommendations for further research.

1.13 Conclusion

This chapter presented a summary of the study, introduced, and suggested the research to be done, and summarized the chapters of the dissertation. The next chapter presents the literature review for the study.

Chapter Two

Literature review

Project Management, Project quality and Project Risk Management

2.1 Introduction

The previous chapter described the context, introduced the research problem, set the research objectives, and outlined an overview of the study. This chapter, firstly, contextualises the study to bring the study into perspective. Secondly, it seeks to create a theoretical basis on which research is focused by reviewing the related literature to define research interests in the effectiveness of quality management systems for projects and the various methods used by quality experts to ensure the continuous improvement of the quality management processes of projects in the organisation.

2.2 Purpose of a literature review

Savin-Baden (2010: 12) defines the literature review as a critical analysis of the relevant literature with the view of describing the existing state of knowledge of the topic. This helps not only to explain the theoretical basis for analysis, but also to demonstrate how the study fits within the current body of knowledge. Hart (2018: 38), Defines the study of literature in two phases. First as a comprehensive search of accredited sources and tools involving the identification of paper and electronic sources related to the subject and method(s). Secondly, literature review is described as the critical assessment of the study and synthesis of current knowledge applicable to all research problem.

2.3 Context of the study

2.3.1 Coal 81 Mtpa

Wyman (2009: 14) defines project Coal 81 Mtpa as the capacity upgrade of the Coal line from its current supply chain capacity 70 million tonnes per annum (Mtpa) to a sustainable tonnage throughput of 81 Mtpa, from about 48 mine loading sites situated mainly in Mpumalanga, to the Richards Bay Coal Terminal (RBCT). The 81Mtpa rail expansion programme was designed to meet the increasing international market demand for export coal. The program involves increasing the rail capacity of the coal line and addressing operational bottlenecks which impact on the stable flow for train

traffic (Grey 2011: 74).

2.3.2 Background of Coal 81 Mtpa

The coal line formation was developed during the 1970s and began to show signs of formation failure during 1994 -1995. According to Gräbe (2008: 14), the failure was due to the use of sub-standard materials during construction and the weathering and decomposition of the built layer(s) due to cyclic loading. In addition to the above, Martin (2009: 2), states that the formation was built for 20ton per axle loading, not 26ton per axle which could not handle current high volumes of traffic. As a result, Transnet has been rectifying these problems along the length of the coal line since 1995.

The original FEL-2 study for 81Mtpa was completed in August 2009. This study was then subsequently validated by Wyman (2009: 8) and various changes to the outcomes were proposed to Transnet in April 2010. Based on Wyman (2009: 11) recommendations of several work packages were added, and some of the work packages from the original FEL-2 study were removed while others were reviewed to rationalise costs. The focus of the validation study was only at the sustainable capex and capitalised operational expenditure (COPEX) over a 5year period (Wyman 2009: 10).

Voster, Pinnock and Grey (2011: 22) in the FEL-2 report detailed the work packages to attain the overall 81Mtpa and no further studies conducted thereafter. According to Coal 81Mtpa business case, it was found that undertaking repairs was time consuming rendering sections of track out of service for the duration of the work (Budler, Rich and McMahon 2012: 20). The impacted section will therefore subject to single line working during this period, which clearly impacts the slot capacity of the coal line. This results a pipeline break in the coal supply chain, leading to customer dissatisfaction and loss of revenue. The risks associated with a single line approach is clearly outlined by the Overvaal Tunnel Business Case described in sub-section 2.3.3.

2.3.3 Overvaal Tunnel

According to the Overvaal Tunnel Business Case Sihlahla (2015: 23), Overvaal Tunnel is situated in Mpumalanga between Ermelo and Piet Retief on the Richards Bay Coal line, it has a stretch of 4km single track on the edge of the escarpment at Overvaal.

2.3.3.1 Background of the current tunnel

The Overvaal Tunnel as describe by Sihlahla (2015: 15) is a 4 km long single tunnel, constructed in 1974, and completed in 1976 . Approximately 40 percent of the rail freight in South Africa passes through the single track Overvaal tunnel. This single track poses a risk to organisation as it requires regular maintenance. Currently, about R 14.9 billion revenue is invested through this tunnel annually. Having a single tunnel was the biggest risk to the coal supply chain, since there was no alternate route. The risk was exacerbated by the deterioration of the existing tunnel. Additionally, reconstruction of the tunnel would lead to 6 months' closure of the tunnel (Transnet Integrated Report 2016: 66). Clearly, Transnet could not afford a pipeline break, as a result, there was an urgent need to build a second tunnel next to the current tunnel.

Minnie (2016: 7) detailed the primary purpose of the civil construction of an additional tunnel was to mitigate the operational risk posed by the current single line tunnel, thereby protecting Transnet's revenue. This should provide alternatives to transport coal and further provide ease of maintenance to reduce the operational downtime during such an event.

2.3.3.2 Overvaal Tunnel's Link to Transnet strategic objectives

The Overvaal tunnel project is at the top end of the spectrum as an action to achieve the higher order objectives set out by Transnet. Sihlahla (2015: 14) state that the Overvaal Tunnel helps to achieve strategic objectives by protecting current coal revenue, increasing coal export throughput capacity, creating jobs, enhancing the quality of rail operations, and reducing the effect of maintenance activities on throughput volumes, reducing downtime.

The figure 2.1 Illustrates the key elements of Transnet's strategic objectives.

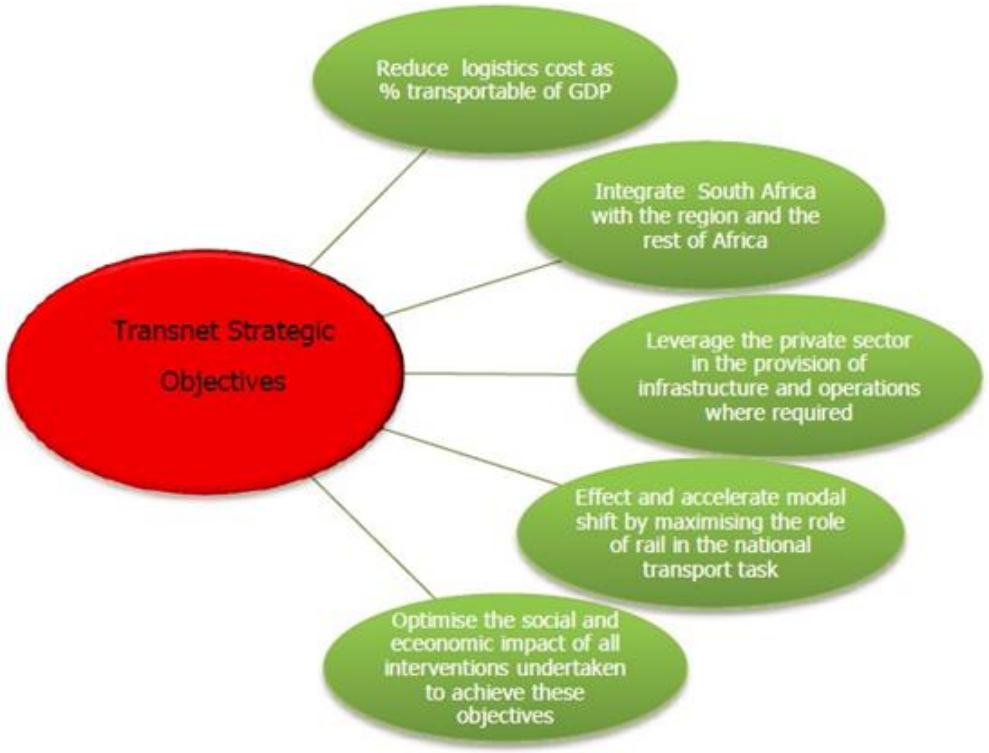


Figure 2.1 Transnet Overvaal Strategic Objectives
Source: Sihlahla (2015: 14)

From the above, the researcher assumes that it is difficult to maintain the current tunnel to the necessary level, given its high rate of train occupancy and the limited capacity to conduct the required major maintenance. As a result, the construction ofa second tunnel next to the current tunnel would minimise the likelihood of a full shutdown if an incident occurs in the tunnel. In addition, the current tunnel would be usable as a backup bypass if the downtime is operational. In addition, the current tunnel will be available as a backup bypass if operating downtime is needed within the new tunnel. In doing so the revenue generated on the coal line will be protected enabling Transnet Freight Rail to sustainably maintain the current throughput (Sihlahla 215: 14).

2.3.3.3 Overview of Project Lifecycle Process

Project Lifecycle Process (PLP) is the technique used for the efficient management of capital investment projects within Transnet to ensure that all projects are handled with a clear approach (Budler and Liphauphau 2011: 13).

The phases of the PLP are conceptual study (FEL-1); pre-feasibility (FEL-2); feasibility (FEL-3); execution (FEL-4); and finalise (Close-out).

Figure 2.2 illustrates the phases of the project lifecycle processes

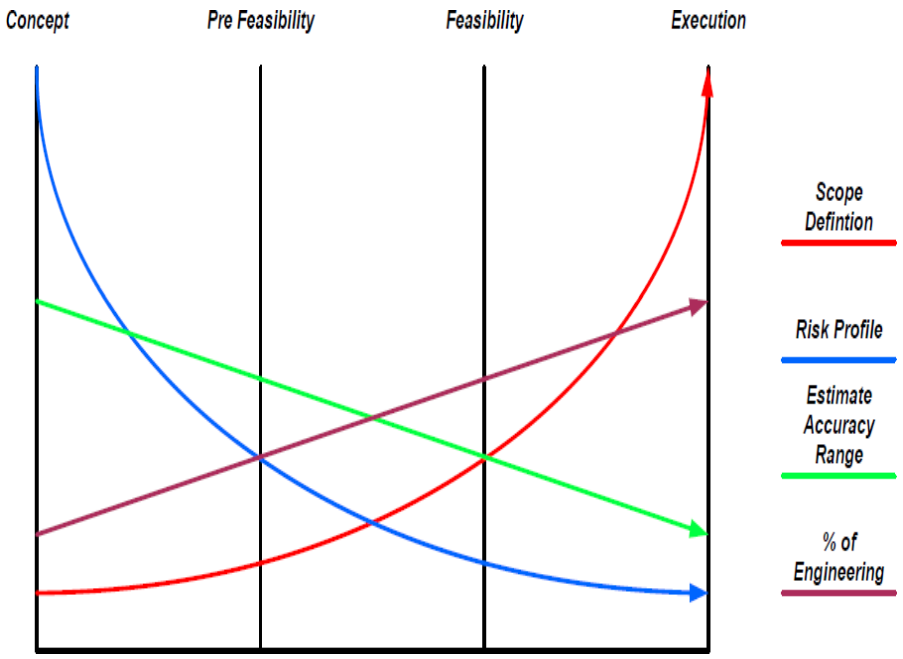


Figure 2.2 Project Lifecycle Process

Source: Dyer and Lesch (2008: 3)

Front End Loading (FEL) is used in the first four PLP phases to minimise risk and increase certainty in line with increasing investment. Front End Loading means that an incremental investment is made as justified by the degree of risk and certainty, rather than by committing significant amounts to an unpredictable investment at the outset.

Murray (2015: 16) defines the PLP phases as the value and opportunity that may be realised by adequately scoping, planning, and ensuring that in the early phases of the project lifecycle scope of the project is clearly defined where there is still possible to influence the effective result of the project.

The stage of the gate review (quality assurance process) is conducted by a designated Transnet team at the end of each phase to ensure each project phase has been done thoroughly before the project can proceed to the next phase (Budler and Liphauphau 2011: 33).

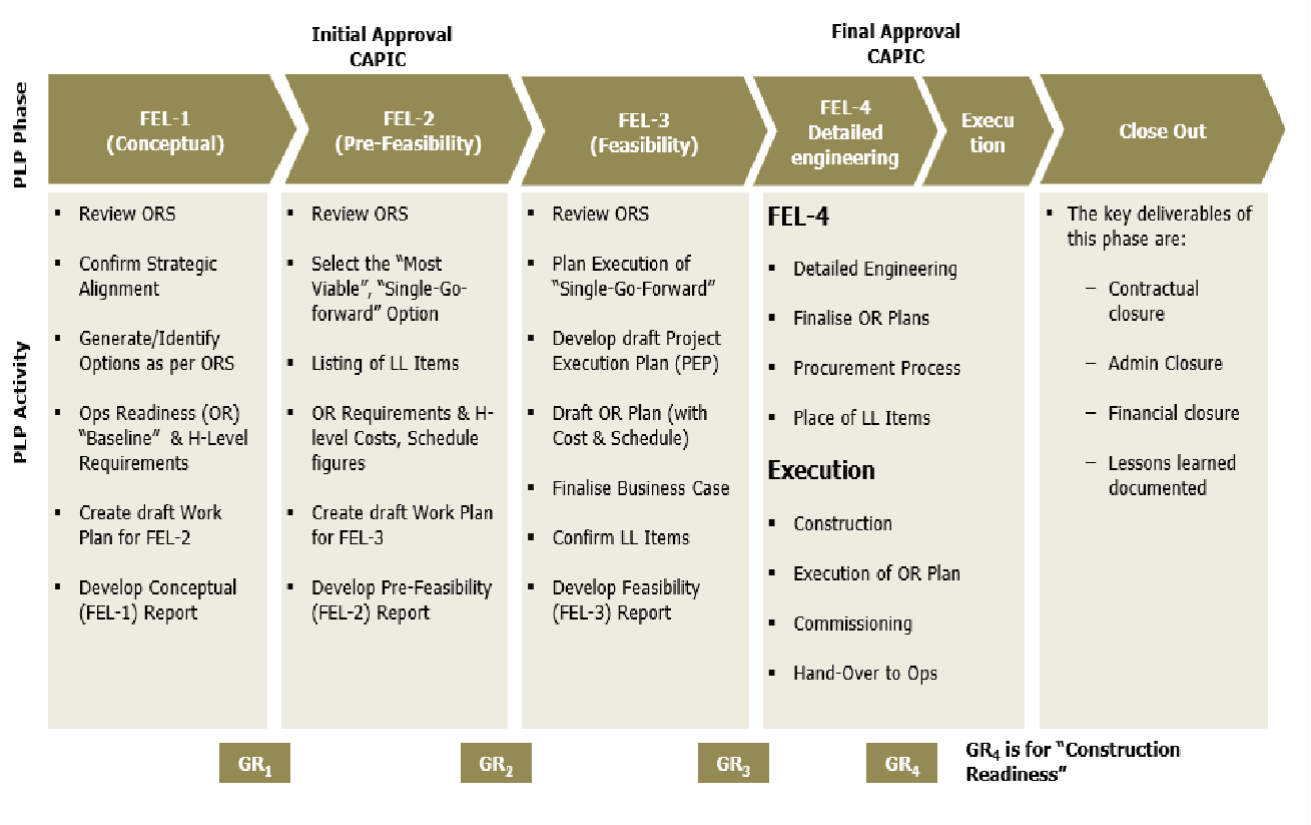
2.3.2.4 Adoption of PLP by Transnet

In the light of the above, the sub-sections below introduce the general concept of project quality management system and project management in the context of TGC. These concepts are reviewed to contextualise the research further. In 2008, Transnet

adopted a PLP methodology for capital investment projects to provide arobust and standardised practice for the effective management of capital investment projects within Transnet. This will result in projects' consistent approach throughout the project lifecycle (Meyer 2017: 409).

According to Murray (2015: 17), PLP value can be realised by scoping, planning, and defining the project at the initial stage of the project lifecycle. At this stage individuals can be easily influenced to meet the successful outcomes of the project. The work of each phase should be done and is assessed throughout stage gate review. Each phase should be given the best attention to ensure that a project proceeds to the next step with minimum quality issues (Schibi and Lee 2015: 30).

The original business case is initiated at the FEL1 conceptual level and is then strengthened and expanded through the FEL 2 phase, then at the final stage of the



FEL 3 feasibility phase, where detailed project knowledge is available. The commercial objectives for the project will be clearly defined in the business case (Transnet Gate Review Training Manual 2016: 18). Figure 2.3 details the process maps of how projects are classified and how the PLP practise is altered according to project type.

Figure 2.3 Project classification, PLP roadmap and Process-steps.

Source: Transnet Gate review Training manual (2016: 7)

Dyer and Lesch (2009: 55) state that the process of gate reviews provides an assurance mechanism for management reviews of critical project outputs at the completion of a FEL phase. The quality of deliverables and comprehensiveness of each FEL phase will be presented in each review report. It confirms commercial, technical, construction and operational viability. The management reviews further make recommendations to Capital Investment Committee (CAPIC). It confirms PLP compliance and technical soundness. It ensures that Transnet's corporate strategy is protected.

Table 2:1 illustrates the gate reviews phases that Transnet conduct throughout the FEL phases (Dyer and Lesch 2009: 57).

Table: 2.1 Gate reviews phases

Gate review phases	Description
Setup gate reviews: Mandatory for all project types	Conducted on request at the beginning of each FEL Phase to prepare and guide the project team in confirming applicable PLP Requirements and setting up a team in keeping with project scope.
Interim gate reviews: Mandatory for E type projects	Conducted prior to the end of phase gate review to confirm that the deliverables decided at the start of the phase were achieved within the approved time frame.
End of phase gate reviews: Mandatory for all project types	Conducted in each FEL Phase to confirm that the plan has satisfied the requirements of the current phase and is viable and ready to progress to the next phase.

Source: Adapted from Dyer and Lesch (2009: 57).

The PLP is the approach adopted by Transnet to execute its capital projects. It requires performing FEL studies at various stages of the project lifecycle to achieve risk reduction. Gate review is conducted in each phase to review the results of the initial plan, confirm compliance, review the feasibility, and give the mandatory authorisation for the project to be evaluated for the next phase. These serves a control that minimize

project risks (Dyer and Lesch 2009: 58). For this to happen, there was need for Transnet to develop or adopt set NEC Engineering and Construction Contract performance oriented legal standard as detailed in 2.3.2.5.

2.3.2.5 Application of the NEC Engineering and Construction Contract.

The third edition of the NEC Engineering and Construction Contract (NEC3) was accepted as a contract of choice by the South African Government. (The Society of Construction Laws, 2002: 53).

Williamson (2012: 15) state that the New Engineering Contract (NEC) is a family of contracts that promotes the application of complete project management principles and practices as well as the concept of authorised relationships. Laryea (2016: 4) mentioned that NEC3 is appropriate for the procurement of a wide variety of works, and the acquisition of supplies and products.

Table: 2.2 List the nineteen types of compensation events as interpreted in the NEC3 (Clause 60.1).

Table: 2.2 The nineteen types of compensation events in the NEC3

No:	**Compensation events in clause 60 of NEC**
1.	Changes to Works Information
2.	Denial of access to Site
3.	Failure to Provide Information by a specified date
4.	An Instruction to stop or not start work
5.	Failure to work within agreed timelines and conditions
6.	Failure to reply to a communication from the contractor within the period required by the contract
7.	Instruction for dealing with objects of value and historical interest found on the site
8.	Changes to a decision previously communicated to the contractor
9.	Withholding an acceptance for a reason other than one stated in the contract
10.	Instruction to search for a defect that is not found
11.	Tests or inspections causing unnecessary delay
12.	Encountering physical conditions which would not have been reasonable to allow for in the contract
13.	Weather conditions not usually encountered annually
14.	Events stated in the contract as employer's risk
15.	Certification of takeover of a part of the works before completion and the completion date
16.	Failure to provide materials, facilities, and samples for tests and inspections
17.	Correction to an assumption stated earlier about a compensation event
18.	Breach of contract by employer which is not covered by events listed here

19.	An event which stops the contractor from completing the works and which neither party could prevent, which an experienced contractor could not have judged at contract date, and other events not listed as compensation events in clause 60.1

Source: Adapted from Jenkinson (2013: 139)

It is imperative to note that Transnet used the NEC3 as a standard to ensure that civil engineering projects adhere to. These quality-oriented standards are put in place so that project managers are issued with certificate of completion at the end of agreed defects liability period. As such, this process forces project managers to ensure high quality project management systems. Only then are they issued with a final payment.

2.4 Brief History of Project Quality Management (PQM)

In the year 500-1500 the era of craftsmanship were skilled craftsmen created a wide range of metal, steel and leather this was produce through quality principles. (Evans and Lindsay, 2008: 5). According to Juran (1995: 26), China's history of quality can be traced back to more than 200 BCE and during the Zhou Dynasty, China developed quality control in its handicrafts between 1100 and 250 BCE. There was mainly ceremonial artefacts production (Rumane 2011: 8). In all the studies mentioned that were conducted it was noted that only skilled workers were assigned to ensure quality of the product is achieved and specialised inspectors conducted audits in a factory system, before the industrial revolution (Corbett and Rastrick 2000: 14). Rumane (2011: 3) mention that the industrial revolution there was a complete change in the manufacturing approach. Furthermore, Taylor (1911: 17) introduced Fredrick Taylor's system of scientific management in the manufacturing sector withan objective to increase production.

In 1930 systemic approach was introduced in industrial production, were attention was paid to the cost of scrap and the effect of mass production (Susilo 2009: 13). Mark (2016: 2) confirms that quality control was a key input in the construction process of the Great Pyramid of Giza. Steyn (2019: 27) states that the project management structure in the 1950s was predominantly concerned with processes that were aligned quality management avoid errors and failures. In order to address the decrease in efficiency, factory managers implemented quality control principles. (Dent and Bozeman 2014: 145). Rumane (2011: 49) mentioned that quality has beenof great concern throughout human history. The demand for goods that perform well or better

than the needs and expectations of the consumer has always been a constant in human history (Rumane 2011: 8).

The above view clearly depict that projects always demonstrate activities that involve different stakeholders. Dale *et al.* (2016: 272) maintain that to achieve effective communication with top management, it is important to integrate quality processes into each project. This can be achieved by being familiar with and using different quality tools and techniques for each project (Kull and Walker 2010: 226). Further Abdullah (2012: 6) noted that when time has been allocated for proper planning, it is important to develop good project metrics and to recognise the principle of variation that significantly improves the effectiveness of management projects.

2.5 Project management overview

2.5.1 What is a project?

According to Cartlidge (2015: 3), a project has distinctive characteristics that differentiate it from ongoing work or business activities because it is of a temporary nature with a set start date and end date. Meredith et al. (2017: 3) describe this as a significant function, as a large part of the project effort is committed to ensuring that the project is finished at the appointed time. Pinto (2019: 4) notes that the timeous completion of a project can only be achieved after detailed schedules, indicating when tasks should begin, and end are created.

2.5.2 Project characteristics

According to Project Management Body of Knowledge PMBOK® Guide (2017: 5) project characteristics remain being the start and the finishing point of the project which end with a unique product outcome. The unique requirements that have been established to ensure project success has evolved along with the development of research (Nixon *et al*., 2012: 205). A project is efficient if it overcomes several constraints such as time, expense, quality, scope, resources and risks (Schwalbe 2013: 7). In view of the foregoing, an organisation must select a project using strategically agreed mechanisms, taking the aforementioned variables in to consideration.

2.5.3 Project selection

Literature acknowledges that project prioritisation and selection is a key ingredient for effective QMS implementation and expected organisational sustainable outcomes or impact. Pande et al., (2000: 17); Bañuelas and Antony, (2002: 4) point out that a structured approach for project selection, prioritisation and project monitoring is required. Dedicated management is needed to set the pace for process improvement projects. Project selection is a vital phase in the project management cycle. In this phase, stakeholders evaluate each project idea and select projects of highest priority (Kibe and Wanyoike 2016: 270). According to Darwish and Cadorin (2014: 55), an effective project selection process should lead to greater satisfaction of all stakeholders, especially the end-users of the products derived from the project. This is also centred on the competences and capabilities of the organisation's human capital. This aspect is briefly discussed in subsection 2.5.4., below.

2.5.4 Culture, skills, and capabilities

Each project needs an efficient and sustainable investment into human capital. Over the years, TGC has been operating in the space of infrastructure management for the organisation. According to Ireland (2014: 69), people management entails more than just employees carrying out their activities on a daily basis. It is the entirety of behaviour that clearly describes what needs to be achieved, how it should be done, when it needs to be done, and the standards required in the final product or service. The most productive outcome in a project is achieved through organisational capabilities, high skills, and a strong culture (Wroblewski 2020: 3).

Yesil and Kayab (2013: 428) discuss that among the factors that affect organisational performance, one of the factors is the organisational culture. Several studies (Cameron and Quinn (2006: 2); Duke II & Edet (2012: 69); Fekete (2011: 6); Zheng et al., (2010: 8) confirm that culture can build obstacles to achieving the results needed to stay competitive and can hamper the organisation's or project strategy. Suda (2007: 4) states that project leaders who lack cultural knowledge may be limited by the values and beliefs of the common culture of the organisation.

2.5.5 Project management

Fossum *et al.* (2019: 129) note that project management (PM) literature on global

projects (GP) focuses on background and on how global organisations can achieve their projects' objectives. Several authors such as Aaltonen and Sivonen (2009: 138); Aarseth *et al.*, (2011: 330); Lind and Brunes (2015: 557); Orr *et al*., (2011: 30); Ainamo *et al.,* (2010: 345); Tang and Shen, (2013: 323) addressed cost overruns, delayed deliverables and low stakeholder satisfaction challenges within the project's execution environment.

Ebbesen and Hope (2013: 1) mentioned that the implementation of structured project management discipline sets out metrics for assessing project performance, such as the well-known Iron Triangle, which positions expense, time, and quality at the core of project success. Pollack *et al.* (2018: 527) define it as the Triple Constraint or the Project Management Triangle, which tests the performance of the project. Berssaneti and Carvalho (2015: 640) states that the maturity of project management is related to the Iron Triangle. Weaver (2012: 42) explains that the Iron Triangle shows how three factors can be linked in project management and if two of these factors on the triangle change, the third point is affected. A change in two of the three factors will result in a compromise in the third, which is better described by Barborka (2018: 4)as per the following equations:

i. Faster time + increased quality = higher cost
ii. Faster time + lower cost = lower quality
iii. Higher quality + lower cost = slower time

Figure 2.4. Presents a version of the Iron Triangle as depicted by Dhillon (2018: 3), illustrating that if the Iron Triangle is broken by making a change to one restriction (cost, time and scope), the other two must be changed accordingly, otherwise quality will be impacted.

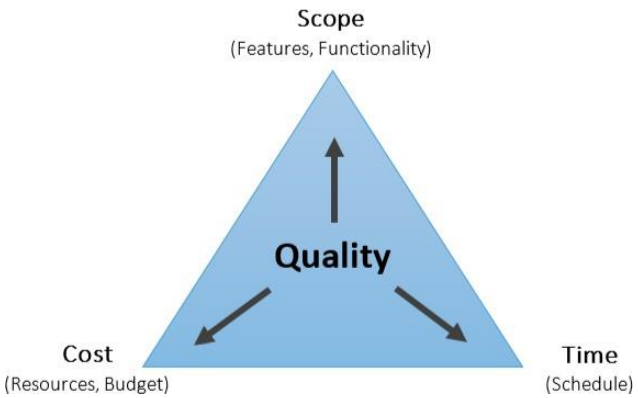


Figure 2.4 Iron Triangle

Source: Dhillon (2018: 3)

The Iron Triangle has become the prototype for routine evaluation of project results (Pinto 2010: 35). Project failure in one constraint is most likely to result in negative pressure on one or both of the other two (Mokoena *et al.*, 2013: 814). Most importantly, when the Iron Triangle is misunderstood or misinterpreted it can lead to project failure regardless of the effective management of all other aspects of a project (Mokoena *et al.*, 2013: 813).

2.6 Project strategic alignment

According to Shenhar et. al. (2007: 34) major challenges arise in the process of aligning project management with the corporate plan as the strategic priorities differ over time. Project managers become successful when they grasp the corporate plan and are aligned with the organisational goals (Kloppenburg and Petrick 2002: 28).

Miller (2002: 360) and Eriksson (2013: 337) note that several large projects are executed with no strong links to the business strategy. Dash (2016: 4) points out that this leads to poor organisational efficiency, resulting in several projects being wasted, citing on average that only fifty six percent of the strategic measures implemented by the organisations are successful. The strategic alignment of Nicholas and Steyn (2019: 1300) with the implementation of the business strategy set out in Figure 2.7 below clarifies the relation between vision, purpose and strategic goals and objectives.

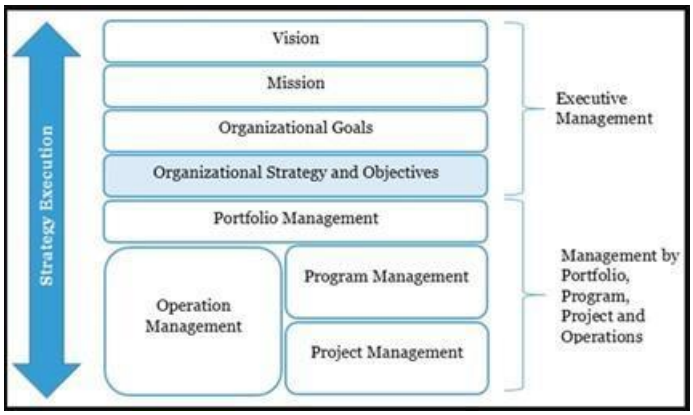


Figure 2.7 Business strategy and strategic alignment of projects.
Source: Nicholas and Steyn (2019: 1300)

Organisational strategic planning recognises the purpose and goal of the organisation and sets out priorities, plans and objectives to achieve the vision (Nicholas and Steyn

2019: 1300). The researcher believes that the first four layersset the goal for the organisation and the organisational strategy. Objectives act as a focal point for linking what is being done by senior management and what needs tobe done by the project.

The importance and production potential of the organisation is achieved through the strategic goals and objectives that form the bottom layers of the planned projects and programmes of the organisation. (Nicholas and Steyn 2019: 1300). The researcher interprets the operations management phase to be the post project implementation phase that operationalises projects to use organisational resources to create value.

2.6.1 The benefits of strategic alignment of projects

Easton (2018: 5) point out that strategic alignment is not a return on investment, and it is not net present value. The writer further emphasise that organisations should align their projects to strategy. Buss (2018: 5) states that the effect of inferior quality on construction is not just a financial expense to the industry, as there are other detrimental effects that can also have an indirect impact on earnings. Examples are shown in Figure 2.9 below.

Figure 2.8. Impact of poor quality in projects

Source: Buss (2018: 5)

Returning to the central theme of this study, which revolves around compensation events, Netscher (2014: 236) posit that time and saving money in a project are poor excuses since it usually takes the same amount of time to do quality work as it takes

to produce mediocre quality work. The cost of completing inferior quality work is usually the same as doing the work correctly. However, that is where the similarity stops as the consequences of poor-quality work can be dire, as explained by Ellis (2020: 7) below:

i. Cost: inferior quality would result in an increase in the overall cost of the project due to rework;
ii. Programme: if rework is needed, decreased quality would have a significanteffect on the programme,
iii. Health & Safety: inferior quality and poor health and safety are correlated because the safety incident is the result of a quality issue;
iv. Environment: the needs to substitute materials may also result in poor quality.
v. Reputation: inferior quality can affect the customer's reputation;
vi. Management time: resolving non-compliance can be highly time-consuming for managers; and
vii. Pride and morale: it can be highly demoralizing to see work being destroyed by a lack of care and security or demolished because the design was incorrect.

The researcher surmises that cost, although a critical element, is only one aspect to the consequences of compensation events and notes that there are other far reaching implications as well.

2.7 Project Quality Management (PQM)

2.7.1 Overview of PQM

In the field of project management, PLP is categorised into the four basic phases which are initiation, planning, execution, and closure (Schibi and Lee 2015: 65). According to Lester (2017: 46), project status information is part of a PQM process, from the first phase to the closure. Soetanto and Ganjian (2010: 10) mention that project requirements are documented at the initial phase of a project to provide direction to construction managers that provides for effective management of requirements to meet project deliverables (Schibi and Lee 2015: 77).

The project manager must document all the requirements in starting the project, organising its processes, preparing it, and involve the stakeholders until the end of the project (Bartlett 2017: 34). Project management will only be successful if the cost and time of the project are reduced that will result in project quality improvement (Hajiagha et al. 2015: 33). Gadner (2015: 39) explains that many projects fail because of the client embarking on the project without considering the implications.

PMBOK® Guide (2017: 23) has included PQM Figure 2.5 as one of the ten knowledge areas which focusses on the following three processes:

i. Plan quality management: It is the process that defines the qualityrequirements and standards for the project and its deliverables, and to document how the project can demonstrate compliance with quality requirements and standards.

ii. Manage quality (assurance): It is the process of transforming the quality management strategy into executable quality activities that integrate the quality policies of the company into the project; and

iii. Control quality: It is the process of monitoring and recording the results of the execution of quality control activities is designed to assess performance and ensure that project outcomes are complete, correct and meet customer expectations.

The processes mentioned in the PMBOK® Guide (2017: 272) are useful and generally applicable to all projects.

2.7.2 Summary of project quality management

The summary of project quality management illustrated in Figure 2.5.

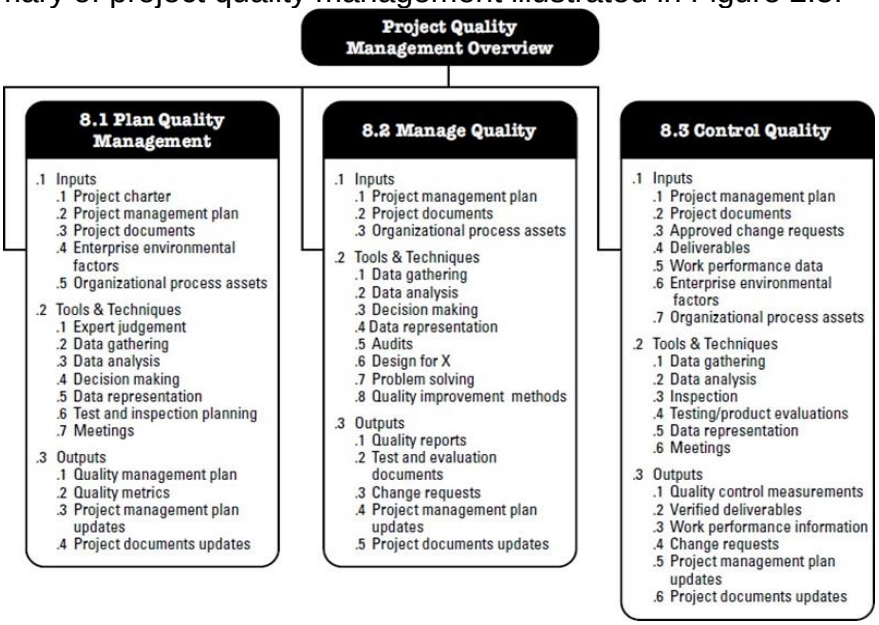


Figure 2.5 Summary of project quality management
Source: PMBOK® Guide (2017: 272)

The PMI (2013: 13) states that quality assurance (QA) is seen as a systematic programme that involves the development, organisation and quality control of inputs, tools and techniques and performance parameters. This is like quality planning, quality assurance (QA) and quality control (QC) under the Plan-Do-Check-Act cycle, where QA is defined as Do' and QC as 'Check-Act' elements (Demin 2000: 44).

The three elements (quality planning, quality assurance and quality control) have been considered and outlined in a more comprehensive context, as shown in Figure 2.6.

Figure 2.6. Framework of PQM

Source: Nicholas and Steyn (2019: 1300).

Quality Control (QC) is the method of confirming that quality assurance is compatible with the plan and in Figure 2.6., QC manages project quality preparation and QA to demonstrate this relationship. Nicholas and Steyn (2019: 1302) state that quality planning should include decisions regarding actions required to meet quality requirements and the planned quality actions often entail the use of specific QA and QC techniques. Nicholas and Steyn (2019: 1302) states that when there is development of a new systems for a specific project, project quality planning involve:

i. Requirements to be met as set out in the agreed criteria and requirements, including benchmarking against other projects;
ii. Actions required in the overall project plan to meet the required requirements and expectations, including tools and techniques to be used in QA and QC; and
iii. Metrics to be used to determine whether the specifications and standards have been achieved.

The researcher finds Nicholas and Steyn's (2019: 1300) framework to be informative especially considering Stevenson's (2017: 568) view that quality assurance is less understood in project management. In quality assurance the emphasis is that the quality of all items and services should be controlled at all points necessary to assure conformance with the requirements of a quality assurance manual. Measures should include requirements to ensure that acceptable quality levels are defined and included in these design documents. The detailed project programme should recognise the need for special controls, systems, test equipment, instruments and expertise to achieve the quality needed and the need for quality verification through inspection and testing (Stevenson 2017: 572).

According Ruessmann *et al.* (2020: 18), monitoring and quality control in the project ensures that all project operations fall within the framework of initial project planning and progress as per baseline projections and specifications. Patel and Jain (2012: 7) mention that to perform quality control, various tools and techniques are available. These are detailed in in Table 2.3.

Table 2.3 Quality control tools

Collecting project data	
Check Sheet	- Use to collect and archive data from observations or historical data.
Understanding data of the project	
Graphs	- Graphs are used to organise, summarise, and view data, usually over time.
Histograms	- It is a type of bar graph that deals with data that occur in a continuous range from low to high numbers. It shows the frequency distribution of the range of data.
Pareto charts	- It is used to classify the greatest potential for change and the small number of most influential or critical causes among a number of possible sources of error.
Scatter diagram	- Identifies possible relationships between two variables to explain the relationship between data components.
Understanding the structures of projects	
Flowchart	- It identifies the sequence of events in a process.
Run chart	- It is used to observe the output of the process over time.
Control chart	- It is used to track, monitor, and enhance processes over time. It is used to evaluate repeatable processes in which outcomes are supposed to be constant over time.
Evaluation of project processes	
Cause and effect diagrams	- It is used to define, explore, and demonstrate all possible causes of the issue and its root causes. It's also called a fishbone diagram.
Pillar charts	- These are cause and effect diagrams that are used to evaluate a problem and to define possible causes.
Problem solving project	
Force field analysis	- Identify and recognise the factors that drive change within an organisation. This includes forces that support or allow change and those that impede or limit change.
Brainstorming	- It is a practice that allows one to produce a high volume of ideas creatively and effectively, free from criticism and other negative factors.
Affinity diagrams	- It is used to organise and outline problems or proposals typically generated from brainstorming.

Source: Adapted from Patel and Jain (2012: 7)

The primary objective of each of these tools is to analyse the product, service, or outcome, as well as the project processes for compliance with quantitative standards. (McClintock 2016: 2). It provides the means of gathering data, analysing data, determining root causes, and evaluating outcomes. This make it easier to identify, implement and track areas of improvement (Varsha *et al.* (2014: 364).

Kloppenburg (2014: 296) clarifies that to understand how to achieve quality in a project, it is important to understand the four principles of quality in the contemporary core project as shown in Table 2.4

Kloppenburg (2014: 296) mentioned that the core project quality concepts set out the specifications and criteria to ensure that the requirements are met. It enhances project processes by implementing a model based on the plan-do-check-act definition. The definition carefully gathers data and uses appropriate analytical methods to provide valuable information to promote honest, open, and difficult communication when making decisions. All these concepts are implemented to mitigate project risk Fonseca (2018: 42).

Table: 2.4 Core project quality concepts

Engagement - Develop stakeholders matrix and classify and rate	**Process management** - Certify that the project processes are capable and flexible.
Empowered performance - Develop performance matrix and aligned it to the objectives.	**Fact-based management** - Ensure everyone understands and accepts their responsibilities and are ready to share lessons learned and other information as widely as possible.

Source: Kloppenburg (2014: 296).

Kloppenburg (2014: 296) mentioned that the core project quality concepts set out the specifications and criteria to ensure that the requirements are met. It enhances project processes by implementing a model based on the plan-do-check-act definition. The definition carefully gathers data and uses appropriate analytical methods to provide valuable information to promote honest, open, and difficult communication when

making decisions. All these concepts are implemented to mitigate project risk Fonseca (2018: 42).

2.8 Quality management system

Quality management programmes provide common procedures and standards for the development of an appropriate practice for quality management that contribute to project success (Aized 2012: 53 and Dentch 2016: 12). Willar, Coffey and Trigunarsyah (2010: 2) state that the presence of QMS documents such as quality plans, procedures and work instructions does not inherently comply with the core operating practices and processes necessary to achieve and exceed customer satisfaction. Construction industry research has shown that the use of QMS principles has a profound impact on the cost effectiveness of construction projects and good project efficiency. McCornac (2006: 79); Tricker (2008: 44); Fotopoulos, Psomas and Vouzas (2010: 510); Wahid, Corner and Tan (2011: 745). This can be accomplished by applying different procedures and concepts of quality, such as work procedures and work plans, to manage the project during each activity and to improve the management and preparation of the construction project (Ogland 2017: 7).

The most influential approach to quality management systems is the international standard, ISO 9001:2015, by defining specifications for quality management systems. The standard will enhance the effectiveness of organisational processes through generic guidance and documentation and continuous improvement through the Plan-Do-Check-Act (PDCA) approach to meet customer satisfaction and quality objectives successfully. (Watson and Howarth 2011: 9).

All quality management efforts, including those following and in compliance with the ISO 9001 QMS standard, include an emphasis on risk management andthe PDCA cycle for continuous improvement. Figure 2.9 details the process of PDCA methodology that can enable the organisation to determine the factors that cause deviations and put in place preventive controls to minimise negative effects that can maximise the opportunities.

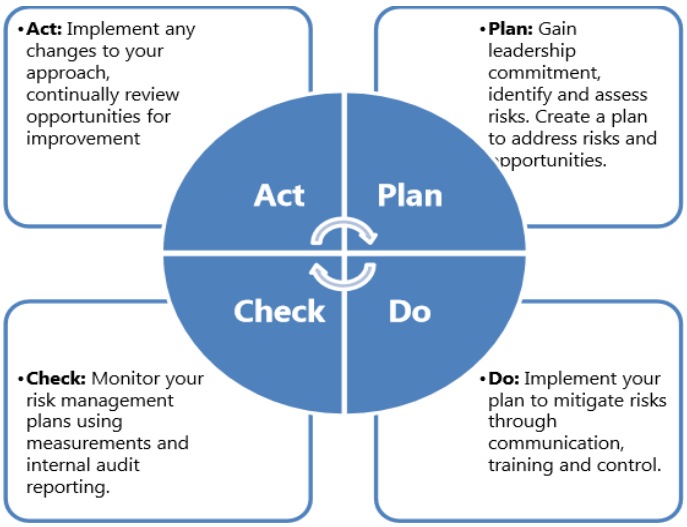


Figure: 2.9 Risk management through the Plan-Do-Check-Act (PDCA)Source: Keen (2019: 4)

The digitalisation of quality management systems and enforcement are paramount in this industrial revolution. It focuses not solely on technology itself, but also on enhancing the culture, teamwork, competence, and leadership that technology makes possible (Evolution et al. 2017: 28). Fenton (2019: 4) states that each aspect of a quality management system helps to accomplish the overall objectives of fulfilling the expectations of the customers and the organisation. Although quality management systems should meet the specific needs of an organisation, the common elements of all such systems include commoncomponents as listed below:

i. The organisation's quality policy and quality objectives;
ii. Quality manual;
iii. Procedures, instructions, and records;
iv. Data management;
v. Internal processes;
vi. Customer satisfaction from product quality;
vii. Improvement opportunities; and
viii. Quality analysis

The ISO 9001 standard, the product of the TC 1766 Technical Committee, was first published in 1987 (Aba *et al.* 2016: 77). As specified by the revised ISO 9001:2015, the standard is based on seven principles. These are customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision-making, and relationship management as per the Figure 2.9.

Figure: 2.10 Quality Management System Principles

Source: ISO 9000 (2015: 14)

2.13.2 ISO 9001:2015 revision and focus

The ISO/IEC Guide 2 2004 standard is a document drawn up by consensus and accepted by competent authorities (Eto *et al.* 2010: 25). The ISO 9001 standard addresses the specifications of a quality management system that is part of the certification of the quality management system (Aba et al. 2016: 44).

According to Ross (2015: 18), the revision of the ISO 9001 standards seeks to incorporate risk-based thinking into the overall quality management system and thereby provide a secure basis for the future. In addition, multiple new and current risks that impact the company and impair efficiency are required to be considered by organisations (Ross 2015: 19).

Table 2.12 illustrates that ISO 9001 has been updated several times since its first publication in 1987 to remain relevant and in line with the business needs of companies. In September 2015, a new revision of the standard was released, replacing the previous edition published in 2008. Wilson and Campbell (2018: 2) notethat the reforms implemented in ISO 9001:2015 influence key areas of the QMS of businesses, with over 1.2 million companies accredited around the world. The detailed history of Standards is elucidated in Table 2.7.

Table: 2.5 History of ISO 9001

Standard	Description
ISO 9001:1987	It had tight framework with twenty specifications, but it concentrated on conforming to procedures and somewhat missed the big picture of producing a high-quality process (Psomas and Fotopoulos 2009: 129).
ISO 9001:1994	It had issues related to compliance. This meant that companies suffered under the burden of laws and regulations, compiling heavy manuals that often suppressed the process rather than supporting it. (Lee et al., 2011: 170; Zeng, Tian, & Shi, 2005: 398).
ISO 9001:2000	This standard had a major change since the implementation of ISO 9001. I minimise the paperwork and provided a structure on the QMS manuals and relevant documents. The focus was that was about developing a quality management system through process performance steps (Moriones *et al.* 2011: 34).
ISO 9001:2008	This standard had a minor change since which sought to make clearer the requirements of the last ISO and to improve the way it aligned with other standards, such as the ISO 14001 (Prajogo 2008:605; Psomas *et al*. 2011: 438).
ISO 9001:2015	This revised standard aimed to incorporate risk-based thinking into the overall quality management process and expect organisations to consider the various new and emerging risks that impact theorganisation and the quality of the management system (Chen *et al.* 2016: 71).

Source: Compiled by researcher

According to Hinsch (2019: 6) ISO 9001:2015 needs a systematic way of defining business operating threats, such as operational risks, which have a direct or indirect effect on the objectives of the organisation.

2.9 Total Quality Management (TQM) in the project environment

In the view of the foregoing section (2.8), it is critical to note that project environment or Engineering Procurement Construction and Manufacturing (EPCM) organisations face a unique competitive environment, where each needs to maintain compliance within thin operating margins while at the same time delivering fit for purpose products

to their clients (Aecom 2013: 13). Rumane (2011: 8) states that the emphasis on quality for building projects and manufacturing or servicesectors varies because the product is not repetitive, but a unique piece of work with specific specifications. The quality of the construction projects depends primarily on the supervision of the construction, which is the primary responsibility of the contractor (Watson and Howarth 2011: 26). According to Alias *et al.* (2014: 4) construction industry focuses more on management control as well as project schedules, consequently avoiding quality management. Mane and Patil (2015: 127) emphasised that more attention should be paid towards quality.

Dale (2003: 497) explains that the TQM theory means that the consistency of production of each department and the standardisation of works and constant attempts to develop them are also part of the philosophy. In some organisations, the elements of TQM are so important that many organisations use them as a collection of core values and principles on which the organisations work (Westcott 2013: 312). The methods for implementing this approach come from the teachings of quality gurus (Westcott (2013: 315). Table 2.8 provides a summary of how to implement the TQM elements (Aized 2012: 219).

Table 2.6. Summary of TQM elements.

Elements	**Discussion**
Customer-focused	In the end, the consumer decides the quality standard. No matter what a company does to encourage quality enhancement in the training of its staff, to incorporate quality into the design process, or to update computers or software, the customer decides if the initiative was worthwhile.
Total employee involvement	Employees are interested in working towards shared objectives and employee engagement can only be made when fear has been driven from the workplace, when empowerment has taken place, and when management has created the right atmosphere. High-performance work processes combine quality improvement activities with regular business operations.
Process-cantered	The emphasis on process where internal or external
	inputs turns them into outputs.

Integrated system	System integration is the process of connecting separate subsystems to a single larger system that operates as a single system.
Strategic and systematicapproach	A critical part of the management of quality is the strategic and systematic approach to achieving an organisation's vision, mission, and goals. This process, called strategic planning or strategic management, includes the formulation of a strategic plan that integrates quality as a core component.
Continual improvement	Continuous change forces a company to be both analytical and innovative in seeking ways to become more efficient and more successful in fulfilling the needs of stakeholders.
Fact-based decision making	TQM allows an organisation to constantly collect and analyze data to enhance decision-making accuracy, reach consensus and allow for past history-based predictions.

Source: adapted from Aized (2012: 219)

Bernal et al. (2015: 23) give the summary of evidence that demonstrate that TQM improves organisational performance. Nicholas (2014: 12) discusses various aspects that have been identified for successful implementation of TQM which are understanding quality, TQM guidelines, approaches, and implementation plan. Bernal et al. (2015: 24) states that these improvements benefit the shareholders, employees, customers, and society. In the progression of quality, Figure 2.10 indicate levels in a hierarchical progression of quality management.

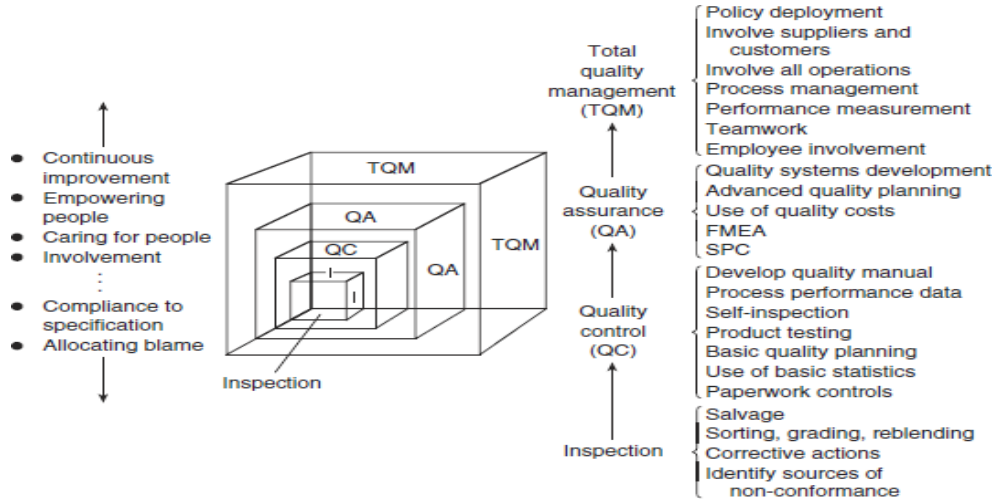


Figure: 2.11 The four levels in the evolution of TQM

Source: Dale, Bamford and Wiele (2016: 16)

Dale, Bamford and Wiele (2016: 4) define TQM as the collective cooperation of everyone in an organisation and related business processes to create demand that meet and exceed the needs and expectations of customers through the following process:

i. Inspections: conformity determination by observation and judgment, followed, as required, by calculation, testing or calibration;
ii. Quality control: part of quality management based on meeting quality requirements; and
iii. Quality assurance: is part of quality management focused on having confidence that quality criteria will be met.

Llusar (2008: 23) states that TQM has developed and acquired many other ideas, making it a full theory of quality management. Total quality Management, along with lean production and Just in Time (JIT) will bring major changes to the business while at the same time reducing costs and generating more value. (Merih 2016: 9). This will work well if there is dedication, support, and commitment from the senior management as well as good understanding of concepts from the employees.

2.10 Project outcomes

According to Davies (2002: 185) differences between project performance measured against the overall project goals and project management performance is measured against the widespread indicators which cost, time and quality.

It has been pointed out that many companies are starting to define project performance in a holistic way (Nogeste and Walker 2005: 55). The traditional project management theory points out the success project outputs through Iron Triangle project monitoring (PMBOK® Guide 2017: 17).

The PMI defines project objectives, outcomes and outputs as follows:

i. Project objectives are considered as measurable criteria that must be met fora project to be considered successful (PMBOK® Guide 2017: 56);

ii. Project outcomes are either tangible or intangible, a new building is an example of this type tangible outcomes and intangible outcomes such as people who can effectively apply knowledge after their training (PMBOK® Guide 2017: 47);
iii. Project outcomes are any measurable, tangible, verifiable product, outcome, or object that must be generated in order to complete a project (PMBOK® Guide 2017: 200).

2.11 Compensation event in NEC contracts

In view of the foregoing, project management teams should find ways to effectively handle complexity to deliver the project's expected outcomes (Moazzami et al. 2011: 2553). Laryea (2016: 2) states that compensation events can have a significant impact to the objective of the project. This can be achieved by implementing the NEC3, unfortunately, there has been little systematic research on the frequency of NEC compensation in projects to monitor and mitigate their effects. However not all compensation events are triggered by the contractor or the project team, as these can be due to environmental conditions or site conditions (Williamson 2012: 15). Ennis (2010: 19) demonstrated that one of the fields where disagreements appear to occur is during claims and during the determination of compensation events.

It critical to note that attaining project outcome strongly depends on the existence of functional project quality management systems and risk mitigation strategies. These must run throughout the project cycle.

2.12 Project risk

2.12.1 Purpose of Project Risk Management

The purpose of risk management is to identify risk, likelihood of its occurrence and severity of its impact if it occurs (Rezakhani 2012: 27). The failure mode and effect analysis methodologies are an example of a close partnership between project risk management techniques and project quality management techniques (Nieto *et al.* 2011: 223). Cawood (2014: 13) states that many capital projects are often overrun in terms of time, cost and degraded project quality. The identification of project risk is critical to the success of project delivery (PMBOK® Guide 2017: 271). According to Koirala (2012: 10), risk management is a scientific approach to detecting, predicting, and mitigating potential adverse impacts on programmes. Both risk categories and risk

breakdown structure are used to structure defined building risk factors (Marzouk, Kherbawy and Khalifa 2013: 9).

2.12.2 Reasons for failure

According Georgiou (2010: 371), defects or faulty work occur when the quality and quality of the workmanship and materials as stated within the contract are deficient. Discenza and Forman (2007: 23) note that various organisations are handling functional projects differently and while others may have wide aggregations of project management practitioners in an exceedingly centralised support organisation. Most of the projects fail when the manager neglects, the two important risks, which are white space risk and the integration risk (Matta & Ashkenas 2010: 112). White space risk is experienced when some required project activities are not identified before the beginning of the project. These permit gaps within the project plan. Integration risk is that the likelihood that each one the various initiatives will not form a cohesive project outcome. (Matta & Ashkenas 2010: 113).

Antony and Gupta (2018: 357) state that many progressive business enterprises have incorporated various process improvement initiatives like lean, six sigma, lean six sigma (LSS) for tackling process and quality related issues. However, it has been reported that the impact of those process improvement initiatives on business performance are skewed towards either untimed termination or ultimate failure. Antony and Gupta (2018:368) perceive that there is an inventory of top ten reasons, as depicted in Table 2.5 that are frequently cited by researchers and well stated by practitioners. These must be considered when deliberating on project failure risk mitigation strategies.

Table: 2.7 Top ten reasons for process improvement project failures

Reasons for process improvement project failures	Descriptions
1. Lack of commitment and support from top management	The temporary nature of projects makes it essential to own full commitment from top management to avoid time and value overrun and meeting the general objectives of the projects (Tzempelikos 2015: 34).

2. Poor communication practices	Communication has been perceived as one of the most crucial catalysts to drive change managementprocess in a process improvement project with thecomplexity of communication practices arising from many reasons, such as semantics, power politics and organisational and technological issues (Gillard: 2005: 13; Neill and Jiang 2017: 77).
3. Incompetent team	As a process improvement team is generally multifunctional in nature, in a team, members' skills should complement one another and must demonstrate unity in diversity (Mathieu et al. 2014: 45).
4. Inadequate training and learning	It is recommended that game-based training method facilitates the training process by increasing users' intrinsic motivation (Venkatesh and Speier 2000: 33) which could be linked with psychological traits of trainees supported learning style theory (Kolb *et al.* 1971: 23).
5. Faulty selection of process improvement methodology and its associated tools/techniques	A business enterprise may commit a mistake in selecting the appropriate tool for identification of bottleneck in its operations or may pick wrong tools in devising the solution. There are many process improvement methodologies. Each methodology is developed to handle a selected variety of operational issue and each has a set of specific tools (Thomas *et al.* 2016: 599).
6. Inappropriate rewards and recognition system/culture	Generally, projects' activities keep employees on their toes due to their time-bound nature. It is advocated to incentivise their efforts by appropriate recognition and rewards (Crawford 2015: 4).
7. Scope creepiness	Although process improvement projects are time-bound in nature, scope creepiness is one of the common factors for failure. It is important for the project sponsor to work with the project (Keil *et al.* 1998: 23).

8. Sub-optimal team size and composition	Team size was a key factor to consider during the design and conceptualization of the project. It usually depends on the scale, length, and complexity of the projects. (Lee-Kelley 2002: 23).
9. Inconsistent monitoring and control (lack of expert supervision)	Monitoring and supervision of project management is more critical than any other stream of management science. Many projects fail either because of the ad hoc arrangement of the process management specialist or because of no arrangement, not only costing millions of dollars due to the failure of the project, but also harm the spirit of continuous improvement or quality culture of the company. (Crawford and Bryce 2003: 45).
10. Resistance to change (partial cooperation by employees)	Organisational transformation efforts influence everyone as they require recognition of a new culture Sufficient evidence exists to support employee engagement and commitment as the key to effective implementation of change management. (Kotter and Schlesinger 1989: 67); Kerber and Buono, 2005: 88).

Source: Compiled by the researcher

Kerzner (2014: 35) states that while the list of reasons why projects fail is quite large, most organisations do not recognise the symptoms of failure or they disregard the symptoms when they do appear. Furthermore, it has been noted that projects can fail in any phase of the project life cycle (Kerzner 2014: 19).

2.13 Chapter summary

Based on the literature review, the researcher summarises that complying with ISO 9001 has been a key organisational focus since the inception of the standard. The compliance strategy must however, be constructive and result-oriented and not limited to the achievement of a credential. Organisations will do well to incorporatethe criteria of the updated standard into their business processes and to regularly follow these requirements in the value chain so that they become part of their day-to- day activities. Organisations can also choose and use different risk mitigation methods and methodologies, record data, analyse performance, maintain a managed quality

environment, conduct impact assessments, and engage individuals. The purpose of quality management is to systematically apply the tools and procedures associated with the processes of quality planning, quality control and quality assurance when developing goods, delivering services, and achieving results.

2.14 Conclusion

The analysis of literature on the effectiveness of project quality management systems in project management has been performed on TransnetGroup Capital case. The analysis of relevant literature and the theoretical structures underpinning the thesis was drawn up in this chapter. It addressed the issues of project quality control, quality assurance and project management. The next chapter will address the data collection process.

Chapter Three
Research Methodology and Design

3.1 Introduction

A summary of the literature relevant to this study was given in the previous chapter. The research design and methodology for this study is discussed in this chapter. It also addresses research objectives and aspects such as sample collection, sample size, questionnaire design, data interpretation, validity, reliability, methods used to validate the report, removal of biases and ethical considerations.

3.2 Research design

According to Creswell (2018: 309), the research design is a plan or strategy that moves from the underlying philosophic assumptions to determine the selection of the data collection techniques to be used and the data analysis to be performed. Leedy and Ormrod (2010: 12) note that the research methodology refers to the general approach of the researcher to the execution of the research project.

3.2.1 Different between Qualitative and Quantitative research designs

The quantitative research deals with quantifying and analysing variables in order to get results. It involves the utilization and analysis of numerical data using specific statistical techniques to answer questions like who, how much, what, where, when, how many, and how. It also describes the methods of explaining an issue or phenomenon through gathering data in numerical form (Creswell, 2016: 200). The illustration in Figure 3.1. quantitative methods have been categorized into experimental (true experiment, quasi-experimental and single subject) and nonexperimental (descriptive, correlational, causal-comparative, and experimental). Furthermore, qualitative research interactive (phenomenological, ethnographic, grounded theory, historical, case study, and action research and noninteractive (concept and historical analysis).

Schmidt and Brown (2009: 159) define qualitative research as the study of things in their natural surroundings with the goal of making sense of or interpreting phenomena in terms of the meaning's individuals assign to them. Qualitative research is employed when little is known about the phenomena, or when the nature, context, and boundaries of the phenomenon are poorly understood and characterized, according to

(Brink, Van der Walt, and Van Rensburg 2012: 120).

The Figure 3.1 below further illustrates the types of research design.

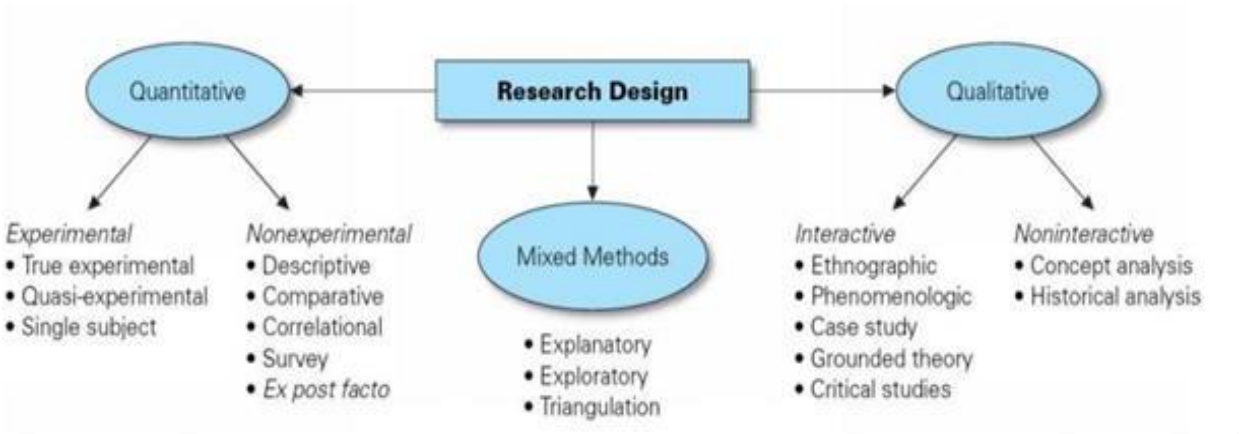


Figure 3.1. Types of research design Source: Adapted from Hassan (2014: 15)

This research study is categorised as quantitative in nature and descriptive research was considered suitable for this study as it describes systematic, accurate facts and characteristics of a given population (Creswell, 2014: 88). Leedy and Ormrod (2010: 94) point out that quantitative analysis requires the analysis of the amounts or quantities of one or more variables of interest. Primary data were collected employing a questionnaire administered to a sample of Transnet Group Capital (TGC) project management team. The secondary data was be obtained from TGC management information systems (Primavera databases) wherein a repository of the required documentation is maintained.

3.2.1.1 Descriptive Research

A descriptive method, according to Schmidt and Brown (2019: 149), presents a picture of a situation as it occurs naturally without the modification of any variables. The objective of a descriptive study, according to Polit and Beck (2014: 160), is to observe, describe, and document features of a scenario. There is no manipulation of variables in a descriptive design. The protection against bias in a descriptive design is achieved through conceptual and operational definitions of variables, sample selection and size, valid and reliable instruments, and data collection procedures that might partially control the environment (Grove et al., 2017: 20).

3.2.1.2 Correlative Research

The correlational research examines relationships and is conducted to develop and refine explanatory knowledge. The explanatory design, is the first type of correlational design it is conducted when researchers want to explore the extents to which two or more variables co-vary, that is, where changes in one variable are reflected in changes in the other (Creswell, 2008: 358).

3.2.1.3 Experimental Research

The researcher explores the treatment of an intervention into the study group and then measures the treatment's outcomes during the experimental research. Pre-experimental, real experimental, and quasi-experimental approaches are the three categories of exploratory approaches (Grove et al., 2017: 34).

3.3 Research methodology

According to Bertram (2010: 139), the research methodology is determined by the nature of the data and the research problem. The research methodology may best be described as a technique used by a researcher to make progress in the study possible. Table 3.1 indicate the difference between the types of designs where fixed designs (quantitative) are normally theory driven and Instrument based questions often, these variables are measured quantitatively. Flexible designs which are qualitative using open-ended questions that allows for more freedom during the data collection process. Lastly mixed method that has both has both open and closed ended questions with qualitative and quantitative approach.

Table: 3.1 Qualitative, quantitative, and mixed data collection methods

Quantitative methods	Qualitative methods	Mixed methods
Pre-set	Developing methods	Both pre-set and Developing methods
Instrument based questions	Open-ended questions	Both open and closed-ended questions
Output data, attitude data, observation andcensus data	Interview data, observation data, document data, and audio-visual data	Multiple forms of data drawing on all possibilities
Statistical analysis	Text and image analysis	Statistical andtextanalysis
Statistical interpretation	Themes, patterns interpretation	Across databases interpretation

Source: Creswell (2009:15)

To address the key research objectives, quantitative method was adopted where a survey was a primary source and document content analysis was the secondary source of data. The primary data was collected by administering questionnaires to a selected sample from the targeted population at Transnet Group Capital. The secondary data was extracted from content analysis of the Primavera project report. Table 3.1indicates the approaches that can be used to carry out a research project.

3.4 Population

The population is made of all the people who are considered for the research(Wegner 2012: 5). This research is based on a population of sixty-five people at Transnet Group Capital, with the focus being on the project management team at TCG (different disciplines) in the Gauteng region. The study population of the research comprises of Transnet Group Capital Project Management team, which include General Managers, Project Directors, Senior Project Managers, Project Managers, Engineering team, Quality Managers, Quantity Surveyors, Quality Officers, Construction Managers and Site Supervisors. The targeted team were involved in both projects that were sampled. The workers classification in terms of positions and numbers as derived from company documents is illustrated in Table 3.2.

Table 3.2 Population

Discipline	**Population**
General Managers	2
Executive Manager	5
Project Directors	3
Senior Project Managers	10
Project Managers	10
Engineering team	13
Quality Managers	5
Quantity Surveyors	2
Quality Officers	5
Construction Managers	6
Site Supervisors	4
Total	**65**

Source: Adapted from Transnet Group Capital Project Organogram

3.5 Sampling method

According to Kumar (2011: 177), sampling is the process of selecting a few subjects from a bigger group to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation, or outcome regarding the bigger group.

3.5.1 Sampling designs

Sekaran (2016: 236) states that the basic types of sampling techniques available are probability sampling where all members of the population have a known chance of being included in the sample. Kumar (2011: 182) also notes that a sample can be considered a random sample if all members of the population has an equal chance of being selected in the sample. This study used simple random sampling from the population sixty-five and with considerable the sample size of fifty-six.

3.5.2 Sampling

The structure of sample frame presented in Table 3.3. The table represents the sampling framework that depicts the population to sample project team for Transnet Group Capital.

Table: 3.3. Sampling framework

Discipline	Population	Sample
General Managers	2	2
Executive Manager	5	5
Project Directors	3	3
Senior Project Managers	10	9
Project Managers	10	8
Engineering team	13	11
Quality Managers	5	4
Quantity Surveyors	2	2
Quality Officers	5	5
Construction Managers	6	4
Site Supervisors	4	3
Total	**65**	**56**

Source: Generated by the researcher

3.5.3 Sample size

The population of this study comprises sixty-five employees of the Transnet Gauteng region, with the sample size being 56 employees selected from the various project management teams. According to Sekaran and Bougie's (2016: 248) population sample table for a population size of sixty-five (65), a sample size of fifty six (56) is considered as being appropriate.

3.5.4 The research instruments

An instrument is defined as something that is used to collect data (Sekaran and Bougie 2016: 192). Bertram & Christiansen, 2014: 72 define questionnaire as a pre- formulated written set of questions to be answered by the respondents usually as closed or open-ended. A formal questionnaire (see attached appendix A) was used by the researchers since it uses closed questions. A closed-ended question is a question format that restricts respondents to the set of responses they must select to answer. An open-ended question gives respondents enough room to be detailed in their answer and articulation of a question (Bertram and Christiansen, 2014:7 9).

The literature was used as a source of knowledge for the formulation of the questionnaire. The questionnaire was a mixture of questions with questions of the dichotomous and Likert scale type and was presented in English. The five-point Likert scale was used because is simple to understand and use for survey administrators and respondents alike. It takes less time and effort to complete than higher-point scales. Dawes (2008:67), state that with a Five - point scale, it is quite simple for the interviewer to read out the complete list of scale descriptors (1 equals strongly disagree, two equals disagree). It also allows for a lower margin of error; any scale without a neutral option can distort results and bring the validity of survey results into question. The questionnaire (Appendix A) was divided into sections. Section A comprised respondents background and section B comprised questions grouped according to the themes of strategic alignment, culture, skills and capabilities, project selection, project outcomes and reasons for failure. The questionnaire comprised thirty questions in total, with a level of measurement at a nominal or an ordinal level. The division of the questionnaire into the eight sections are depicted in Table 4.2.

3.6 Validity

According to Sekaran and Bougie (2010: 330) and Kumar (2011: 186), Validity is a measurement of how well an instrument has been developed and tests the definition to be tested. Neuman (2011: 211) describes the validity of the measurement as well as the degree to which the empiric indicator and the conceptual meaning of the construct that the indicator is intended to measure work together. While there are several forms of validity, it is obvious from a consensus between authors that there are similar methods used to determine the validity of a measuring instrument.

Validity of the face is the degree to which the instrument on the surface is similar to the calculation of the characteristic (Leedy and Ormrod 2010: 92). The questionnaire was reviewed by project sponsors of Overvaal and Coal 81mpta, who were not part of the survey to analyze the quality of the questionnaire, to ensure face validity. The questionnaires were approved with no further recommendations from the sponsors. This was done to ensure that the instrument concentrated on fundamental and important variables of project quality management and there were no changes made to the instrument.

3.7 Primary data

3.7.1 Administration of questionnaire

In gathering and interpreting the information, the survey monkey data collection software was used to construct the questionnaire. Creswell (2009: 66) states that data collections in a case study occur over a sustained period. The data for the study was collected through questionnaires distributed on-line using the survey monkey software. The survey questionnaire was forwarded through email to Transnet Group Capital (TGC) project team. The respondents had to complete the questionnaires (See Appendix A) over a period of three weeks from the 10th to 28th of June 2019. The participants received information through a covering letter of information disclosing the relevant details of the studyand an invitation to participate voluntarily.

3.7.2 Pilot testing

Kumar (2011: 150) states that having developed a research tool, whether an interview schedule or a questionnaire, it is important that it be checked before it is used for the actual collection of data. Pre-testing a research instrument requires a critical review,

as understood by a respondent, of the interpretation of each question and its significance. Three participants that were not project sponsors were chosen from the target population to participate in the pilot study and provide input on the common problems they experienced in responding to the questionnaire. The questionnaire was hand delivered to the selected participants to isolate problems about accuracy of information. The objective was not to collect data but to recognise the problems that potential respondents might have in either understanding or interpreting a question. The problems such as alignment to internal operational language that is used by Transnet were identified and the questionnaire was updated with the inputs obtained to ensure that it was accurate for the key analysis. All the participants had a clear understanding of English, and there were no difficulties in this regard.

3.7.3 Steps to improve the response rate

To improve the response, rate an email invitation was short and simple with just one link that navigated straight to the Survey. The cover page detailed the following:

i. Who was the researcher and the purpose of your study;
ii. The survey's benefit to the individual;
iii. Length of survey; and
iv. Privacy statement.

The survey link sent an automatic five days reminder emails to those who still need to complete the survey. Forty-nine responded received in the first round and eighteen after the automatic reminder.

3.8 Secondary data

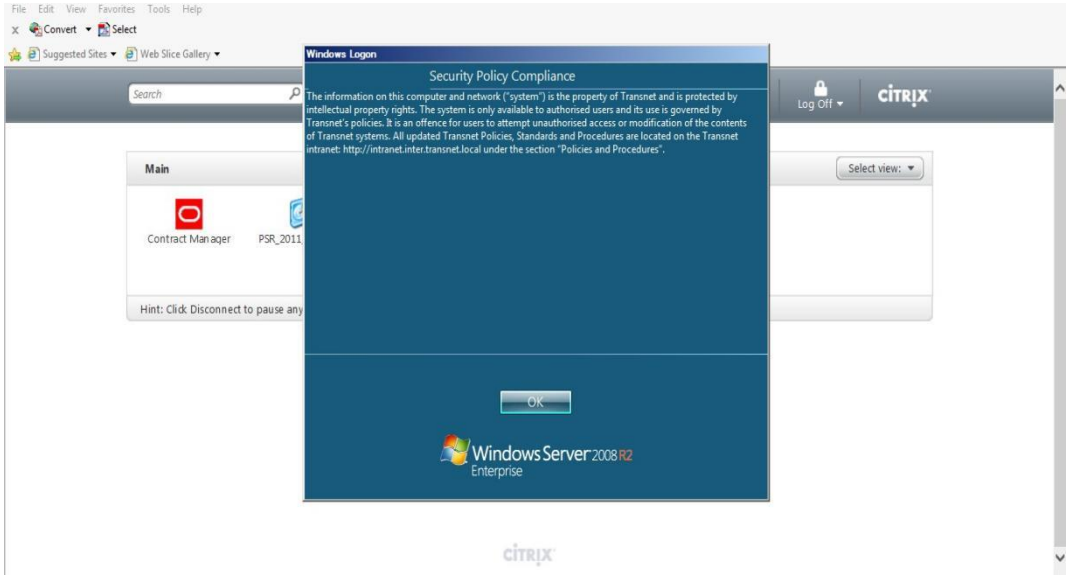
Secondary data was collected by reviewing the project report that was generated by the researcher. This was done with the view to align with and to address the first research objective. A secondary source desktop evaluation was performed from a project status report derived from Primavera, an enterprise portfolio management programme that covers project management, scheduling, risk analysis, incentive management, resource management, and collaboration and control capabilities. The report presented the status of the project and the compensation events. The status of the report was reviewed to confirm the reasons, number and cost associated with compensation events in 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects.

3.8.1 How to access the report on Primavera

The Primavera report database provides a central repository for all portfolio, project, and resource data. Its open architecture enables users to build their own custom operating reports and business intelligence review below are the steps below are steps that were followed to access the Primavera report.

Step 1 – Login to Citrix using the normal login details.

Step 2 – Login to Contract manager this password is generated by the Primavera system to ensure security of the system.

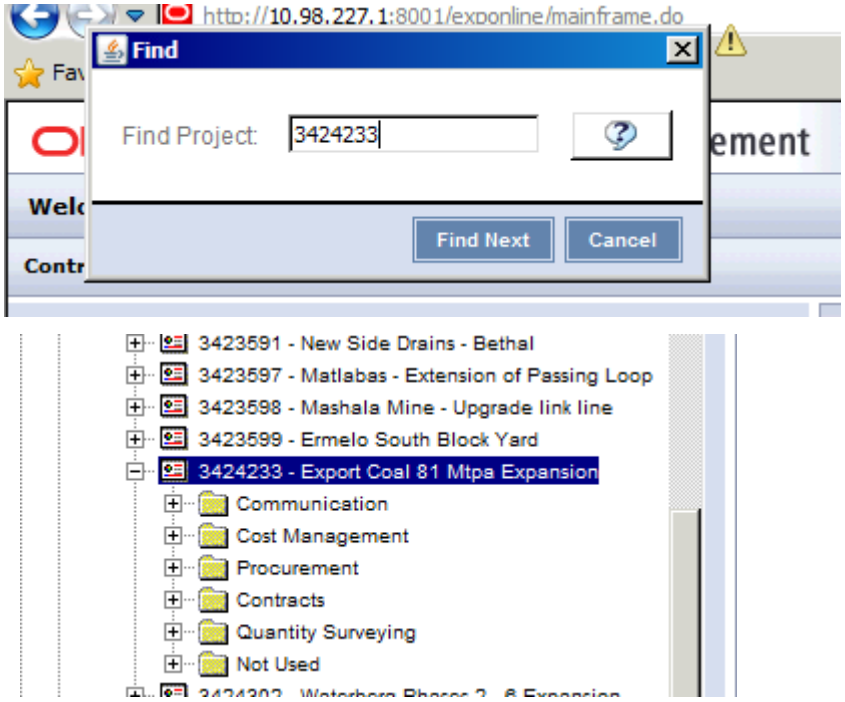


The Primavera Data Service uses Hypertext Transfer Protocol (HTTP) basic authentication to authenticate requests. HTTP is a protocol for distributed, interactive, hypermedia information systems that is the application layer. To authenticate using HTTP Basic Authentication, clients must provide the username and password of a

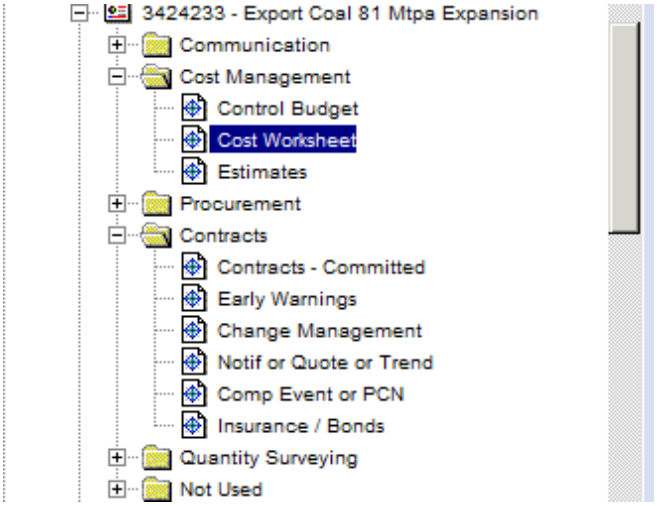
valid Primavera user in the HTTP headers of their requests.

Step 3 – Contract Management Dashboard Screen

Step 4 – Type in the project number to retrieve project status



Step 5 – Choose the activity status for project



ORACLE Primavera Contract Management — Correspondence Queue | Print | Search | Help | Logout

Export Coal 81 Mtpa Expansion (3424233) — September 18, 2020

Control Center > Cost Worksheet

Cost Worksheet — Select an action... — 1 2 3 4 5 ... — Find — Layout: Commitments

Cost Code	Title	Original Commitment	Approved Commitment Revisions	Revised Commitment	Pending Commitment	Commitment Trends	Estimated Future Commitmen
34-X-01-C-01	Saaiwater - Direct costs	R69,473,380.62	R16,931,122.22	R86,404,502.84	R59,441.01	R0.00	R-6,025,096.0
34-X-01-C-02	EPCM	R23,415,389.60	R0.00	R23,415,389.60	R0.00	R0.00	R0.0
34-X-01-C-03	External Consultants	R548,550.00	R-17,218.00	R531,332.00	R0.00	R0.00	R245,177.0
34-X-01-C-04	Environmental Cost	R0.00	R0.00	R0.00	R0.00	R0.00	R0.0
34-X-01-C-05	FEL 3 Study Cost	R0.00	R0.00	R0.00	R0.00	R0.00	R0.0
34-X-01-C-06	Contingency	R0.00	R0.00	R0.00	R0.00	R0.00	R0.0
34-X-01-C-07	Escalation	R0.00	R0.00	R0.00	R0.00	R0.00	R-0.4
34-X-01-C-08	Forex	R0.00	R0.00	R0.00	R0.00	R0.00	R0.0
34-X-01-C-09	Undistributed Funds	R0.00	R0.00	R0.00	R0.00	R0.00	R0.0
34-X-01-C-10	Client Cost	R10,000,000.00	R0.00	R10,000,000.00	R0.00	R0.00	R10,898,841.8
34-X-01-C-11	Overhead Costs	R0.00	R0.00	R0.00	R0.00	R0.00	R-707,743.6
34-X-01-C-12	Re-routing of Cables	R6,774,248.81	R0.00	R6,774,248.81	R0.00	R0.00	R0.0
34-X-02-C-01	Blackhill - Direct costs	R58,903,033.18	R3,631,718.00	R62,534,751.18	R124,929.45	R0.00	R342,545.2
34-X-02-C-02	EPCM	R15,578,029.34	R0.00	R15,578,029.34	R0.00	R0.00	R0.0
34-X-02-C-03	External Consultants	R258,510.00	R-18,490.00	R240,020.00	R0.00	R0.00	R109,980.0
Log Totals:		R1,258,538,482.42	R220,550,376.04	R1,479,088,858.46	R2,037,371.36	R0.00	R339,592,992.79

Step 6 – Export the data to excel

:ost Report

:xport Coal 81 Mtpa Expansion

	G	H	J=G+H	K	L	M	N=J+K+L+M	P=(C+D+E)-N	
	COMMITTED								
	Approved			Estimate to Complete			Forecasts	Variance	Expenditure (inc retention)
FFC	Original Commitment	Compensation Events	Current Approved Commitment	Pending Changes	Comp Event Phase 1	Estimated Future Commitments	Forecast Final Cost	Budget Variance Over (-) Under (+)	Expenditure to Date
.00	R 69 473 380.62	R 16 931 122.22	R 86 404 502.84	R 59 441.01	R 0.00	R-6 025 096.00	R 80 438 847.85	R 6 261 152.15	R 86 198 162.19
.60	R 23 415 389.60	R 0.00	R 23 415 389.60	R 0.00	R 0.00	R 0.00	R 23 415 389.60	R 0.00	R 21 740 725.37
.00	R 548 550.00	R-17 218.00	R 531 332.00	R 0.00	R 0.00	R 245 177.00	R 776 509.00	R 0.00	R 531 332.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R-0.48	R-0.48	R 0.48	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.40	R 10 000 000.00	R 0.00	R 10 000 000.00	R 0.00	R 0.00	R 10 898 841.88	R 20 898 841.88	R-10 185 340.48	R 9 990 124.63
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R-707 743.66	R-707 743.66	R 707 743.66	R 0.00
.00	R 6 774 248.81	R 0.00	R 6 774 248.81	R 0.00	R 0.00	R 0.00	R 6 774 248.81	R 25 751.19	R 6 661 150.50
.66	R 58 903 033.18	R 3 631 718.00	R 62 534 751.18	R 124 929.45	R 0.00	R 342 545.27	R 63 002 225.90	R 12 976.76	R 42 204 594.51
.34	R 15 578 029.34	R 0.00	R 15 578 029.34	R 0.00	R 0.00	R 0.00	R 15 578 029.34	R 0.00	R 15 578 029.34
.00	R 258 510.00	R-18 490.00	R 240 020.00	R 0.00	R 0.00	R 109 980.00	R 350 000.00	R 0.00	R 140 220.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00

Page: 1 of 18 — r_cost.pbl - r_cw_02

3.9 Data interpretation and analysis

3.9.1 Content analysis

According to Cohen et al (2011: 16), document analysis entails defining or delineating as precisely as possible those ideas in the documents that the researcherwants to research. According to Bowen (2009: 27) document analysis is characterised as a systematic process for the study or evaluation of both printed and electronic (computer-based and internet-transmitted) records.

Quantitative content analysis was used for this study, which provide the units of data collection. The conclusion of the standard content analysis is the statistical overview. (Neuendorf 2019: 212).

The researcher, being a Transnet employee, was able to use her password as a valid Primavera user in the HTTP to identify headers of requests. The exported report was analysed by verifying the classifications and total number of compensation events against the project budget to calculate the percentages of overall compensation events.

3.9.2 Quantitative analysis (survey)

The quantitative data was analysed using descriptive and inferential methods using the Statistical Package for Social Science version 26.0. The data was cleaned by the researcher and subjected to analysis in the system by the assistance of the statistician. Furthermore, the statistician coded the data using a excel spread sheet, imported into SPSS, and processed for frequencies, descriptive analysis and cross tabulations and tested for significance levels. Thereafter, the findings were discussed to ultimately develop a Transnet culture based PQM framework that is aligned to the project lifecycle.

3.9.2.1 Descriptive and inferential analysis

The purpose of analysis is to analyse the data about information of respondents in a sample or population. The field of statistics is composed of two broad categories which are descriptive and inferential statistics.

Table 3.5 illustrates the differences between these categories. Descriptive statistics describes the important characteristics of the data using the measures of central

tendency and the measures of dispersion. The objective of descriptive research is to describe things, such as demographics and perceptions of respondents (Armstrong and Kotler 2011: 135).

Table: 3.4. Descriptive vs. inferential statistics

S. No	Descriptive Statistics	Inferential Statistics
1	Concerned with the describing the target population	Make inferences from the sample and generalize them to the population.
2	Organize, analyze and present the data in a meaningful manner	Compares, test and predicts future outcomes.
3	Final results are shown in form of charts, tables and Graphs	Final result is the probability scores.
4	Describes the data which is already known	Tries to make conclusions about the population that is beyond the data available.
5	Tools- Measures of central tendency (mean/median/ mode), Spread of data (range, standard deviation etc.)	Tools- hypothesis tests, Analysis of variance etc.

Source: De Vaus (2014:207-208) and Walliman (2011: 213)

Inferential statistics are aimed at drawing results from a study and generalizing them to the population.

3.9.2.2. Reliability analysis

Kumar (2011: 186), state that the reliability of the instrument refers to its ability to yield accurate measurements if the instrument is administered to the similar population under the similar conditions and to achieve equivalent results. To test and determine the reliability of the instrument used to measure results in this study the Cronbach's Alpha coefficient was used. According to Sileyew (2019: 10) Cronbach's alpha is a measure of internal consistency, that is, how intricately connected a set of items are. According to Cooper and Schindler (2001: 215), a high Cronbach's Alpha that is close to one indicates that if the research is applied again, the results will be the same and therefore deemed reliable. A Cronbach's alpha reliability coefficient of 0.70 and above is considered as acceptable in most research (Tavakol and Dennick2012: 54).

3.10. Delimitations

This study was confined only to the Gauteng Project Management Team with the other Transnet regions not being considered. The exclusion of other regions was based on time constrains and the nature of selected projects for the research.

3.11. Limitations to the study

The limitation is that the study cannot be generalised to other organisations due to

specific and unique projects that are specific to Transnet.

3.10 Ethical considerations

Furseth and Everett (2013: 10) emphasises that before data collection, it is necessary to obtain the consent of participants. Participants were given a letter of information describing the intent of the study along with the questionnaire, andinformed consent was sought. All Durban University of Technology institutional ethicsprotocols were adhered to and ethical clearance for the study was obtained from the relevant research ethics committee at the institution. Marshall and Rossman (2014: 58) state that the purpose of research ethics is to ensure that participants areprotected from potential harm resulting from research activities. An effort was made to ensure privacy, confidentiality, voluntary participation and that no potential harm occurred to any respondent who participated in the research. In line with the ethical considerations of science, participation in the study was voluntary and there were no financial benefits for participants.

3.11 Conclusion

This chapter detailed the research design and methodology employed in this study to address the research objectives. The quantitative method approach was used using the survey method and document content analysis was considered appropriate for this study. The research design decisions outlined a guide that the researcher followed in effectively addressing the research problem. Having discussed the research methodology used in this study, the next chapter deals with data presentation, presentation, analysis, and interpretation of results.

Chapter Four

Statement of Findings, Interpretation and Discussion of the Data

4.1 Introduction

This chapter presents the results and discusses the findings obtained from the primary and secondary sources of data. In this regard, tables and graphs have been used to present information.

4.2 Phase 1: Primary data

The research questions for this section of the study were:

i. What are the factors that contribute towards poor project execution?
ii. What is the impact of poor project quality practices to project life cycle?
iii. How can risks to poor project management be mitigated?

4.2.1 The sample

Due to the sample size of fifty-six (56) not being different from the population size of sixty-five (65) questionnaires were dispatched to fifty-six (56) project team members. A total of fifty-eight (58) participants completed questionnaires were received. The response rate was hundred and three percent (103%).

4.2.2 Response rate

Questionnaire success rate = questionnaires received x 100 ÷ (total questionnaires administered): 58 x 100 / 56 = 103 %. The response according to population to sample breakdown is depicted in Table 4.1.

Table: 4.1 Response according to population to sample breakdown

Discipline	Populations No:	Target sample No:	Response No:	Response rate (%)
General Managers	**2**	**2**	**2**	100
Executive Manager	5	5	**5**	100
Project Directors	3	3	**3**	100
Senior Project Managers	10	9	**9**	100
Project Managers	10	8	**10**	125
Engineering team	13	11	**10**	91
Quality Managers	5	4	**4**	100
Quantity Surveyors	2	2	**1**	50
Quality Officers	5	5	**5**	100
Construction Managers	6	4	**6**	75
Site Supervisors	4	3	**3**	100
Total	**65**	**56**	**58**	**103%**

Source: Generated by the researcher

According to Patten (2016: 76) 50% response is deemed to be acceptable based on the number of questionnaires received. Table 4.1 illustrate that there was 103% response rate which is deemed significantly enough for the statistical analyses to be conducted.

The division of the sections of the questionnaire according the specific research objectives are depicted in Table 4.2.

Table: 4.2. Questionnaires sections aligned to the objectives.

A	**Participant background**
1-3	General and biographical data
B	**Strategic alignment, culture, skills, and capabilities, project selection and project outcomes**
4-7	Objective 2 - Ascertain the root cause of poor project quality practices in the project lifecycle through a survey;
C	**Reasons for failure.**
8	Objective 3 - Ascertain the impact of poor project quality practices in the project lifecycle through survey; and
D	**Feedback of B and C**
	Objective 4 - To propose risk mitigation strategies using quality tools.

Source: Generated by the researcher

4.3 General and biographical information

Table 4.3 presents the biographical information of the respondents according to age distribution.

Table: 4.3. Participants according to age distribution

Item	Age	Count	Response
1	23-35	21	36%
2	36-45	26	45%
3	46 & Above	11	19%
	Grand Total	**58**	**100%**

Table 4.3 depicts the age groups into which respondents fell. 45% of the participants were between the age 36 – 45, and 36% of the participants are between 23-35 ages. The remaining 19% are 46 and above. The demographic age profile of the study participants shows that the 36-45 age group were the dominant age group.

Table 4.4 below describes the age distribution according to gender.

Table: 4.4. Age distribution according to gender

		Gender		Total
Age		Male	Female	
23 - 35	Count	11	10	21
	% within Age	52%	48%	100.0%
	% within Gender	31%	46%	36.%
	% of Total	19.0%	17%	36.%
36 - 45	Count	16	10	26
	% within Age	62%	38%	100.0%
	% within Gender	44%	46%	45%
	% of Total	28%	17%	45%
> 45	Count	9	2	11
	% within Age	82%	18%	100.0%
	% within Gender	25%	9%	19.0%
	% of Total	16%	3%	19.0%
Total	Count	36	22	58
	% within Age	62%	38%	100.0%
	% within Gender	100.0%	100.0%	100.0%
	% of Total	62%	38%	100.0%

Overall, the ratio of males to females is approximately 3:2 (62%: 38%). Within the age category of 36 to 45 years, 62% were male. Within the category of males

(only), 44% were between the ages of 36 to 45 years. This category of males between the ages of 36 to 45 years formed 28% of the total sample. The age distributions were only marginally not similar (p = 0.049).

The gender parity has not been achieved throughout all the demographic disciplines. The overall, women's representation remains unequal. Although South African policies have encouraged better representation, the implementation of policies on gender equality remains weak. (The World Bank Group, 2013: 25). Figure 4.1 below indicates the length of service of the respondents.

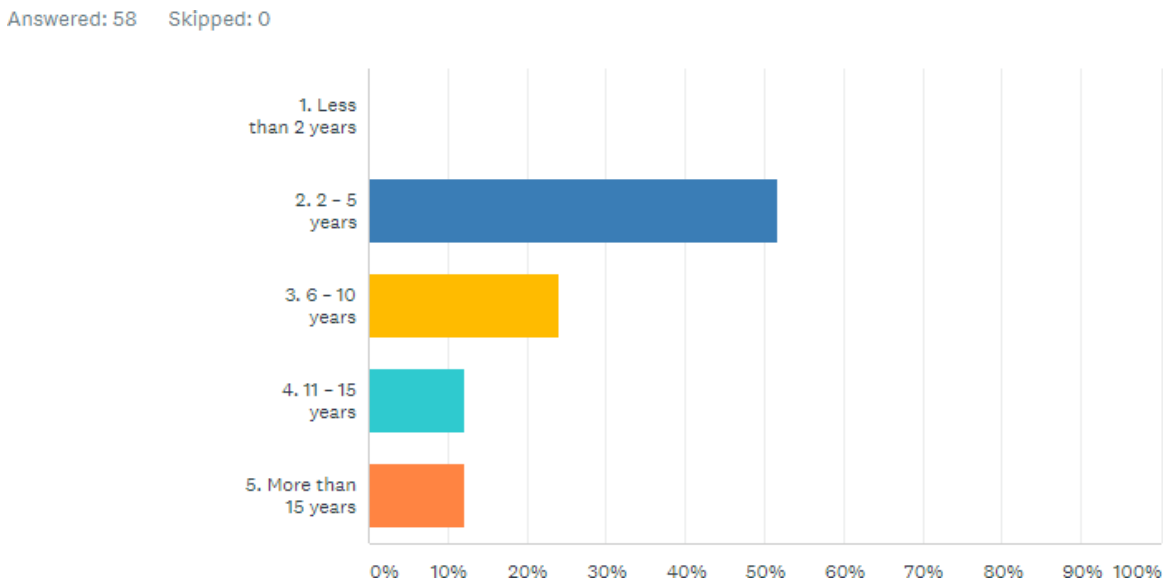


Figure 4.1. Length of service of the respondents

Just over half of the respondents (51.7%) had been in employment for between 2and 5 years, with the remaining half having more than 5 years of experience (p < 0.001). This implies that respondents had been in employment for a while and this is also a useful fact as it indicates responses from experienced workers.

Table 4.5 depicts the positions held by respondents.

Table: 4.5 Participants according to positions

	Frequency	Percent
Construction Manager	6	10.3
Engineering	10	17.2
Executive Manager	5	8.6
General Manager	2	3.4
Project Director	3	5.2
Project Manager	10	17.2
Quality Manager	4	6.9
Quality Officer	5	8.6
Quantity Survey	1	1.7
Senior Project Manager	9	15.5
Site Supervisor	3	5.2
Total	58	100.0

There were similar levels of Construction Managers, Engineering, Project Managers and Senior Project Managers, but significantly smaller levels of the remaining groups ($p = 0.040$). This gives an assurance to reliable feedback as the respondents are the most involved in the execution and monitoring of the project.

4.4 Reliability statistics

According to Ekolu (2016: 7) the two most significant measurements of precision are reliability and validity. The newly developed definition of states that reliability coefficient of 0.70 or greater is considered acceptable (Wiid and Digginess 2015: 249). Table 4.6 reflects the Cronbach's alpha score for all the items that constituted Section B of the questionnaire.

Table: 4.6 Cronbach's alpha score

Questions	Section	Number of items	Cronbach's Alpha
Q4	Strategic alignment	3	0.709
Q5	Culture, skills, and capabilities	5	0.700
Q6	Project selection	5	0.700
Q7	Project outcomes	5	0.749
Q8	Reasons for failure	8	0.740

The reliability scores (rounded to two decimals) for all sections exceed the recommended Cronbach's alpha value of 0.70. This indicates a degree of acceptable, consistent scoring for these sections of the research.

4.5 Factor analysis

A factor analysis was conducted for the purposes of data reduction. Analysis of variables helps to analyse data and promotes simple comprehension and analysis of patterns and relationships (Yong and Pearce 2013: 79).

The requirement is that the Kaiser-Meyer-Olkin (KMO) calculation of sampling adequacy should be greater than 0.50 and the Bartlett Sphericity Test less than 0.05. In all cases, the conditions are met which make it possible to conduct a factor analysis procedure. Factor analysis is conducted only on Likert scale items. Certain components are separated into finer components. This is explained in the rotated part matrix below.

4.6 KMO and Bartlett's test

Table 4.7 displays the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Bartlett's Test of Sphericity.

Table: 4.7. KMO and Bartlett's test

		Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
	Section		Approx. Chi-Square	df	Sig.
Q4	Strategic alignment	0.634	32.908	3	0.000
Q5	Culture, skills and capabilities	0.718	44.274	10	0.000
Q6	Project selection	0.610	60.594	10	0.000
Q7	Project outcomes	0.678	82.505	10	0.000
Q8	Reasons for failure	0.644	130.630	28	0.000

All the conditions are satisfied for factor analysis. The Kaiser-Meyer-Olkin Measure of sampling adequacy value should be greater than 0.500 and the Bartlett's Test of sphericity significance value should be less than 0.05.

The principle component analysis was used as the extraction method, and the rotation method was Varimax with Kaiser Normalisation. This is an orthogonal

rotation method that minimises the number of variables that have high loadings on each factor. It simplifies the interpretation of the factors as documented in the Table 4.8 below.

Table: 4.8. Rotated component matrix

Component Matrix[a]	
Q4: Strategic alignment	Component
	1
Projects are selected in line with business goals	0.694
Project outcomes are clearly defined by the client	0.838
The client determines project success by measuring project outcomes	0.844
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	
Component Matrix[a]	
Q5: Culture, skills and capabilities	Component
	1
There is continuous surveillance from the project owner through the life of the project	0.834
Project owners are equipped with the skills to analyse business requirements when defining project outcomes	0.681
The Transnet concept of project management is clearly defined and understood	0.516
Lack of awareness of cultural differences are a source of recurring problems	0.456
Quality awareness is conducted throughout the organisation	0.760
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	
Rotated Component Matrix[a]	

Q6: Project selection	Component	
	1	2
Project managers are appointed at the concept stage of the project	0.810	0.135
The project manager is involved in the project selection process	0.811	0.129
Project results have a strategic fit in the design and execution of future products and services	0.129	0.895
Projects are selected in line with business growth and expansion strategies	0.170	0.884
The principles of project management are applied uniformly irrespective of the size of the project	0.642	0.114
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		
Rotated Component Matrix[a]		

Q7: Project outcomes	Component	
	1	2
The project usually satisfies the business operational requirements	0.853	0.031
Project deliverables are generally produced on time and within budget	-0.072	0.879
Projects always deliver the business value it promises	0.604	0.583
The time, cost, quality and scope constraints are usually managed as planned	0.375	0.808
Projects ultimately provide satisfactory return on investment to the customer	0.777	0.157
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		
Rotated Component Matrix[a]		

Q8 Reasons for failure	Component	
	1	2
Lack of user involvement	0.689	0.129
Long or unrealistic timescales	0.819	0.027
Failure to adequately identify, document and track requirements	0.800	-0.017
Scope creep	0.617	0.348
No formal change control system	-0.051	0.641
Inadequately trained or inexperienced project managers	0.065	0.621
No Quality Control process	0.162	0.856
No Quality Assurance process	0.264	0.764
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

Factor analysis show inter-correlations between variables. Items of questions that loaded similarly imply measurement along a similar factor. An examination of the content of items loading at or above 0.5 (and using the higher or highest loading in instances where items cross-loaded at greater than this value) effectively measured along the various components.

The statements that constituted questions 4 and 5 loaded perfectly along a single component. This implies that the statements that constituted these sections perfectly measured what it set out to measure. It is noted that the variables that constituted questions 6, 7 and 8 loaded along 2 components (sub-themes). This means that respondents identified different trends within the respective sections. Within the section, the splits are colour coded.

4.7 Section analysis

The following section analyses the score trends of the respondents by variable per section. The results are first presented using the overview percentages for the variables that constitute each segment. The findings are then further evaluatedbased on the relevance of the statements.

This section dealt with the strategic alignment (Q4) of the project. Three statements were pitched, and participants had to indicate the extent to which they agreed or disagreed with each statement. Table 4.9 present the scoring pattern.

Table 4.9. The Responses to section on strategic alignment (Q4)

		Strongly disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Projects are selected in line with business goals	Q4.1	0	0.0%	2	3.5%	3	5.3%	34	59.6%	18	31.6%	0.000
Project outcomes are clearly defined by the client	Q4.2	0	0.0%	11	19.3%	10	17.5%	32	56.1%	4	7.0%	0.000
The client determines project success by measuring project outcomes	Q4.3	0	0.0%	10	17.2%	15	25.9%	28	48.3%	5	8.6%	0.000

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The alternate states that there is a significant difference between the levels of agreement and disagreement. The results are shown in the Table 4.9 the highlighted significant values (p-values) are less than 0.05(the level of significance) implying that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant.

It is observed that all statements (Q4.1, Q4.2 and Q4.3) have significantly higher levels of agreement than disagreement ($p < 0.05$). The three statements (Q 4.1, Q 4.2, and Q 4.3) show (significantly) higher levels of agreement in terms of projects selected in line with business goals, project outcomes are clearly defined by theclient and that client determines project success by measuring project outcomes

The below Figure 4.2 charts a graphical representation of the results of project strategic alignment.

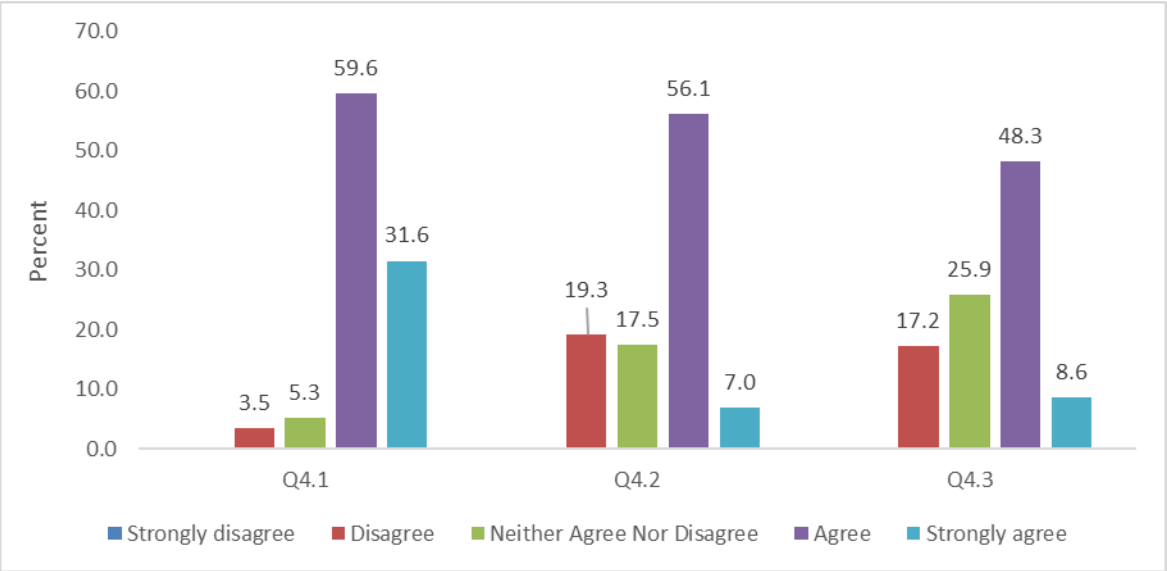


Figure 4.2. Strategic alignment responses (Q4)

By considering an agreeable or disagreeable index, determined by combining agree with the strongly agree responses and disagree with the strongly disagree, thefollowing observations emerge:

i. There was agreement (91.2%) that projects are selected in line with business goals;
ii. 63.1% respondents agreed that project outcomes are clearly defined by the client;
iii. 56.9% of the respondents agree that the client determines project success by measuring project outcomes this shows that there is an effective monitoring of the project outcomes from client.

The results support to the notion that the selected projects were subjected to an independent gate review at the appropriate stages as defined (earlier) in the PLP Methodology and as per the project's classification outcome. The gate review team is responsible for affirming the technical, project management, and both financial and commercial validity of the project during its lifecycle as defined in the PLP roadmaps (Murray 2015:33). Hence, no serious areas of concern emerge from this section.

The next section (Q5) dealt with the culture, skills, and capabilities within the project team. Five statements were pitched, and participants had to indicate the extent to

which they agreed or disagreed with the statements. Table 4.10 presents the scoring patterns.

Table: 4.10. Responses on culture, skills and capabilities responses (Q5)

		Strongly disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
There is continuous surveillance from the project owner through the life of the project	Q5.1	0	0.0 %	8	13.8 %	10	17.2 %	34	58.6 %	6	10.3 %	0.000
Project owners are equipped with the skills to analyse business requirements when defining project outcomes	Q5.2	2	3.4 %	12	20.7 %	20	34.5 %	20	34.5 %	4	6.9 %	0.000
The Transnet concept of project management is clearly defined and understood	Q5.3	0	0.0 %	12	21.1 %	13	22.8 %	24	42.1 %	8	14.0 %	0.020
Lack of awareness of cultural differences are a source of recurring problems	Q5.4	0	0.0 %	14	24.1 %	16	27.6 %	21	36.2 %	7	12.1 %	0.073
Quality awareness is fostered throughout the organisation	Q5.5	2	3.4 %	15	25.9 %	9	15.5 %	21	36.2 %	11	19.0 %	0.002

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The highlighted p-values are less than 0.05 (for Q5.1, Q5.2, Q5.3 and Q5.5) implying that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant. Statement Q 5.4 does not show any significant difference in scoring patterns (p = 0.073). Figure 4.3 charts a graphical representation of the data.

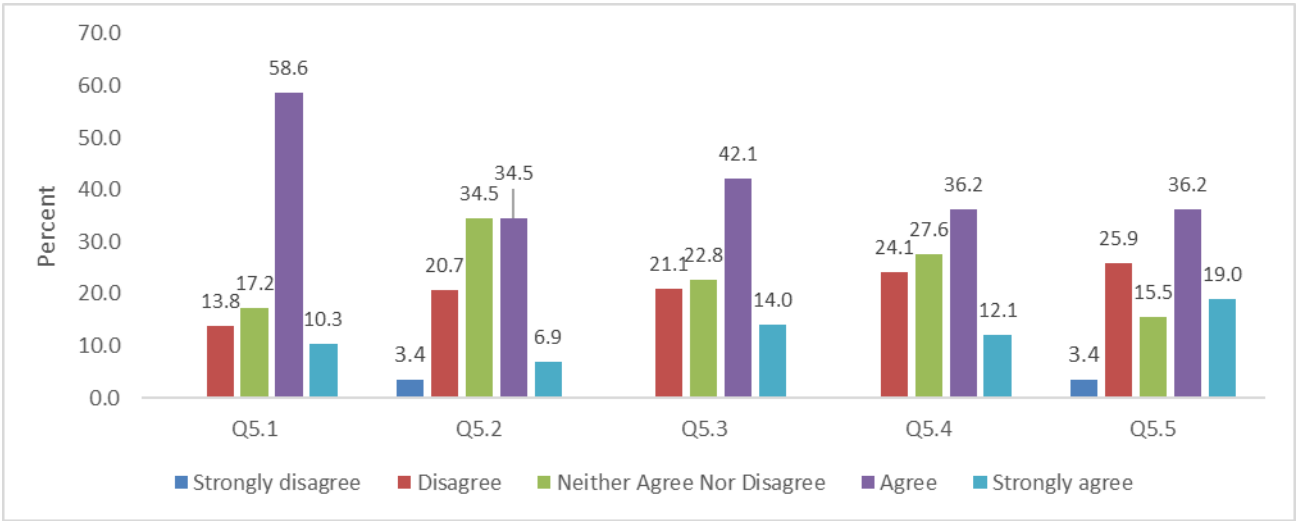


Figure: 4.3. Culture, skills, and capabilities responses (Q5)

Three statements (Q5.1, Q5.3, and Q5.5) shows higher levels of agreement than levels of disagreement. The 68.9 % of participants agreed that there is continuous surveillance from the project owner through the life of the project, 56.1% agreed that the Transnet concept of project management is clearly defined and understood and 55.2% agreed that quality awareness is fostered throughout the organisation.

Only 41.4% (Q 5.2) agreed that project owners are equipped with the skills toanalyse business requirements when defining project outcomes. According to Radujković *et. al.* (2017:608) managing a project is applying knowledge, skills, tools, and techniques to project activities, to satisfy project goals. This this is noted as another area of concern.

In question 5.4 participants were required to indicate the extent to which they agreed or disagreed with the statement. Lack of awareness of cultural differences are a source of recurring problems. Almost half (48.3%) of the participants agreed with the statement. Kivrak *et. al.* (2009: 59) state that culture has the potential to impact the success of projects. Therefore, companies should consider the cultural issues in their daily businesses to operate successfully in the global marketplace to minimise recurring problems emerging from cultural differences.

This next section dealt with project selection (Q6). Five statements were pitched, and participants had to indicate the extent to which they agreed or disagreed with the statements. Table 4.11 presents the scoring patterns.

Table: 4.11. The responses to section on project selection (Q6).

		Strongly disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Project managers are appointed at the concept stage of the project	Q6.1	2	3.4%	18	31.0 %	4	6.9%	22	37.9 %	12	20.7 %	0.000
The project manager is involved in the project selection process	Q6.2	4	7.0%	20	35.1 %	11	19.3 %	10	17.5 %	12	21.1 %	0.021
Project results have a strategic fit in the design and execution of future products and services	Q6.3	1	1.7%	4	6.9%	11	19.0 %	35	60.3 %	7	12.1 %	0.000
Projects are selected in line with business growth	Q6.4	0	0.0%	5	8.6%	7	12.1 %	31	53.4 %	15	25.9 %	0.000

and expansion strategies												
The principles of project management are applied uniformly irrespective of the size of the project	Q6.5	2	3.4%	14	24.1 %	12	20.7 %	23	39.7 %	7	12.1 %	0.000

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The highlighted p-values are less than 0.05 for all the statements implying that the distributions were not similar. Figure 4.4 charts a graphical presentation of the data.

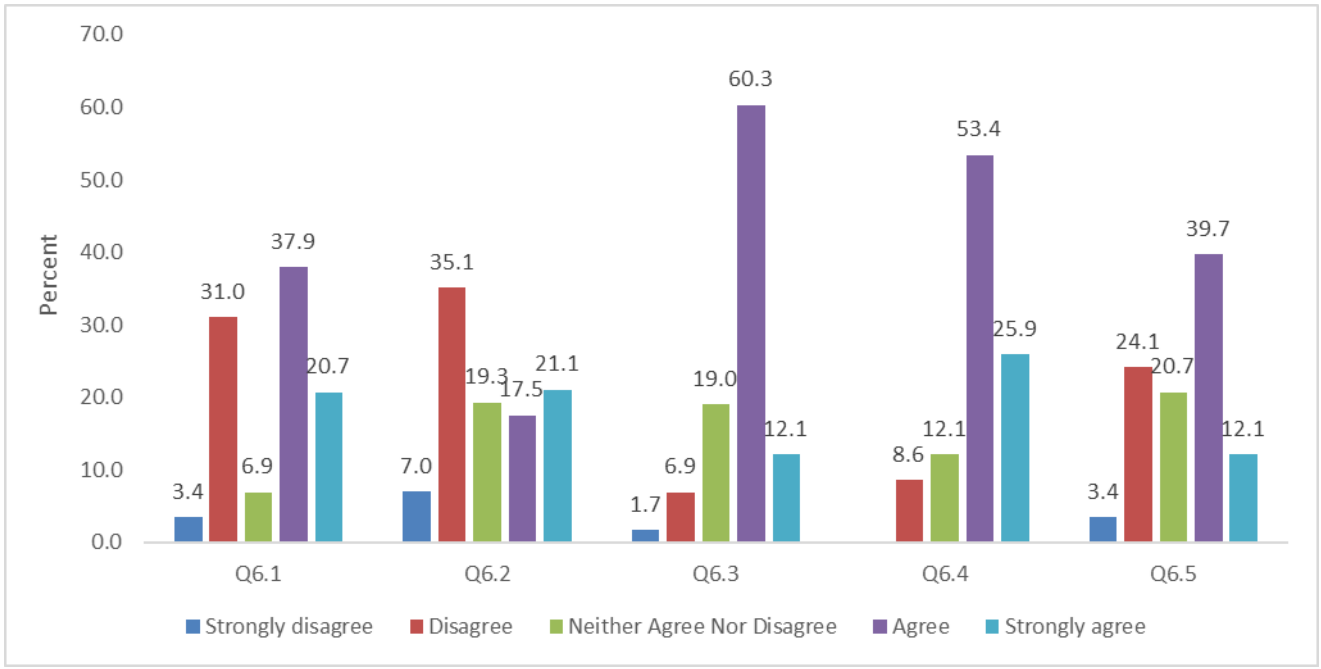


Figure: 4.4. Responses to section on project selection (Q6)

There was greater agreement (66%) than disagreement (35.4%) that project managers are appointed at the concept stage of the project (Q6.1). There were marginally higher levels of disagreement (42,1%) than agreement (36.6%) that the project manager is involved in the project selection process (Q6.2). There are much higher levels of agreement than levels of disagreement for the remainder of the statements (Q6.3, Q6.4, Q6.5). This augurs well as the literature suggests that the best way to optimise project selection performance is to align this process with the company's strategy as explained by Asaka *et al.* (2011: 66), the goal of strategic project alignment is to foster synergy between the projects implemented by organisations.

The next section dealt with project outcomes (Q7). Five statements were pitched, and participants had to indicate the extent to which they agreed or disagreed with the statements. Table 4.12 presents the scoring patterns.

Table: 4.12. The responses to section on Q7 the project outcomes.

		Strongly disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly agree		Chi Square p-value
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
The project usually satisfies the business operational requirements	Q7.1	0	0.0 %	5	8.6 %	10	17.2 %	35	60.3 %	8	13.8 %	0.000
Project deliverables are generally produced on time and within budget	Q7.2	2	3.4 %	22	37.9 %	13	22.4 %	12	20.7 %	9	15.5 %	0.001
Projects always deliver the business value it promises	Q7.3	2	3.4 %	17	29.3 %	13	22.4 %	20	34.5 %	6	10.3 %	0.001
The time, cost, quality and scope constraints are usually managed as planned	Q7.4	0	0.0 %	24	41.4 %	8	13.8 %	19	32.8 %	7	12.1 %	0.002
Projects ultimately provide satisfactory return on investment to the customer	Q7.5	0	0.0 %	9	15.5 %	22	37.9 %	25	43.1 %	2	3.4 %	0.000

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The highlighted p-values are less than 0.05 for all the statements implying that the distributions were not similar. Figure 4.5 charts a graphical representation of the data.

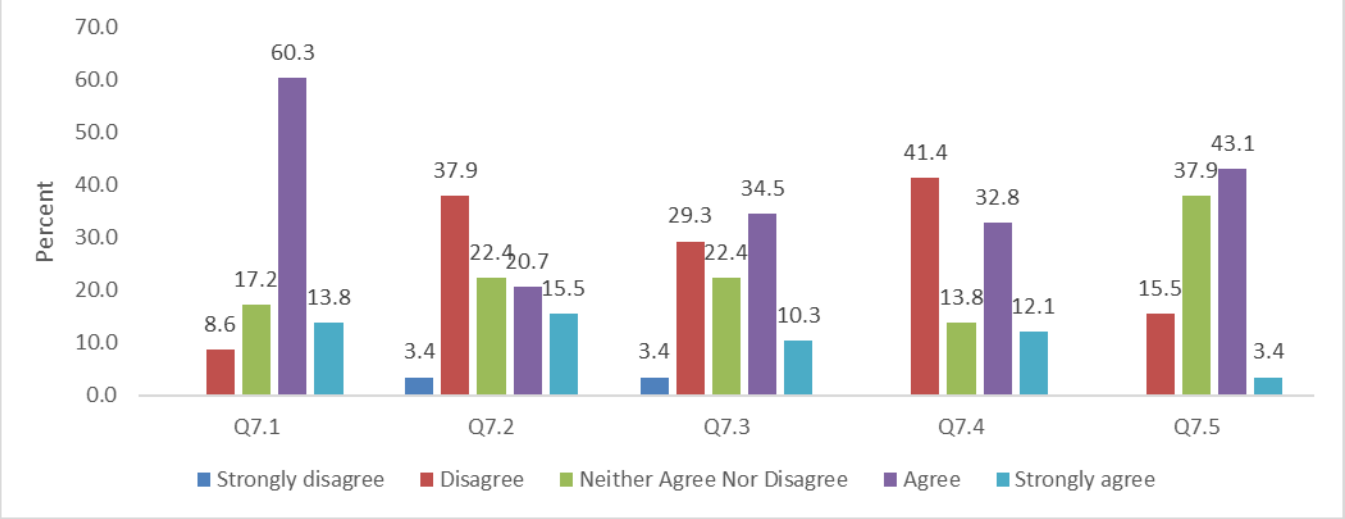


Figure 4.5 Responses to section on Q7 project outcomes

There was greater agreement (74.1%) than disagreement (8.6%) that the project usually satisfies the business operational requirements. There was marginally higher level of agreement (44.8%) than disagreement (32.7%) that projects always deliver the business value it promises. There was greater disagreement (41.3%) thanagreement (36.2%) that project deliverables are generally produced on time and within budget. Similarly, there was greater disagreement (41.4%) than agreement (44.9%) that time, cost, quality, and scope constraints are usually managed asplanned. More participants agreed (46.5%) than disagreed (15.5%) that projects ultimately provide satisfactory return on investment to the customer.

The last section dealt with failure of the project. Eight statements were pitched, and participants had to indicate the extent to which they agreed or disagreed with each statement. Table 4.13 presents the scoring patterns.

Table: 4.13 The responses to section on Q8 failure of the project.

		Strongly disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Lack of user involvement	Q8.1	0	0.0%	7	12.1 %	12	20.7 %	30	51.7 %	9	15.5%	0.000
Long or unrealistic timescales	Q8.2	1	1.7%	3	5.2%	5	8.6%	34	58.6 %	15	25.9%	0.000
Failure to adequately identify, document and track requirements	Q8.3	0	0.0%	6	10.3 %	6	10.3 %	30	51.7 %	16	27.6%	0.000
Scope creep	Q8.4	0	0.0%	5	8.8%	4	7.0%	24	42.1 %	24	42.1%	0.000
No formal change control system	Q8.5	0	0.0%	14	24.6 %	16	28.1 %	19	33.3 %	8	14.0%	0.208
Inadequately trained or inexperienced project managers	Q8.6	0	0.0%	11	19.0 %	15	25.9 %	21	36.2 %	11	19.0%	0.202
No Quality Control process	Q8.7	0	0.0%	12	20.7 %	14	24.1 %	24	41.4 %	8	13.8%	0.022
No Quality Assurance process	Q8.8	1	1.7%	16	27.6 %	11	19.0 %	23	39.7 %	7	12.1%	0.000

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The highlighted p-values are less than 0.05 for all the statements, except Q5 and Q6, implying that the respective distributions were not similar. Figure 4.6 charts a graphical representation of the data.

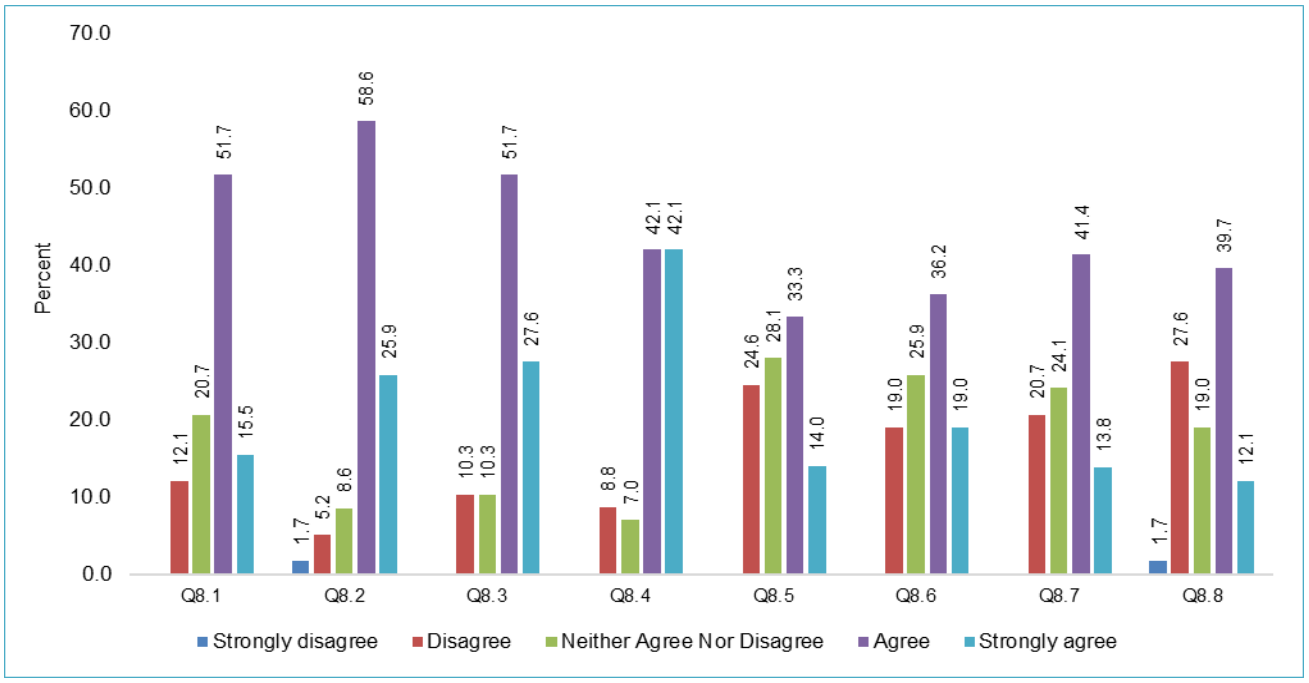


Figure 4.6. Responses to section on Q8 failure of the project.

Out of eight statements six statements that shows (significantly) higher levels of agreement whilst other two levels of agreement are lower (but still greater than levels of disagreement Q8.5 and Q8.6). Most of the respondents agree that there is a lack of user involvement, there is long or unrealistic timescales, there is failure to adequately identify, document and track requirements and respondents agree that there is scope creep. Over half of the respondents agree that there is no formal change control system, inadequately trained or inexperienced project managers, no quality control process and there is no quality assurance process.

The ultimate purpose of risk identification and analysis is to prepare for risk mitigation. Mitigation includes reduction of the likelihood that a risk event will occur and/or reduction of the effect of a risk event if it does occur.

Objective 4 of the study was to propose the risk mitigation strategies using quality tools using the feedback from objective 2 and 3. The results relating to objective 4will be discussed in chapter 5 as part of the recommendations of the study.

4.8 Cross tabulations

A second Chi square test (appendix F) was performed to determine whether there was a statistically significant relationship between the variables (rows vs columns). The null hypothesis states that there is no association between the two and alternate hypothesis indicates that there is an association.

The table 4.14 summarises the results of the chi square tests. The p-value between projects are selected in line with business goals and designation is 0.011. This means that there is a significant relationship between the variables highlighted in yellow. That is, the designation of the respondent did play a significant role in termsof how respondents viewed projects being selected with business goals in mind. All p-values more than 0.05 do not have a significant relationship.

X Table: 4.14. The table below summarises the scoring patterns of Q4.1 Chi-Square tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	82.362[a]	30	0,000	.[b]		
Likelihood Ratio	43,208	30	0,056	0,006		
Fisher's Exact Test	40,889			0,011		
Linear-by-Linear Association	1.251[c]	1	0,263	0,269	0,141	0,013
N of Valid Cases	57					

a. 41 cells (93.2%) have expected count less than 5. The minimum expected count is 0.04.
b. Cannot be computed because there is insufficient memory.
b. The standardized statistic is 1.119.

Y Table: 4.15 The table below summarises the scoring patterns of Q4.1 Cross tabulations

Crosstab		Designation											Total
Projects are selected in line with business goals		Construction Manager	Engineering	Executive Manager	General Manager	Project Director	Project Manager	Quality Manager	Quality Officer	Quantity Survey	Senior Project Manager	Site Supervisor	
Disagree	Count	0	0	0	2	0	0	0	0	0	0	0	2
	% within Designation	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	3,5%
Neither Agree Nor Disagree	Count	1	0	0	0	0	2	0	0	0	0	0	3
	% within Designation	16,7%	0,0%	0,0%	0,0%	0,0%	20,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,3%
Agree	Count	4	7	4	0	0	6	1	4	0	7	1	34
	% within Designation	66,7%	70,0%	80,0%	0,0%	0,0%	60,0%	25,0%	100,0%	0,0%	77,8%	33,3%	59,6%
Strongly agree	Count	1	3	1	0	3	2	3	0	1	2	2	18
	% within Designation	16,7%	30,0%	20,0%	0,0%	100,0%	20,0%	75,0%	0,0%	100,0%	22,2%	66,7%	31,6%
Total	Count	6	10	5	2	3	10	4	4	1	9	3	57
	% within Designation	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Projects are selected in line with business goals when looking at the level of Agree and Strongly Agree, there is a difference in terms of the scoring. 100% on Project

Directors and Quantity Surveyors strongly agree, and Executive Manager 80% agrees and 20% strongly agrees this might be because they are involved in the project at an early phase (initiation phase).

4.9 Correlations

According to Cohen, West and Aiken (2010:45) correlation analysis is used most often to measure the strength of a relationship between two variables. The values range between negative 1.0 and positive 1.0 where a correlation of negative 1.0 shows a perfect negative correlation, while a correlation of 1.0 shows a perfect positive correlation and a correlation of 0.0 shows no linear relationship between the movements of the two variables (Ranganathan 2019:702).

The results of bivariate correlation of (ordinal) data are found in the appendix G and they indicate the following patterns. Positive values indicate a directly proportional relationship between the variables and a negative value indicates an inverse relationship. All significant relationships are indicated by a * or **. Table: will used interpret the results of the correlation coefficient of this study as per the explanation of Rumsey (2012: 6).

Z Table: 4.16. Table: Correlation coefficient

All negative relationships are inverse.	**All positive relationships are directly proportional**
• Exactly negative 1. A perfect negative linear relationship • Negative 0.70. A strong negative linear relationship • Negative 0.50. A moderate negative relationship • Negative 0.30. A weak negative linear relationship	• +0.30. A weak positive linear relationship • +0.50. A moderate positive relationship • +0.70. A strong positive linear relationship • Exactly +1. A perfect positive linear relationship
0. No linear relationship	

4.9.1 Results of question 4 and 5

The researcher selected 3 positive correlations and 1 negative correlation from appendix G (positive highlighted in yellow and negative highlighted in blue):

- The results show a positive linear relationship between projects are selected in line with business goals and project outcomes clearly define by the clients (r = 0.315*). The respondents indicate that the more project outcomes are clearly define by the clients greater the alignment to business goals, and vice versa.
- There is also a positive linear relationship between projects are selected in line with business goals and the client determines project success by measuring project outcomes" (r = 0.326). The respondents indicate that the more the client measure project outcomes, the greater the alignment to business goals and that result into project success.
- There is a positive correlation between projects are selected in line withbusiness goals and quality awareness is conducted throughout the organisation (r = 0.316). This indicates that the more quality awareness is conducted throughout the organisation greater the alignment to business goals.

The negative correlation coefficient value between project outcomes are clearly defined by the client and long or unrealistic timescales is -0.292. That is, the more projects outcomes are clearly defined, the less unrealistic timescales become. Hence the more projects are specified the less time is taken to do the projects because people know what needs to be done.

4.9.2 Question 6 - 7

The researcher selected 2 positive correlations and 1 negative correlation from Appendix G (Positive highlighted in yellow and Negative highlighted in blue):

- The results show a 0.560* correlation coefficient value between the appointment of project managers at the concept stage of the project and the involvement of Project Managers in the project selection process. The

respondents indicate that the earlier the involvement of the project managers in the project result in positive output of the projects.

- There is a positive relationship between project deliverables that are generally produced on time and within budget and the management of time, cost, quality and scope constraints of the project (r = 0.553). The results show that an effective management of time, cost, quality, and scope constraints of theproject result in projectect deliverables being produced on time and within the budget.

The negative correlation value between the project manager is involved in the project selection process and inadequately trained or inexperienced project managers is -0.378*, which is an inverse relationship. That is, the more inadequately trained or inexperienced project managers in an organisation, the lesser the involvement of Project Managers in the project selection process.

4.9.3 Question 8

Under question 8 the researcher selected 3 positive correlations:

- The results from the respondents indicates r = 0.387** indicating a positive correlation between scope creep and long or unrealistic timescales which means the more the project experience scope creep the longer the time scales of the projects increase.
- There is positive correlation between quality assurance process and formal change control system (r = 0.282), which means that there is no formalchange control systems in a projects quality assurance process will not be effective.
- The coefficient r = 0.809** between quality assurance process and quality control process is positive. This means checking the quality of the deliverables during the project management process is essential, to accomplish this is by using a process checklist (quality control) and a project audit (quality assurance).

4.10 Phase 2: Quantitative data

4.10.1 Document review project status report

One of the research questions for this study was to verify the reasons, number and costs associated with compensation events for Overvaal and Coal 81Mtpa projects. In terms of the internal process of PLP, Overvaal project was classified as a category E project, implying that all the core technical and operational options are known. Aurecon was appointed as an Engineering Procurement Construction and Manufacturing (EPCM) by Transnet to conduct a FEL-3 (Feasibility) Study, as well as the detail engineering of the implementation phase (FEL-4). Further to the reviews, a Due diligence report was prepared aiming to arrive at a scope freeze to enable a focused and aligned FEL-3 basic engineering study of the selected options and reducing the number of options to be taken forward in the FEL-3 design. The FEL-4 detail engineering was subsequently developed based on the options selected during the FEL-3 basic engineering study.

Objectives 1 of this study was to establish the reasons, number and cost associated with compensation events at the 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects, through documentary analysis (secondary research). Below is the data from the analysis generated from the primavera project report (appendix F and G). The details of the parameters examined (cost and quantity) and their associated compensation events are summarised in Table 4.16. In specific relation to compensation events, the data relating to value per contract, number of compensation events, percentage change in value for each contract, and overall effect of compensation events on the contract value are presented.

Table: 4.16. Overvaal and Coal 81 Mtpa project status

Items	**Overvaal** (Aurecon)	**Coal 81Mtpa**
Project Budget	R 55 400 000	R 1 400 654 141
Original Contract value **(**Aurecon)	R 3 059 400.21	R 1 178 160 265
CE's Value	R 1 481 695.30	R 39 492 800
Overall project expenditure	**R32 001 095.51**	**R1 217 653 065**
% of the Contract value	4.9 %	3.4%
Total number of CE's	7	46

Source: Generated by the researcher from appendix I and J

Both Overvaal and Coal 81 Mtpa projects are all target cost contracts based on estimated on completion of the work as per the activity schedule. The compensation events form part of the mechanism for adjusting the target price in each case, all compensation events caused changes to the overall project contract (Naughter 2017:1). The total number of compensation amount to R 1 481 695.30 Overvaal (Aurecon) and R 39 492 800 Coal 81Mtpa which is 4.9 % and 3.4% of the contract value respectively. The main reasons of the compensation events as per the project status reports is the additional scope due to scope being not clearly defined at the initial phase of the project as documented in Table 4.17.

The literature review highlighted that success in respect to compensation events and the notification of compensation events is familiarity with the contract provisions and good contract management (Hughes et al. 2015:235). For the purposes of this study, an attempt was made to categorise compensation events for a better understanding of how they occur. Out of nineteen types of compensation events in the NEC3 (Clause 60.1) that were defined in the literature review (Table: 2.2) four categories were recorded in the Primavera system which are:

i. Additions: compensation events arising from extra work or new additions to the original works information;
ii. Changes: compensation events arising from alterations to original works information;
iii. Inadequate or late information: compensation events arising from inefficient work of project consultants; and
iv. External events: compensation events arising from events outside of either party's control

BB Table: 4.17. Analysis of the Overvaal and Coal 81 Mtpa compensation events

Sources/causes of compensation events	Overvaal (Aurecon)	Coal 81Mtpa	**Total**
1. Change in scope	1	7	8 (15%)
2. Additional scope	5	13	18 (34%)
3. Inadequate or late information	1	24	27 (47%)
4. External Events		2	2 (4%)
Total	**7**	**46**	**53**

Source: Generated by the researcher from appendix G

Table 4.17 shows that there were 53 total number of compensation events for both projects, 47% of the events are Inadequate or late information in scope, 34% are additions, 15% are due to changes, and 4% due to external events. Most of the identified factors relate to works information which is a combination of the role of the client in deciding or changing information and the role of engineering designers in carrying out their work efficiently and providing timely and adequate information.

4.11 Conclusions

This chapter summarised the key results from the data obtained in the report. The biographies of the respondents in this research study categorised in gender, age, years of experience in project management was presented. The Cronbach alpha was presented suggesting a degree of appropriate, consistent scoring for these research sections. The data collected from the survey and document analysis has been presented in tabular form or in charts and figures and were explained and matched with the discussed theories or literature. Objectives 1, 2 and 3 of the study were achieved satisfactorily and objective 4 will be discussed in the recommendations section. The findings and recommendations will be discussed in the next chapter.

Chapter Five

Conclusions and recommendations

5.1 Introduction

In this chapter, the findings from chapter four are discussed. The literature reviewed, the theoretical framework adopted, and the findings aligned to the research questions are summarised. Subsequently, the recommendation as presented concludes with a plan for future studies.

5.2 Research questions

The following research questions that were set in chapter 1 formed the basis of the research:

i. What are the reasons, number and cost associated with compensation events in 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects?
ii. What are the factors that contribute towards poor quality project execution?
iii. What is the impact of poor project quality practices in the project life cycle?
iv. How can quality tools be used to mitigate risks to poor project management?

5.3 Summary of the findings and conclusions

The purpose of this study was to assess the effectiveness of project quality management systems within the life cycle of projects implemented by TransnetGroup Capital. The following is a presentation of the results and conclusions that are explored in the light of the research questions set out in chapter 1.

5.3.1 What are the reasons, number and cost associated with compensation events in 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects?

Transnet Group capital NEC3 projects 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects executed in South Africa between 2018 and 2019 were studied. A total of 53 compensation events recorded which indicates significant occurrence of compensation events in each case. The impact on the original project value of 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects is 3.4%, 6% respectively as reflected in Table: 4.16. The compensation events may have positive or negative effects on the financial aspects of a project in this case all contributed negatively in the projects. Out of 19 types of compensation events listed in NEC3 only 4 types occurred as per Table: 4.17. In terms of analyses of the compensation events in Table 4.17, 47% of the events are inadequate or late information in scope, 34% are additions, 15% are due to changes, and 4% due to external events. Coal 81Mtpa main reasons for the changes was that 81mtpa was one of the projects that did not follow a proper PLP process, it was moved from FEL2 straight into execution as stated earlier in the context on the study, therefore execution was started with designs that were not completed.

It is essential for Transnet Capital Group to minimise and control compensation events for the purposes of value for money and achieving intended objectives. To address the compensation events the following are three key focus areas that can be affected. The project managers should ensure project information is clearly documented, minimise changes in the construction phase, and getting project managers to perform their work efficiently and provide timeous and detailed production information. The effective implementation of NEC3 contracts should result in major benefits for projects in terms of time, cost savings and improved quality.

5.3.2 What are the factors that contribute towards poor quality project execution?

5.2.3.1 Culture differences are a recurring problem

It has been noted in the literature section 2.5.4 Culture, skills, and capabilities that large complex construction projects involve close cooperation across all disciplines to achieve optimum performance. The findings of the study indicate that cultural differences are a persistent issue. This can build barriers and obstacles to the achievement of the objectives of the project, as described in the literature.

Transnet Group Capital needs to develop a strong culture that forms the organisational decision-making patterns, directs decisions and influences the individual conduct of all project team members.

5.2.3.2 Quality awareness is not conducted throughout the organisation

There were two studies in Table: 2.6 that mentioned poor communication practices and Inadequate training and learning as areas contributing to project failure. The results from this study shows that quality awareness is not conducted throughout the organisation. This gives a reflection that TGC quality awareness program are not effectively communicated and implemented. Project quality awareness can be used as an effective tool to drive change management.

5.2.3.3 Project selection

The discussion from section 2.5.3 project selection of the literature demonstrate that the most important method for any organisation is project selection. It helps the organisation to expand its business and gain recognition. Feedback from the study shows that majority of the respondents are thinking along the same patterns that TGC has a proper process of project selection. This confirms the objective of Transnet as a state-owned company to be fully self-sufficient and a catalyst of economic growth and development.

5.2.3.4 Project outcomes

Project Management Body of Knowledge PMBOK® Guide (2017: 17) states that the performance measurement improves project management and effectiveness. When focusing on project results, early progress can be identified, and projects completed

are more likely to have a substantial effect on the value of the project. Projects are intended to deliver benefits to the investment to the organisation, but the performance criteria for many projects exclude the introduction of benefits. (PMBOK® Guide 2017: 18). In this study, this section yielded highest rate of neutral responses (37.9%) demonstrating that respondents are not part of the team that measure the project outcomes and were not able to commit to agreeing or disagreeing whether projects ultimately provide satisfactory return on investment to the customer

5.2.4 Objective 3: Ascertain the impact of poor project quality practices in the project lifecycle through a survey

The findings relating to objective 3 can be summarised as follows:

- There is a lack of user involvement;
- There are long or unrealistic timescales;
- There is Scope creep;
- No formal change control system
- There is an inadequately trained or inexperienced project manager and
- There is no quality control and quality assurance process.

The findings are that the quality control and quality assurance process are noteffective in the projects at TGP. FEL1 to FEL3 projects frequently begin muchsimpler and smaller than the FEL4 project, which ends up with an unplanned expansion, which is referred to as scope creep. Changes in projects over time when information about costs, time limits, and site limitations are learned. Inevitably, such broadening of reach leads to shortcuts that extend a restricted budget and defined timeline. It is necessary to control the scope of the project to retain the samestandard of quality across the entire project.

5.2.5 Objective 4: To propose risk mitigation strategies using quality tools.

Section 2.12 Project risk in the literature noted that risk management for projects is a method that involves risk evaluation and mitigation techniques for certain risks. Objective 4 of the study was to propose risk mitigation strategies using quality tools. The risk reduction strategy is intended to reduce or mitigate the effect of occurrences of risk events that have a detrimental effect on the project. Risk detection is both an innovative and a disciplined operation. Risk reduction measures and detailed action plans should also be included in the project management plan, or in risk assessments. The root cause analysis tool can be used in earlier phases of the risk assessment process to define and measure risks.

While risk mitigation strategies can be comprehensive and implemented by contractors, requirements for a clear risk mitigation planning process should be established by the owner's programme and project management. Owners were expected to have independent, impartial external expert evaluation of project risk reduction plans prior to final approval. This should be achieved prior to the completion of the design of the project or the allocation of construction funds. Beyond the completion of the project, risk reduction preparation should begin by collecting data and lessons learned that can support future projects.

Table: 5.1 Summary of findings in relation to each of the objectives

A	**Participant Background**
Q:(1-3)	General and biographical data
Findings 01	The gender parity has not been achieved throughout all the categories. The overall, women's representation remains unequal.
B	**Strategic alignment, culture, skills and capabilities, project selection and project outcomes**
Question 1	What are the reasons, number and costs associated with compensation events in 81 Million tons per annum (Mtpa) programme and Overvaal Tunnel projects?
Findings 02	The total number of Compensation amount to R 1 481 695.30 Overvaal (Aurecon) and R 39 492 800 Coal 81Mtpa which is 4.9 % and 3.4% the contract value respectively.
Question 2	What are the factors that contribute towards poor quality project execution?
Objective 2 Q:(4-7)	Ascertain the root cause of poor project quality practices in the project lifecycle through a survey;
Findings 03.1	Culture differences are a recurring problem in the project space.

Findings 03.2	Quality awareness is not conducted throughout the organisation.
C	**Reasons for failure.**
Objective 3 Q:(8)	Ascertain the impact of poor project quality practices in the project lifecycle through survey; and
Findings 04.	There is a lack of user participation in the study input from the respondents; there are long or unrealistic timescales, there is Scope creep, there is no systematic change management mechanism, there is an insufficiently qualified or inexperienced project managers, there is no quality control and quality assurance process.
D	**Feedback of B and C**
Question 4	How can quality tools be used to mitigate risks to poor project management?
Objective 4	To propose risk mitigation strategies using quality tools.
Proposal	Risk proposal refer to table 5.2

Source: Generated by the researcher

Considering the influence that risk management has on the objectives of the project in terms of quality and cost, risk management should a clear and knowledgeable process across all phases of the project. The findings from objective 2 and 3 confirm that risk management has a key role in a project. Positive finding confirms an effective methodology adopted by Transnet to executed capital projects is contained in the Project Lifecycle Process (PLP). This approach includes performing front-end loading (FEL) studies at various stages of the project lifecycle to achieve risk mitigation and increased certainty in line with increased investment. A gate review is carried out at the end of each process.

Gate reviews are a crucial way of assessing the results of the project to date, verifying compliance of the project, reviewing the feasibility of the project, and granting the requisite authorisation for the project to be evaluated for the next step. During the gate review, project cost estimates are set to more precision due to therisk mitigation associated with the project. However, this methodology needs to be emphases to minimise all the risk during execution phase (FEL4).

5.3 Research recommendations

There is a clear business case that is backed by literature based on the results, review and conclusions presented, that project management needs projects to be on track (scope), to be on time (schedule), to be executed within available resources (cost), and ultimately to satisfy clients.

5.4.3 Findings 01: General and biographical data

Transnet Group Capital should work towards a better outlook for future jobs and ensure gender equality is balanced. TGC should demonstrate its commitment to a more evolved work environment that encourages gender equity. Any inherent skills deficiencies need to be addressed by workforce strategies to ensure that women are afforded opportunities to improve skills or reskill.

5.4.4 Findings 02: The total number of compensations amounts to R 1 481 695.30 Overvaal (Aurecon) and R 39 492 800 Coal 81Mtpa which is 4.9 % and 3.4% the contract value respectively.

To manage the NEC3 compensation event process properly requires considerable forward planning and a good understanding of the terms of the contract. To ensure the project's progress, there must be a well-defined project scope. A clear vision and an agreement on the results of the project should be followed by the project team, allowing each project milestone to remain on track. The focus in this regard is to ensure that completeness of project information is timeously and properly documented to minimise changes in the construction phase.

5.4.5 Findings 03.1: The lack of awareness of cultural differences are a recurring problem in the project space.

It has been noted that TGC should consider the internal forces that shape culture and ensure that subcultures are aligned to the organisational culture by emphasising Transnet’s core values. The Code of Ethics of Transnet Company promotes a culture of entrenched values, beliefs, expectations, and norms that govern the actions of employees of the company. The Code seeks to create a culture of fairness, respect, dignity and overall ethical behaviour for employees' obligations to internal and external stakeholders. All employment contracts should adhere to and comply with the code. Core principles will encourage value-creating initiatives as workers will be motivated to

do what's right, even though it's hard to do the right thing. The organisational vision, mission, strategy should be well communicated to all employees.

5.4.6 Findings 03.2: Quality awareness is not conducted throughout the organisation.

It is recommended that Transnet Group Capital should commit to quality and that this should be driven by top management and be reinforced repeatedly. Once the quality criteria and project requirements have been defined proper monitoring should be ensured. The project quality management plan should be executed using the standards and processes defined in the project plan. Quality control and quality assurance should be implemented effectively to ensure continual project improvements throughout the project. A quality day in the project schedule should be identified to provide the opportunity to promote quality, to share lessons learnt, and to recognise and reward excellence.

5.4.7 Risk mitigation strategies

The enormous mitigating factor for risk is knowing the objective of the project that will eliminate all the type risks that relate to scope. Table 5.2 detailed the risk mitigation plan based on the finding of this study.

Table: 5.2. Risk mitigation plan

No:	Risk Description	Cause	Impact	Mitigations
1.	There is a lack of user involvement.	Scope not aligned to the user requirements	Project delays	Increase commutation with user and developedeffective operational readiness programme
2.	There is a long or unrealistic timescale.	Schedule risk assessment and simulation not conducted	Project overrun	Conduct schedule risk analysis to improve the predictability and performance of a project.

3.	There is Scope creep	Poor requirements analysis. Not Involving users early enough. Underestimating the complexity of the project. Lack of change control.	Project delays	Document detailed scopeand ensure all stakeholders are involved and understand the complexity of the project and trace all changes
4.	There is inadequately trained or inexperienced project managers	Inexperienced managers are given projects	Project delays	Assigned project managers that are experience and understand the projectscope e.g. electrical project assigned an electrician and mechanical project (mechanical engineer)
5.	There is no Quality Control and Quality Assurance process	No quality awareness which result in non-quality mind-set	Poor Quality Project non-conformance	Ensure on going quality control and quality assurance activities are conducted as planned

Source: Generated by the researcher

To minimise risks of project failure TGC should implement full scale of PLP process by ensuring that all stages of feasibility (FEL1-FLE3) studies are followed. The gate review process at the end of each development phase before deciding on whether to proceed to the next phase will mitigate the projects risks.

5.4 Research Conclusion

In this study the assessment of the effectiveness of project quality management systems within the life cycle of projects implemented by Transnet Group Capital was conducted. The rationale for rail capacity of 81 Mtpa relates to the threshold of infrastructure capacity, beyond which the 3.9km Overvaal single tunnel was sampled. Transnet Group Capital process for projects are effectively implemented. The research questions and objectives were intended to understand the factors that contribute towards poor project execution, impact of poor project quality practices to project life cycle and how can risks to poor project management be mitigated. The literature review showed that the application of QMS can be an efficient strategy for effectively achieving

project goals through a process approach based on PDCA methodology to improve project efficiency and solve problems. Furthermore, it has shown that project performance is the most effective key to assessing construction industry projects, the satisfaction of the client, and the Iron Triangle(cost, time, quality) is the most relevant tool. Table: 5.1 detailed the summary of findings in relation to each of the objectives. It is therefore concluded that the effectiveness of project quality management systems within the life cycle of projects implemented by Transnet Group Capital will be realised only when a full scale of PLP process of feasibility (FEL1-FLE3) studies are followed, commitment to quality, understanding and awareness of the project scope.

5.5 Recommendations for future research

It is proposed that future research studies should be undertaken on the effectiveness of Quality Management Systems through all TGG projects, as the current study emphasis was only on two projects. The focus should be at the benefits realisation process that enables the project to lead- to the delivery of outputs.

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Appendices

Appendix A: Questionnaire

Participant Background

You are invited to participate in our survey of the "Effectiveness of Quality Management System in Project Management" The case study of Transnet Group Capital (TGC). It will take approximately 10 minutes to complete the questionnaire.

Your participation in this study is completely voluntary. It is very important for us to learn your opinions. Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact:
Duduzile Kumalo at 083 795 2289 or by email at the email address specified below.
duduzile.kumalo@transnet.net

Thank you very much for your time and support.

Disclaimer and Confidentiality

Please note that this questionnaire is for research purpose only and information obtained will be treated as confidential. This questionnaire is designed to collect exploratory information. The questionnaire is designed not to reveal any participant's identity and thus no identification is required, it is an anonymous exercise, and hence no issue with confidentiality of the information provided.

Copyright issues

This questionnaire is largely informed by the theoretical framework and empirical study by Behnam Neyestani (2016) "*Effectiveness of Quality Management System (QMS) on Construction Projects"*.

Section A: Participant Background

Please indicate your Age Group

1. Under 23
2. 23 – 35
3. 36 - 45
4. > 45

1. Under 23	
2. 23 - 35	
3. 36 - 45	
4. > 45	

Please indicate your Gender

1. Male	
2. Female	

Indicate Years of Service with Our Organisation

1. Less than 2 years	
2. 2 – 5 years	
3. 6 – 10 years	
4. 11 – 15 years	
5. More than 15 years	

Please indicate your Race Group

1. Black African	
2. Coloured	
3. Indian	
4. White	
5. Other (Specify)	

Indicate your Designation/Position within your organisation

1. General Manager/Executive Manger	
2. Project Directors	
3. Senior Project Manager	
4. Project Manager	
5. Quality Manager	
6. Quantity Surveyor	
7. Quality Officer	

Section B:

Answer the questions below by ticking the relevant option.

1	Strongly disagree
2	Disagree
3	Neither Agree Nor Disagree
4	Agree
5	Strongly agree

1. Strategic Alignment

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1.1	Projects are selected in line with business goals					
2	Project outcomes are clearly defined by the client					
3	The client determines project success by measuring project outcomes					

2. Culture, Skills and Capabilities

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	There is continuous surveillance from the project owner through the life of the project					
2	Project owners are equipped with the skills to analyse business requirements when defining project outcomes					
3	The Transnet concept of project management is clearly defined and understood					
4	Lack of awareness of cultural differences are a recurring problem on projects					
5	Quality awareness is conducted throughout the organisation					

3. Project Selection

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	Project managers are appointed at the concept stage of the project					
2	The project manager is involved in the project selection process					
3	Project results have a strategic fit in the design and execution of future products and services					
4	Projects are selected in line with business growth and expansion strategies					
5	The principles of project management are applied uniformly irrespective of the size of the project					

4. Project Outcomes

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	The project usually satisfies the business operational requirements					
2	Project deliverables are generally produced on time and within budget					
3	Projects always deliver the business value it promises					
4	The time, cost, quality and scope constraints are usually managed as planned					
5	Projects ultimately provide satisfactory return on investment to the customer					

5. Reasons for failure

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	Lack of user involvement					
2	Long or unrealistic timescales					
3	Failure to adequately identify, document and track requirements					
4	Scope creep					
5	No formal change control system					
6	Inadequately trained or inexperienced project managers					
7	No Quality Control process					
8	No Quality Assurance process					

Appendix B: Permission to Conduct Research/Gate Keeper

Transnet SOC Ltd
Registration Number
1990/000900/30

Carlton Centre
150 Commissioner Str.
Johannesburg
2001

P.O. Box 72501
Parkview
South Africa, 2122
T +27 11 308 4701

TRANSNET

MEMORANDUM www.transnet.net

To: Ms Duduzile Kumalo
Quality Manager, Coal Portofolio, TGC

From: Ms Corli Van Rensburg,
General Manager, Capital Governance and Controls, TGC

Date: 25 July 2017

SUBJECT: **REQUEST FOR PERMISSION TO CONDUCT RESEARCH**
Proposed research study topic:
The effectiveness of Quality Management in a Project Management organization/environment.

Dear Duduzile

Your request to conduct the research on the above topic in Transnet Group Capital and the non-disclosure agreement refers.

I am delighted to inform you that your request for this study has been approved on the following conditions:

- Transnet will receive a presentation outligning the key findings of the study and recommendations to address these findings.
- All data colletion will be conducted and ensure confidentiality of the data and the identity of the participants.
- A non-disclosure agreement be signed by relevant parties

This being in order, I would like to take this opportunity to wish you everything of the best with your study.

Do not hesitate to communicate any additional assistance you may require.

Kind Regards,

Corli Van Rensburg, General Manager,
Transnet Group Capital
Capital Governance and Control
Date: 28/7/17

Appendix C: Turn it in Report

Document Viewer

Turnitin Originality Report

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The effectiveness of Quality Management Syste... By Dududizile Kumalo

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Appendix D: Editor's Letter

Saniphet Consulting
Leaders in Technology, Innovation, Training and Consulting Business
Addresss: Century City | Milnerton 7441 | Cape Town
Phone:+27 78 024 8617
Email: info@saniphetconsulting.com | consultant@saniphetconsulting.com
Web:www.saniphetconsulting.com

Date: 23 August 2021

Dear Sir / Madam

This is to confirm that this thesis entitled:

The effectiveness of Quality Management Systems in Project Management: The Case of Transnet

Authored by

Duduzile Emma Kumalo

has been edited for paragraph flow. The following aspects were highlighted to the author; after which when attended to, the thesis will be deemed fit for submission.

Aspect	Short notes: what to attend to
Sentence structuring:	Making use of short sentences which are precise.
Paragraphing:	Minimal use of inverted commas, quoting other authors, semi colonies and other forms of punctuation which mis – represents information.
Punctuation:	Use of punctuation marks appropriately and minimal use of bulleting, listing, inverted commas, and semi colonies
Flow	The arrangement of literature in a sensible and chronological manner to improve the readability of the thesis.
Grammatical errors:	To address the grammatical errors that altered the meaning of sentence or paragraph content as identified by the thesis editor.

Report prepared by:

Elizabeth Mnyandu

signature over printed name

Lead Consultant
0780248617

Affiliation/Contact Number

23 August 2021

Date

Appendix E: Faculty Research Ethics Committee (FREC)

MANAGEMENT SCIENCES: FACULTY RESEARCH ETHICS COMMITTEE (FREC)

15 March 2018

Student Name: Ms. D Kumalo
Student No: 21752113
FREC REF: /18FREC

Dear Ms Kumalo

MASTERS OF MANAGEMENT SCIENCES: QUALITY

TITLE: THE EFFECTIVENESS OF QUALITY MANAGEMENT SYSTEMS IN PROJECT MANAGEMENT: THE CASE OF TRANSNET GROUP CAPITAL

Please be advised that the FREC Committee has reviewed your proposal and the following decision was made: **Approved** – Ethics Level 2

Date of FRC Approval: 24 April 2018

Approval has been granted for a period of two years from the above FRC date, after which you are required to apply for safety monitoring and annual recertification. Please use the form located at the Faculty. This form must be submitted to the FREC at least 3 months before the ethics approval for the study expires.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the FREC according to the FREC SOP's.
Please note that ANY amendments in the approved proposal require the approval of the FREC as outlined in the FREC SOP's.

Yours sincerely

Prof JP Govender
Chairperson: Faculty Research Ethics Committee

Appendix F: Chi Square Test

	Chi-Square	df	Asymp. Sig.
Gender	3,379	1	0,066
Age	6,034	2	0,049
Years of Service	24,345	3	0,000
Designation	19	10	0,040
Projects are selected in line with business goals	47,772	3	0,000
Project outcomes are clearly defined by the client	31,491	3	0,000
The client determines project success by measuring project outcomes	20,207	3	0,000
There is continuous surveillance from the project owner through the life of the project	35,517	3	0,000
Project owners are equipped with the skills to analyse business requirements when defining project outcomes	25,103	4	0,000
The Transnet concept of project management is clearly defined and understood	9,877	3	0,020
Lack of awareness of cultural differences are a recurring problem	6,966	3	0,073
Quality awareness is conducted throughout the organisation	17,172	4	0,002
Project managers are appointed at the concept stage of the project	25,793	4	0,000
The project manager is involved in the project selection process	11,509	4	0,021
Project results have a strategic fit in the design and execution of future products and services	63,724	4	0,000
Projects are selected in line with business growth and expansion strategies	28,897	3	0,000
The principles of project management are applied uniformly irrespective of the size of the project	21,483	4	0,000
The project usually satisfies the business operational requirements	39,517	3	0,000
Project deliverables are generally produced on time and within budget	18,034	4	0,001
Projects always deliver the business value it promises	19,414	4	0,001
The time, cost, quality and scope constraints are usually managed as planned	14,414	3	0,002
Projects ultimately provide satisfactory return on investment to the customer	24,345	3	0,000
Lack of user involvement	22,966	3	0,000
Long or unrealistic timescales	64,069	4	0,000
Failure to adequately identify, document and track requirements	26,69	3	0,000
Scope creep	26,719	3	0,000
No formal change control system	4,544	3	0,208
Inadequately trained or inexperienced project managers	4,621	3	0,202
No Quality Control process	9,586	3	0,022
No Quality Assurance process	24,414	4	0,000

Appendix G: Summarised Correlations

			Q4: Strategic Alignment			Q5: Culture, Skills and Capabilities					Q6: Project Selection					Q7: Project Outcomes					Q8: Reasons for failure							
			Projects are selected in line with business goals	Project outcomes are clearly defined by the client	The client determines project success by measuring project outcomes	There is continuous surveillance from the project owner through the life of the project	Project owners are equipped with the skills to analyse business requirements when defining project outcomes	The Transnet concept of project management is clearly defined and understood	Cultural and ethical differences are a recurring problem	Quality aw areness is conducted throughout the organisation	Project managers are appointed at the concept stage of the project	The project manager is involved in the project selection process	Project results have a strategic fit in the design and execution of future products and services	Projects are selected in line with business growth and expansion strategies	The principles of project management are applied uniformly irrespective of the size of the project	The project usually satisfies the business operational requirements	Project deliverables are generally produced on time and within budget	Projects always deliver the business value it promises	The time, cost, quality and scope constraints are usually managed as planned	Projects ultimately provide satisfactory return on investment to the customer	Lack of user involvement	Long or unrealistic timescales	Failure to adequately identify, document and track requirements	Scope creep	No formal change control system	Inadequately trained or inexperienced project managers	No Quality Control process	No Quality Assurance process
Spearman's rho	Projects are selected in line with business goals	Correlation Coefficient	1,000																								
		Sig. (2-tailed)																									
		N	57																								
	Project outcomes are clearly defined by the client	Correlation Coefficient	.315*	1,000																							
		Sig. (2-tailed)	0,018																								
		N	56	57																							
	The client determines project success by measuring project outcomes	Correlation Coefficient	.326*	.574**	1,000																						
		Sig. (2-tailed)	0,013	0,000																							
		N	57	57	58																						
	There is continuous surveillance from the project ow ner through the life of the project	Correlation Coefficient	.336*	.399**	.427**	1,000																					
		Sig. (2-tailed)	0,011	0,002	0,001																						
		N	57	57	58	58																					
	Project ow ners are equipped w ith the skills to analyse business requirements w hen defining	Correlation Coefficient	0,132	.400**	.606**	.414**	1,000																				
		Sig. (2-tailed)	0,329	0,002	0,000	0,001																					
		N	57	57	58	58	58																				
	The Transnet concept of project management is clearly defined and understood	Correlation Coefficient	0,240	.315*	0,171	.299*	0,182	1,000																			
		Sig. (2-tailed)	0,072	0,018	0,203	0,024	0,176																				
		N	57	56	57	57	57	57																			
	Cultural and ethical differences are a recurring problem	Correlation Coefficient	-0,192	0,155	0,033	0,257	0,163	0,043	1,000																		
		Sig. (2-tailed)	0,152	0,249	0,808	0,052	0,221	0,750																			
		N	57	57	58	58	58	57	58																		
	Quality aw areness is conducted throughout the organisation	Correlation Coefficient	.316*	.572**	.281*	.486**	.283*	.324*	0,164	1,000																	
		Sig. (2-tailed)	0,017	0,000	0,033	0,000	0,031	0,014	0,218																		
		N	57	57	58	58	58	57	58	58																	
	Project managers are appointed at the concept stage of the project	Correlation Coefficient	-0,133	0,030	0,039	0,217	0,165	0,081	-0,018	0,169	1,000																
		Sig. (2-tailed)	0,325	0,825	0,771	0,102	0,216	0,549	0,893	0,204																	
		N	57	57	58	58	58	57	58	58	58																
	The project manager is involved in the project selection process	Correlation Coefficient	0,010	0,245	0,078	.377**	0,118	0,109	0,046	0,254	.560**	1,000															
		Sig. (2-tailed)	0,944	0,068	0,566	0,004	0,382	0,426	0,733	0,057	0,000																
		N	56	56	57	57	57	56	57	57	57	57															
	Project results have a strategic fit in the design and execution of future products and services	Correlation Coefficient	.288*	.274*	.431**	.461**	.359**	0,077	0,244	.367**	0,213	0,188	1,000														
		Sig. (2-tailed)	0,030	0,039	0,001	0,000	0,006	0,569	0,065	0,005	0,109	0,161															
		N	57	57	58	58	58	57	58	58	58	57	58														
	Projects are selected in line w ith business grow th and expansion strategies	Correlation Coefficient	.346**	.290*	.343**	.390**	.384**	0,218	0,134	.368**	0,161	0,231	.516**	1,000													
		Sig. (2-tailed)	0,008	0,029	0,008	0,003	0,003	0,103	0,315	0,005	0,228	0,084	0,000														
		N	57	57	58	58	58	57	58	58	58	57	58	58													
	The principles of project management are applied uniformly irrespective of the size of the project	Correlation Coefficient	-0,159	.454**	0,215	0,221	.442**	.459**	.339**	0,237	.291*	.276*	0,142	.316*	1,000												
		Sig. (2-tailed)	0,238	0,000	0,105	0,096	0,001	0,000	0,009	0,074	0,027	0,037	0,287	0,016													
		N	57	57	58	58	58	57	58	58	58	57	58	58	58												
	The project usually satisfies the business operational requirements	Correlation Coefficient	.289*	.428**	.368**	.354**	.324*	0,188	0,062	.390**	0,193	0,238	.375**	.599**	.401**	1,000											
		Sig. (2-tailed)	0,029	0,001	0,004	0,006	0,013	0,161	0,642	0,002	0,147	0,074	0,004	0,000	0,002												
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58											
	Project deliverables are generally produced on time and w ithin budget	Correlation Coefficient	-0,107	0,195	0,253	0,065	0,109	0,140	0,078	0,001	0,091	0,144	-0,025	-0,001	.347**	0,073	1,000										
		Sig. (2-tailed)	0,428	0,146	0,055	0,628	0,414	0,300	0,559	0,994	0,496	0,284	0,852	0,991	0,008	0,586											
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58										
	Projects alw ays deliver the business value it promises	Correlation Coefficient	0,144	.305*	.273*	.267*	.446**	.384**	0,143	.265*	.313*	0,199	0,187	.449**	.380**	.431**	.357**	1,000										
		Sig. (2-tailed)	0,285	0,021	0,038	0,043	0,000	0,003	0,284	0,044	0,017	0,138	0,159	0,000	0,003	0,001	0,006										
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58									
	The time, cost, quality and scope constraints are usually managed as planned	Correlation Coefficient	0,173	.306*	0,230	0,236	0,188	.328*	0,242	0,251	0,218	0,200	0,186	0,204	.417**	0,254	.553**	.668**	1,000								
		Sig. (2-tailed)	0,197	0,021	0,083	0,075	0,157	0,013	0,067	0,058	0,100	0,137	0,162	0,125	0,001	0,055	0,000	0,000									
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58								
	Projects ultimately provide satisfactory return on investment to the customer	Correlation Coefficient	0,118	.326*	.309*	.339**	.449**	0,200	0,153	.263*	.280*	.291*	.377**	.410**	.427**	.514**	0,189	.446**	.419**	1,000							
		Sig. (2-tailed)	0,383	0,013	0,018	0,009	0,000	0,135	0,251	0,046	0,033	0,028	0,004	0,001	0,001	0,000	0,156	0,000	0,001								
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58							
	Lack of user involvement	Correlation Coefficient	0,058	0,138	-0,098	-0,044	-0,144	0,050	0,010	0,105	0,015	-0,099	0,065	0,000	0,048	0,000	-0,046	-0,207	0,012	-0,130	1,000						
		Sig. (2-tailed)	0,670	0,305	0,463	0,742	0,280	0,710	0,942	0,431	0,909	0,463	0,627	0,997	0,721	0,997	0,732	0,120	0,932	0,333							
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58						
	Long or unrealistic timescales	Correlation Coefficient	0,072	-.292*	-0,110	0,038	-0,011	0,110	-0,006	0,051	0,023	-0,191	0,109	0,078	0,039	0,030	-0,119	-0,170	-0,025	0,110	0,220	1,000					
		Sig. (2-tailed)	0,596	0,027	0,410	0,779	0,936	0,415	0,964	0,706	0,866	0,155	0,414	0,561	0,772	0,822	0,372	0,202	0,854	0,412	0,097						
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58	58					
	Failure to adequately identify, document and track requirements	Correlation Coefficient	0,075	-0,219	-0,045	-0,017	-0,091	0,040	-0,063	-0,170	-0,081	0,035	0,097	-0,057	0,053	-0,141	0,137	-.307*	-0,110	-0,159	.434**	.456**	1,000				
		Sig. (2-tailed)	0,578	0,101	0,740	0,898	0,495	0,769	0,636	0,202	0,545	0,797	0,469	0,672	0,693	0,292	0,306	0,019	0,411	0,233	0,001	0,000					
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58	58	58				
	Scope creep	Correlation Coefficient	0,177	-0,034	-0,105	0,159	-0,164	0,116	0,042	0,094	0,040	-0,005	0,105	0,045	-0,002	-0,044	-0,007	-0,008	0,195	-0,008	.369**	.387**	0,235	1,000			
		Sig. (2-tailed)	0,193	0,806	0,435	0,239	0,223	0,396	0,756	0,488	0,767	0,969	0,435	0,739	0,988	0,745	0,961	0,952	0,146	0,952	0,005	0,003	0,079				
		N	56	56	57	57	57	56	57	57	57	56	57	57	57	57	57	57	57	57	57	57	57	57			
	No formal change control system	Correlation Coefficient	0,033	0,070	0,079	-0,083	0,019	0,056	0,223	0,001	0,113	0,039	0,039	0,111	0,210	0,065	0,224	0,139	.288*	0,197	0,066	-0,089	-0,010	.281*	1,000		
		Sig. (2-tailed)	0,812	0,605	0,559	0,540	0,889	0,683	0,095	0,997	0,404	0,778	0,772	0,412	0,117	0,630	0,094	0,302	0,030	0,142	0,627	0,512	0,942	0,036			
		N	56	57	57	57	57	56	57	57	57	56	57	57	57	57	57	57	57	57	57	57	57	56	57		
	Inadequately trained or inexperienced project managers	Correlation Coefficient	-0,017	-0,009	-0,145	-0,244	-0,216	-0,117	0,096	-0,046	-0,202	.378*	-0,139	-0,181	-0,003	-0,154	0,253	-0,144	0,199	-0,151	0,236	0,060	0,055	0,219	0,255	1,000	
		Sig. (2-tailed)	0,902	0,950	0,277	0,064	0,103	0,387	0,473	0,730	0,128	0,004	0,299	0,174	0,980	0,249	0,056	0,282	0,134	0,256	0,074	0,654	0,683	0,101	0,055		
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58	58	58	57	57	58	
	No Quality Control process	Correlation Coefficient	-0,049	0,152	-0,027	-0,044	-0,083	0,058	0,232	0,133	-0,087	-0,026	-0,045	-0,114	0,223	0,091	0,156	-0,008	0,091	-0,037	0,152	0,026	0,156	0,237	.303*	.373**	1,000
		Sig. (2-tailed)	0,719	0,258	0,840	0,746	0,535	0,670	0,080	0,321	0,517	0,846	0,738	0,394	0,092	0,498	0,241	0,954	0,496	0,782	0,255	0,845	0,242	0,076	0,022	0,004	
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58	58	58	57	57	58	58
	No Quality Assurance process	Correlation Coefficient	0,040	0,090	-0,011	-0,064	-0,042	-0,047	0,156	0,168	-0,055	-0,007	0,100	0,011	0,062	0,057	-0,043	0,029	0,087	-0,004	0,214	0,107	0,202	.282*	.282*	0,224	.809**	1,000
		Sig. (2-tailed)	0,767	0,507	0,935	0,632	0,754	0,730	0,244	0,207	0,683	0,961	0,453	0,936	0,645	0,673	0,746	0,827	0,518	0,976	0,106	0,426	0,129	0,034	0,033	0,091	0,000	
		N	57	57	58	58	58	57	58	58	58	57	58	58	58	58	58	58	58	58	58	58	58	57	57	58	58	58

			Q4: Strategic Alignment			Q5: Culture, Skills and Capabilities				
			Projects are selected in line w ith business goals	Project outcomes are clearly defined by the client	The client determines project success by measuring project outcomes	There is continuous surveillance from the project ow ner through the life of the project	Project ow ners are equipped w ith the skills to analyse business requirements w hen defining project outcomes	The Transnet concept of project managemen t is clearly defined and understood	Cultural and ethical differences are a recurring problem	Quality aw areness is conducted throughout the organisation
Spearman's rho	Projects are selected in line w ith business goals	Correlation Coefficient	1,000							
		Sig. (2-tailed)								
		N	57							
	Project outcomes are clearly defined by the client	Correlation Coefficient	.315*	1,000						
		Sig. (2-tailed)	0,018							
		N	56	57						
	The client determines project success by measuring project outcomes	Correlation Coefficient	.326*	.574**	1,000					
		Sig. (2-tailed)	0,013	0,000						
		N	57	57	58					
	There is continuous surveillance from the project ow ner through the life of the project	Correlation Coefficient	.336*	.399**	.427**	1,000				
		Sig. (2-tailed)	0,011	0,002	0,001					
		N	57	57	58	58				
	Project ow ners are equipped w ith the skills to analyse business requirements w hen defining	Correlation Coefficient	0,132	.400**	.606**	.414**	1,000			
		Sig. (2-tailed)	0,329	0,002	0,000	0,001				
		N	57	57	58	58	58			
	The Transnet concept of project management is clearly defined and understood	Correlation Coefficient	0,240	.315*	0,171	.299*	0,182	1,000		
		Sig. (2-tailed)	0,072	0,018	0,203	0,024	0,176			
		N	57	56	57	57	57	57		
	Cultural and ethical differences are a recurring problem	Correlation Coefficient	-0,192	0,155	0,033	0,257	0,163	0,043	1,000	
		Sig. (2-tailed)	0,152	0,249	0,808	0,052	0,221	0,750		
		N	57	57	58	58	58	57	58	
	Quality aw areness is conducted throughout the organisation	Correlation Coefficient	.316*	.572**	.281*	.486**	.283*	.324*	0,164	1,000
		Sig. (2-tailed)	0,017	0,000	0,033	0,000	0,031	0,014	0,218	
		N	57	57	58	58	58	57	58	58
	Project managers are appointed at the concept stage of the project	Correlation Coefficient	-0,133	0,030	0,039	0,217	0,165	0,081	-0,018	0,169
		Sig. (2-tailed)	0,325	0,825	0,771	0,102	0,216	0,549	0,893	0,204
		N	57	57	58	58	58	57	58	58
	The project manager is involved in the project selection process	Correlation Coefficient	0,010	0,245	0,078	.377**	0,118	0,109	0,046	0,254
		Sig. (2-tailed)	0,944	0,068	0,566	0,004	0,382	0,426	0,733	0,057
		N	56	56	57	57	57	56	57	57
	Project results have a strategic fit in the design and execution of future products and services	Correlation Coefficient	.288*	.274*	.431**	.461**	.359**	0,077	0,244	.367**
		Sig. (2-tailed)	0,030	0,039	0,001	0,000	0,006	0,569	0,065	0,005
		N	57	57	58	58	58	57	58	58
	Projects are selected in line w ith business grow th and expansion strategies	Correlation Coefficient	.346**	.290*	.343**	.390**	.384**	0,218	0,134	.368**
		Sig. (2-tailed)	0,008	0,029	0,008	0,003	0,003	0,103	0,315	0,005
		N	57	57	58	58	58	57	58	58
	The principles of project management are applied uniformly irrespective of the size of the project	Correlation Coefficient	-0,159	.454**	0,215	0,221	.442**	.459**	.339**	0,237
		Sig. (2-tailed)	0,238	0,000	0,105	0,096	0,001	0,000	0,009	0,074
		N	57	57	58	58	58	57	58	58
	The project usually satisfies the business operational requirements	Correlation Coefficient	.289*	.428**	.368**	.354**	.324*	0,188	0,062	.390**
		Sig. (2-tailed)	0,029	0,001	0,004	0,006	0,013	0,161	0,642	0,002
		N	57	57	58	58	58	57	58	58
	Project deliverables are generally produced on time and w ithin budget	Correlation Coefficient	-0,107	0,195	0,253	0,065	0,109	0,140	0,078	0,001
		Sig. (2-tailed)	0,428	0,146	0,055	0,628	0,414	0,300	0,559	0,994
		N	57	57	58	58	58	57	58	58
	Projects alw ays deliver the business value it promises	Correlation Coefficient	0,144	.305*	.273*	.267*	.446**	.384**	0,143	.265*
		Sig. (2-tailed)	0,285	0,021	0,038	0,043	0,000	0,003	0,284	0,044
		N	57	57	58	58	58	57	58	58
	The time, cost, quality and scope constraints are usually managed as planned	Correlation Coefficient	0,173	.306*	0,230	0,236	0,188	.328*	0,242	0,251
		Sig. (2-tailed)	0,197	0,021	0,083	0,075	0,157	0,013	0,067	0,058
		N	57	57	58	58	58	57	58	58
	Projects ultimately provide satisfactory return on investment to the customer	Correlation Coefficient	0,118	.326*	.309*	.339**	.449**	0,200	0,153	.263*
		Sig. (2-tailed)	0,383	0,013	0,018	0,009	0,000	0,135	0,251	0,046
		N	57	57	58	58	58	57	58	58
	Lack of user involvement	Correlation Coefficient	0,058	0,138	-0,098	-0,044	-0,144	0,050	0,010	0,105
		Sig. (2-tailed)	0,670	0,305	0,463	0,742	0,280	0,710	0,942	0,431
		N	57	57	58	58	58	57	58	58
	Long or unrealistic timescales	Correlation Coefficient	0,072	-.292*	-0,110	0,038	-0,011	0,110	-0,006	0,051
		Sig. (2-tailed)	0,596	0,027	0,410	0,779	0,936	0,415	0,964	0,706
		N	57	57	58	58	58	57	58	58
	Failure to adequately identify, document and track requirements	Correlation Coefficient	0,075	-0,219	-0,045	-0,017	-0,091	0,040	-0,063	-0,170
		Sig. (2-tailed)	0,578	0,101	0,740	0,898	0,495	0,769	0,636	0,202
		N	57	57	58	58	58	57	58	58
	Scope creep	Correlation Coefficient	0,177	-0,034	-0,105	0,159	-0,164	0,116	0,042	0,094
		Sig. (2-tailed)	0,193	0,806	0,435	0,239	0,223	0,396	0,756	0,488
		N	56	56	57	57	57	56	57	57
	No formal change control system	Correlation Coefficient	0,033	0,070	0,079	-0,083	0,019	0,056	0,223	0,001
		Sig. (2-tailed)	0,812	0,605	0,559	0,540	0,889	0,683	0,095	0,997
		N	56	57	57	57	57	56	57	57
	Inadequately trained or inexperienced project managers	Correlation Coefficient	-0,017	-0,009	-0,145	-0,244	-0,216	-0,117	0,096	-0,046
		Sig. (2-tailed)	0,902	0,950	0,277	0,064	0,103	0,387	0,473	0,730
		N	57	57	58	58	58	57	58	58
	No Quality Control process	Correlation Coefficient	-0,049	0,152	-0,027	-0,044	-0,083	0,058	0,232	0,133
		Sig. (2-tailed)	0,719	0,258	0,840	0,746	0,535	0,670	0,080	0,321
		N	57	57	58	58	58	57	58	58
	No Quality Assurance process	Correlation Coefficient	0,040	0,090	-0,011	-0,064	-0,042	-0,047	0,156	0,168
		Sig. (2-tailed)	0,767	0,507	0,935	0,632	0,754	0,730	0,244	0,207
		N	57	57	58	58	58	57	58	58

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

			Q6: Project Selection					Q7: Project Outcomes				
			Project managers are appointed at the concept stage of the project	The project manager is involved in the project selection process	Project results have a strategic fit in the design and execution of future products and services	Projects are selected in line with business growth and expansion strategies	The principles of project managemen tt are applied uniformly irrespective of the size of the project	The project usually satisfies the business operational requirement s	Project deliverables are generally produced on time and within budget	Projects always deliver the business value it promises	The time, cost, quality and scope constraints are usually managed as planned	Projects ultimately provide satisfactory return on investment to the customer
Spearman's rho	Projects are selected in line w ith business goals	Correlation Coefficient										
	The project manager is involved in the project selection process	Correlation Coefficient	.560**	1,000								
		Sig. (2-tailed)	0,000									
		N	57	57								
	Project results have a strategic fit in the design and execution of future products and services	Correlation Coefficient	0,213	0,188	1,000							
		Sig. (2-tailed)	0,109	0,161								
		N	58	57	58							
	Projects are selected in line w ith business grow th and expansion strategies	Correlation Coefficient	0,161	0,231	.516**	1,000						
		Sig. (2-tailed)	0,228	0,084	0,000							
		N	58	57	58	58						
	The principles of project management are applied uniformly irrespective of the size of the project	Correlation Coefficient	.291*	.276*	0,142	.316*	1,000					
		Sig. (2-tailed)	0,027	0,037	0,287	0,016						
		N	58	57	58	58	58					
	The project usually satisfies the business operational requirements	Correlation Coefficient	0,193	0,238	.375**	.599**	.401**	1,000				
		Sig. (2-tailed)	0,147	0,074	0,004	0,000	0,002					
		N	58	57	58	58	58	58				
	Project deliverables are generally produced on time and w ithin budget	Correlation Coefficient	0,091	0,144	-0,025	-0,001	.347**	0,073	1,000			
		Sig. (2-tailed)	0,496	0,284	0,852	0,991	0,008	0,586				
		N	58	57	58	58	58	58	58			
	Projects alw ays deliver the business value it promises	Correlation Coefficient	.313*	0,199	0,187	.449**	.380**	.431**	.357**	1,000		
		Sig. (2-tailed)	0,017	0,138	0,159	0,000	0,003	0,001	0,006			
		N	58	57	58	58	58	58	58	58		
	The time, cost, quality and scope constraints are usually managed as planned	Correlation Coefficient	0,218	0,200	0,186	0,204	.417**	0,254	.553**	.668**	1,000	
		Sig. (2-tailed)	0,100	0,137	0,162	0,125	0,001	0,055	0,000	0,000		
		N	58	57	58	58	58	58	58	58	58	
	Projects ultimately provide satisfactory return on investment to the customer	Correlation Coefficient	.280*	.291*	.377**	.410**	.427**	.514**	0,189	.446**	.419**	1,000
		Sig. (2-tailed)	0,033	0,028	0,004	0,001	0,001	0,000	0,156	0,000	0,001	
		N	58	57	58	58	58	58	58	58	58	58
	Lack of user involvement	Correlation Coefficient	0,015	-0,099	0,065	0,000	0,048	0,000	-0,046	-0,207	0,012	-0,130
		Sig. (2-tailed)	0,909	0,463	0,627	0,997	0,721	0,997	0,732	0,120	0,932	0,333
		N	58	57	58	58	58	58	58	58	58	58
	Long or unrealistic timescales	Correlation Coefficient	0,023	-0,191	0,109	0,078	0,039	0,030	-0,119	-0,170	-0,025	0,110
		Sig. (2-tailed)	0,866	0,155	0,414	0,561	0,772	0,822	0,372	0,202	0,854	0,412
		N	58	57	58	58	58	58	58	58	58	58
	Failure to adequately identify, document and track requirements	Correlation Coefficient	-0,081	0,035	0,097	-0,057	0,053	-0,141	0,137	-.307*	-0,110	-0,159
		Sig. (2-tailed)	0,545	0,797	0,469	0,672	0,693	0,292	0,306	0,019	0,411	0,233
		N	58	57	58	58	58	58	58	58	58	58
	Scope creep	Correlation Coefficient	0,040	-0,005	0,105	0,045	-0,002	-0,044	-0,007	-0,008	0,195	-0,008
		Sig. (2-tailed)	0,767	0,969	0,435	0,739	0,988	0,745	0,961	0,952	0,146	0,952
		N	57	56	57	57	57	57	57	57	57	57
	No formal change control system	Correlation Coefficient	0,113	0,039	0,039	0,111	0,210	0,065	0,224	0,139	.288*	0,197
		Sig. (2-tailed)	0,404	0,778	0,772	0,412	0,117	0,630	0,094	0,302	0,030	0,142
		N	57	56	57	57	57	57	57	57	57	57
	Inadequately trained or inexperienced project managers	Correlation Coefficient	-0,202	-.378**	-0,139	-0,181	-0,003	-0,154	0,253	-0,144	0,199	-0,151
		Sig. (2-tailed)	0,128	0,004	0,299	0,174	0,980	0,249	0,056	0,282	0,134	0,256
		N	58	57	58	58	58	58	58	58	58	58
	No Quality Control process	Correlation Coefficient	-0,087	-0,026	-0,045	-0,114	0,223	0,091	0,156	-0,008	0,091	-0,037
		Sig. (2-tailed)	0,517	0,846	0,738	0,394	0,092	0,498	0,241	0,954	0,496	0,782
		N	58	57	58	58	58	58	58	58	58	58
	No Quality Assurance process	Correlation Coefficient	-0,055	-0,007	0,100	0,011	0,062	0,057	-0,043	0,029	0,087	-0,004
		Sig. (2-tailed)	0,683	0,961	0,453	0,936	0,645	0,673	0,746	0,827	0,518	0,976
		N	58	57	58	58	58	58	58	58	58	58

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

			Q8: Reasons for failure							
			Lack of user involvement	Long or unrealistic timescales	Failure to adequately identify, document and track requirements	Scope creep	No formal change control system	Inadequately trained or inexperienced project managers	No Quality Control process	No Quality Assurance process
Spearman's rho	Projects are selected in line with business goals	Correlation Coefficient								
	Long or unrealistic timescales	Correlation Coefficient	0,220	1,000						
		Sig. (2-tailed)	0,097							
		N	58	58						
	Failure to adequately identify, document and track requirements	Correlation Coefficient	.434**	.456**	1,000					
		Sig. (2-tailed)	0,001	0,000						
		N	58	58	58					
	Scope creep	Correlation Coefficient	.369**	.387**	0,235	1,000				
		Sig. (2-tailed)	0,005	0,003	0,079					
		N	57	57	57	57				
	No formal change control system	Correlation Coefficient	0,066	-0,089	-0,010	.281*	1,000			
		Sig. (2-tailed)	0,627	0,512	0,942	0,036				
		N	57	57	57	56	57			
	Inadequately trained or inexperienced project managers	Correlation Coefficient	0,236	0,060	0,055	0,219	0,255	1,000		
		Sig. (2-tailed)	0,074	0,654	0,683	0,101	0,055			
		N	58	58	58	57	57	58		
	No Quality Control process	Correlation Coefficient	0,152	0,026	0,156	0,237	.303*	.373**	1,000	
		Sig. (2-tailed)	0,255	0,845	0,242	0,076	0,022	0,004		
		N	58	58	58	57	57	58	58	
	No Quality Assurance process	Correlation Coefficient	0,214	0,107	0,202	.282*	.282*	0,224	.809**	1,000
		Sig. (2-tailed)	0,106	0,426	0,129	0,034	0,033	0,091	0,000	
		N	58	58	58	57	57	58	58	58
*. Correlation is significant at the 0.05 level (2-tailed).										
**. Correlation is significant at the 0.01 level (2-tailed).										

Appendix H: Summarised Cross Tabulations

Crosstab		Designation											Total
Projects are selected in line with business goals		Construction Manager	Engineering	Executive Manager	General Manager	Project Director	Project Manager	Quality Manager	Quality Officer	Quantity Survey	Senior Project Manager	Site Supervisor	
Disagree	Count	0	0	0	2	0	0	0	0	0	0	0	2
	% within Designation	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	3,5%
Neither Agree Nor Disagree	Count	1	0	0	0	0	2	0	0	0	0	0	3
	% within Designation	16,7%	0,0%	0,0%	0,0%	0,0%	20,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5,3%
Agree	Count	4	7	4	0	0	6	1	4	0	7	1	34
	% within Designation	66,7%	70,0%	80,0%	0,0%	0,0%	60,0%	25,0%	100,0%	0,0%	77,8%	33,3%	59,6%
Strongly agree	Count	1	3	1	0	3	2	3	0	1	2	2	18
	% within Designation	16,7%	30,0%	20,0%	0,0%	100,0%	20,0%	75,0%	0,0%	100,0%	22,2%	66,7%	31,6%
Total	Count	6	10	5	2	3	10	4	4	1	9	3	57
	% within Designation	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	82.362[a]	30	0,000	.[b]		
Likelihood Ratio	43,208	30	0,056	0,006		
Fisher's Exact Test	40,889			0,011		
Linear-by-Linear Association	1.251[c]	1	0,263	0,269	0,141	0,013
N of Valid Cases	57					

a. 41 cells (93.2%) have expected count less than 5. The minimum expected count is .04.

b. Cannot be computed because there is insufficient memory.

c. The standardized statistic is 1.119.

Appendix I: Coal 81 Primavera Report

Cost Code	Project Name	Original Commitment (R)	Approved Compensation Events	Revised Commitment (R)
34-X-01-C-01	Saaiwater - Direct costs	69 473 380,62	16 931 122,22	86 404 502,84
34-X-01-C-03	External Consultants	548 550,00	-17 218,00	531 332,00
34-X-02-C-01	Blackhill - Direct costs	58 903 033,18	3 631 718,00	62 534 751,18
34-X-02-C-03	External Consultants	258 510,00	-18 490,00	240 020,00
34-X-03-C-01	Ermelo Staging Area 19E & C Yards	417 708,75	87 932,47	505 641,22
34-X-03-C-03	External Consultants	402 434,00	-30 425,00	372 009,00
34-X-04-C-01	Ogies Re-fuelling - Direct Costs	102 999 100,20	-5 657 455,93	97 341 644,27
34-X-04-C-03	External Consultants	384 200,00	-28 460,00	355 740,00
34-X-04-C-04	Environmental Cost	782 050,00	-394 363,50	387 686,50
34-X-06-C-01	R/Bay Turnaround - Direct Costs	37 870 352,74	1 387 412,36	39 257 765,10
34-X-06-C-03	External Consultants	810 600,00	0,00	810 600,00
34-X-06-C-04	Environmental Cost	165 000,00	0,00	165 000,00
34-X-08-C-01	Vryheid East Yard - Direct Costs	93 521 369,83	-3 173 439,66	90 347 930,17
34-X-08-C-03	External Consultants	924 720,00	10 925,00	935 645,00
34-X-11-C-01	DC Substation Leeufontein Direct C	28 105 487,20	-7 466 757,13	20 638 730,07
34-X-11-C-03	External Consultants	73 887,50	5 840,00	79 727,50
34-X-11-C-04	Environmental Cost	777 200,00	-84 000,00	693 200,00
34-X-12-C-01	DC Substation Woestalleen Direct C	13 667 994,02	2 259 618,61	15 927 612,63
34-X-12-C-03	External Consultants	76 887,50	5 840,00	82 727,50
34-X-12-C-04	Environmental Cost	357 775,00	262 495,00	620 270,00
34-X-13-C-01	DC Substation Bosmanskop - Direct	13 667 994,02	4 286 426,85	17 954 420,87
34-X-13-C-03	External Consultants	77 137,50	5 840,00	82 977,50
34-X-13-C-04	Environmental Cost	550 400,00	149 625,00	700 025,00
34-X-14-C-01	DC Substation Rietkuil Direct Cost	28 641 347,96	-6 745 325,92	21 896 022,04
34-X-14-C-03	External Consultants	74 137,50	5 840,00	79 977,50
34-X-14-C-04	Environmental Cost	826 100,00	-181 180,00	644 920,00
34-X-15-C-01	Blackhill Traction Sub Direct Cost	9 658 313,97	-1 254 224,85	8 404 089,12
34-X-16-C-01	Upgrade Ogies Traction - Direct Costs	18 678 947,06	-2 763 529,84	15 915 417,22
34-X-17-C-01	Broodsnyersplaas Trans Direct Cost	12 041 366,17	2 855 136,94	14 896 503,11
34-X-18-C-01	Hamelfontein Trans Direct Costs	8 987 365,00	2 495 977,42	11 483 342,42
34-X-19-C-01	Rietvleirus Trans Direct Cost	17 703 153,00	17 218 500,19	34 921 653,19
34-X-21-C-01	Kameel to Savan Direct Costs	13 923 542,14	-1 144 248,94	12 779 293,20
34-X-21-C-03	External Consultants	123 188,00	0,00	123 188,00
34-X-23-C-01	Sheepmor New Traction Direct Cost	33 248 253,66	1 052 992,61	34 301 246,27
34-X-23-C-03	External Consultants	126 600,00	0,00	126 600,00
34-X-24-C-01	Vryheid New Traction Direct Costs	33 571 092,32	1 003 449,02	34 574 541,34
34-X-25-C-01	EnGogweni Up Subst Direct Costs	12 657 546,96	703 927,73	13 361 474,69
34-X-26-C-01	Dumbe up Substation Direct Cost	13 263 344,80	1 793 302,98	15 056 647,78
34-X-27-C-01	Blinkpan Subst Upgr 6-9 MW Direct	15 348 505,08	-845 592,07	14 502 913,01
34-X-31-C-01	Specific Security Enabling Direct	15 984 876,86	332 709,99	16 317 586,85
34-X-41-C-01	Broodsny- Geluksplaas- Direct Cost	35 845 818,04	2 383 387,05	38 229 205,09
34-X-42-C-01	Halfgewonnen to Midpt Direct Costs	64 225 734,02	4 475 104,38	68 700 838,40
34-X-43-C-01	Rietvleirus - Ermelo - Direct Cost	60 480 002,53	4 298 387,26	64 778 389,79
34-X-44-C-01	Kameel to Sav Feeder Wire Direct	6 838 698,65	295 709,84	7 134 408,49
34-X-50-C-01	New Condit Monitor Direct Cost	14 099 095,84	439 706,80	14 538 802,64
34-X-53-C-01	Nsezi Sub Direct Cost	18 525 218,37	1 354 308,12	19 879 526,49
Log Totals:		**859 688 019,99**	**39 928 525,00**	**899 616 544,99**

Appendix J: Overvaal Primavera Report

Cost Code	Project Name	Original Commitmen	Approved Compensation Events	Revised Commitment (R)
34-X-01-C	External Consultants	24 044 450,00	1 481 696,30	25 526 146,30
34-X-02-C	EPCM	6 500 000,00	0,00	6 500 000,00
34-X-03-C	Container	143 790,00	0,00	143 790,00
34-X-04-C	Contingency	0,00	0,00	0,00
Log Totals:		**30 688 240,00**	**1 481 696,30**	**32 169 936,30**