A CONCEPTUAL INFORMATION TECHNOLOGY PROJECT MANAGEMENT ASSURANCE FRAMEWORK

by

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THESIS

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DECLARATION

I certify that the *thesis* submitted by me for the degree *Doctor of Philosophy (Information Technology Management)* at the University of Johannesburg is my independent work and has not been submitted by me for a degree at another university.

ELIZABETH SYLVESTER MKOBA

ABSTRACT

Most organisations continue to align project activities with their business strategy to achieve strategic objectives and create business value. Most of these organisations have adopted information technology (IT) to increase performance and productivity, improve service delivery to customers and create competitive advantage in the market. Some of these initiatives are managed as IT projects. Despite this investment in IT, IT projects still fail at an alarming rate. These failed IT projects resulted in organisations wasting huge amounts of money and not realising a return on their IT investments.

The purpose of this study was fourfold. Firstly, it explored the reasons why information technology (IT) projects are still failing. Secondly, it determined the factors influencing project success. Thirdly, it determined whether a positive relationship between project auditing and project success exists. Fourthly, it examined how project assurance can effectively mitigate IT project failure. These focus areas were addressed by developing a conceptual information technology project management assurance framework to successfully deliver IT projects in organisations.

The research methodology employed a mixed-methods design which combined both qualitative and quantitative research methods. First, the qualitative research method was used to validate the conceptual framework through focus group discussion which was composed of IT project managers from South Africa. The results of qualitative data analysis were used to build an instrument to collect data in the follow-up quantitative research. The quantitative research method used survey questionnaires to validate the conceptual framework amongst IT project managers from Africa. The data were analysed using Atlas.ti 7.0 and SPSS 24.0. Factor analysis was conducted to determine possible correlations between the variables and factors as well as to determine how the conceptual information technology project management assurance framework fits the data. Structural Equation Modelling (SEM) was used to construct the conceptual framework.

The key findings of this research are that project assurance can effectively mitigate IT project failure and the following factors influence IT project success: project auditing, top management involvement, project management methodology adherence, secure project deliverables, support and maintenance, and benefits realisation. The research also reveals that there is a strong correlation between the identified factors that influence IT project success. These factors were important in the development of a conceptual information technology project management assurance framework.

The unique value of this research is it provides a conceptual information technology project management assurance framework. Project managers are still battling to manage and deliver successful IT projects in organisations. The value of the framework is that it can assist project management practitioners to deliver successful IT projects in their organisations. Project governance boards can also use the conceptual information technology project management assurance framework as a guide to conduct project assurance reviews. The framework has IT project assurance processes which can assist the project governance board to assess whether organisations are doing things right in order to deliver successful IT projects.

Furthermore, the value of the framework is that it assists organisation's realising return on IT investment. Failed IT projects cause organisations to waste huge amounts of money. The effective utilisation of the conceptual information technology project management assurance framework can assist organisations in implementing successful IT projects. Successful IT projects enable organisations to achieve their strategic objectives and goals, create business value, increase performance and productivity, improve service delivery, create competitive advantage and realise return on investment (ROI).

This research contributes knowledge to the project management curriculum of the education and training institutions. These institutions can incorporate the concept of IT project assurance in their project management curriculum to create competent project assurance experts in the IT industry. Finally, none of the project management best practices and standards has provided guidance on project auditing and assurance. Therefore, the research value is the contribution to the body of knowledge with regards to project auditing and assurance.

Keywords: Project assurance, Project auditing, Project success, Project governance, Benefits realisation.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION AND BACKGROUND

Most organisations want to achieve greater efficiency, better value for money and improved customer satisfaction, and create strategic business value to sustain competitive advantage in the market. This pressure has led to the increased use of projects within different sectors and industries (Winter & Szczepanek, 2008). The increased use of projects has been evidenced by organisations continually aligning project activities with business strategy to achieve their strategic objectives and goals (Besner & Hobbs, 2006; Too & Weaver, 2014). Most of these organisations rely on information technology (IT)-enabled initiatives to increase performance and productivity, improve service delivery and create competitive advantage (Almajed & Mayhew, 2014; Jung, Valacich & Schneider, 2010; Marnewick & Labuschagne, 2009; Porter & Miller, 1985; Rayport & Jaworski, 2004). Some of these initiatives are often managed as IT projects (Gunasekaran et al., 2001; Marnewick & Labuschagne, 2009).

Literature indicates that organisations worldwide continue to invest in IT projects. For example, in 2017 the global IT spending was forecast to total US$3.5 trillion (a 2.4 percent increase from 2016) focusing on artificial intelligence, cloud computing platforms and digital business (Gartner Inc., 2017). Despite the growth in IT investment, IT projects still failed at an alarming rate (Marnewick, 2013; PMI Brazil survey, 2013; PMI India, 2014; Standish Group, 2016). These failed IT projects resulted in organisations wasting huge amounts of money and not realising the return on IT investment. According to PWC (2015), failed IT projects cost the world's largest 500 companies more than $14 billion a year. For example, in 2016 the CHAOS report, which studied 50000 IT projects worldwide, revealed that IT projects continued to fail as illustrated in table 1-1.

Table 1-1: Global state of IT projects (2011-2015)

Project type	2011	2012	2013	2014	2015
Successful	29%	27%	31%	28%	29%
Challenged	49%	56%	50%	55%	52%
Failed	22%	17%	19%	17%	19%

Source: CHAOS report (Standish Group, 2016)

Among the factors which contribute to the failure of IT projects are lack of top management support, poor communication among the members of project teams, lack of correct auditing processes, lack of change management strategy, lack of end-user(s) involvement in the project and inadequate project funding (Ahimbisibwe, Cavana & Daellenbach, 2015; Marnewick, 2013; Ramos & Mota, 2014; Shenhar, 2008; Sudhakar, 2012). As started earlier, the lack of correct auditing processes can lead to the failure of IT projects. However, the majority of project audits are based on ad hoc management requests rather than systematic auditing processes throughout the project life cycle (Huibers, Tie, Bolluijt & Coleman, 2015). PWC (2013b) suggests that active involvement of internal audits in projects help to ensure the project success.

In recent years, research studies reveal that a positive relationship between project auditing and project success exists (Marnewick & Erasmus, 2014; McDonald, 2002; Sichombo, Muya, Shakantu & Kaliba, 2009; Simon, 2011). Other studies propose that project assurance can be used to mitigate against project failure but is not effectively used. The utilisation of project assurance can also increase the success rate of IT projects (Berg, 2013; PWC, 2015; Tilk, 2002). However, the literature shows that there are limited research studies on project success through project assurance. Therefore, the goal of this research is to develop a conceptual information technology project management assurance framework.

The next section describes the research problem.

1.2 RESEARCH PROBLEM

The literature suggests that organisations continue to investment in IT projects (Gartner Inc., 2017, 2018). Despite this continuous investment, IT projects still fail at an alarmingly high rate (Marnewick, 2013; Standish Group, 2016). Due to these failures, organisations are not achieving their strategic objectives and a huge amount of money is wasted.

There are many factors contributing to IT project failure. Among these is the lack of IT project auditing processes throughout the IT project life cycle (Huibers et al., 2015; Labuschagne & Marnewick, 2008; Lehtinen at al., 2014; Marnewick, 2013; Marnewick & Erasmus, 2014; Ramos & Mota, 2014; Simon, 2011). Kutsch and Hall (2009) conducted a study on how risk management are applied in IT project. Their study reveals that project managers are not effectively applying risk management in the IT projects. Another research study conducted by McDonald (2002) reveals that project audits are not being utilised in an optimised manner to mitigate project failure. There are limited research studies on how project assurance can be effectively mitigate IT project failure. However, none of the project management best practices and standard provides guidance on project auditing and assurance (ISO 21500, 2013; Ohara, 2006; PMI, 2017; PMI Governance Guide, 2016).

Therefore, the research problem is that: *There is a lack of research studies on how project assurance can be effectively utilised to mitigate IT project failure and there is no IT project management assurance framework for the successful delivery of IT projects.*

The next section states the research question.

1.3 RESEARCH QUESTION

Based on the above research problem, the research question is: How can IT projects be continuously audited to increase the number of successful IT projects?

The next section discusses the scope of the research study.

1.4 RESEARCH SCOPE

The scope of this research study remains at project level and not at programme and portfolio level. The research focuses on IT project management in public and private sector organisations in Africa.

The next section discusses the research objectives.

1.5 RESEARCH OBJECTIVES

The goal of this research study is the development of a conceptual IT project management assurance framework. To attain this goal, the following are the research objectives:

1. Explore literature on project success and determine the factors influencing project success.
2. Investigate the existence of relationship between auditing and project success.
3. Explore literature and gain understanding on the concept of auditing.
4. Examine literature on auditing in information technology and establish its link to auditing.
5. Examine literature on project auditing and establish its link to auditing.
6. Explore literature on project assurance and develop a conceptual information technology project management assurance framework.
7. Investigate and select an appropriate research methodology and methods.
8. Design a data collection instrument, collect and analyse data, and interpret results.
9. Develop a final conceptual IT project management assurance framework.

The following section discusses the research methodology.

1.6 RESEARCH METHODOLOGY

According to Kothari (2004), a research methodology is a systematic way of solving a research problem. A research methodology describes how the research is to be carried out. The research philosophical assumptions guide the researcher in selecting the appropriate research approach.

1.6.1 Research Philosophy

The most common philosophical assumptions applied in research are positivism, interpretivism and critical realism (Hirschheim, Klein & Lyytinen, 1995; Mingers & Stowell, 1997; Mumford, Hirschheim, Fitzgerald & Wood-Harper, 1985; Myers & Klein, 2011; Orlikowski & Baroudi, 1991; Walsham, 1993, 1995a, 2006; Winder, Probert & Beeson, 1997). These research philosophies are described in table 1-2.

Table 1-2: Research philosophies used in research

Positivism	Interpretivism	Critical realism
• Positivist researchers believe that objective physical and social worlds exist independent of humans whose nature can be characterised and measured (Myers & Avison, 2002). • Most of the positivist research use the quantitative research approach (Alvesson & Skoldberg, 2009; Orlikowski & Baroudi, 1991; Popper, 1959; Straub, Gefen & Boudreau, 2005).	• Interpretivists believe that research is based on subjective assumptions about the social world on how knowledge can be obtained and shared (Orlikowski & Baroudi, 1991; Walsham, 1995a, 2006). • Most of the interpretivist research use qualitative research approach (Boland, 1991; Denzin & Lincoln, 2005; Klein & Myers, 1999; Remenyi, Williams, Money & Swartz, 1998; Walsham, 1993).	• Critical realists believe that all humans are biased and all studies conducted by human beings are inherently biased (Pather & Remenyi, 2004). • The critical realist research strives to resolve conflicts and contradictions in contemporary society. • Critical realist research uses the qualitative research approach (Hirschheim & Klein, 1994; Myers & Klein, 2011; Ngwenyama & Lee 1997).

Therefore, based on the research objectives and research philosophical assumptions, the interpretivist and positivist research philosophies are adopted in this research. The interpretivist philosophy is adopted because this research aims at validating the conceptual IT project management assurance framework through focus group interviews and collecting qualitative data. The positivist philosophy is adopted because this research intends to validate the conceptual framework into the large sample and collect quantitative data. The adopted research philosophy guides the researcher in selecting the appropriate research approach.

1.6.2 Research Approaches

There are three main approaches to research, namely qualitative, quantitative and mixed methods (Mingers, 2001; Kothari, 2004; Zikmund, Babin, Carr & Griffin, 2010:134).

a) *Qualitative research method:* A qualitative research method is an inductive approach and exploratory in nature which aims at gaining in-depth understanding of a phenomenon under enquiry (Kothari, 2004). The qualitative research approach has been used by interpretivists in Information System (IS) research.

b) *Quantitative research method:* A quantitative research approach involves measuring concepts which provide numeric values for statistical computation and hypothesis testing (Zikmund et al., 2010:135). The quantitative research approach has been used by positivists in IS research.

c) *Mixed methods:* Mixed methods use both quantitative and qualitative approaches in combination to provide a better understanding of research problems than either approach alone (Creswell, 2003). According to Creswell (2003), there are three basic mixed-methods designs, namely:

   (i) Convergence parallel mixed-methods design: This is a form of mixed-methods design in which both quantitative and qualitative data are concurrently collected and analysed separately. A researcher then compares and merges the quantitative and qualitative sets of results. The merged results are then interpreted to find out if the two data sets converge, diverge or relate to each other.

   (ii) Explanatory sequential mixed-methods design: This is a mixed-methods design which starts with the collection and analysis of quantitative data followed by designing a qualitative study based on quantitative results. The qualitative data are then collected and analysed. The qualitative results are interpreted.

   (iii) Exploratory sequential mixed-methods design: This is the reverse sequence from the explanatory sequential design. In the exploratory sequential approach, the researcher starts with collecting and analysing qualitative data. Then the qualitative results are used (i) to build an instrument that best fits the sample under study, (ii) to identify appropriate instruments to use in the follow-up quantitative phase, and (iii) to specify variables that need to go into a follow-up quantitative study. The quantitative data are collected and analysed, and followed by an interpretation of results.

The exploratory sequential mixed-methods design has been adopted to validate the conceptual information technology project management assurance framework because it provides a better understanding of the research problem than either approach alone. Qualitative and quantitative research methods used together produce more complete knowledge necessary to inform theory and practice. The use of the mixed-methods approach in this research overcomes the weaknesses in both methods. Using exploratory sequential mixed methods in the same research study provides multiple sources of data (i.e. triangulation) which increase the validity of the research findings.

1.7 RESEARCH VALUE

The unique value of this research is it provides a conceptual information technology project management assurance framework. The value of the framework is that it can assist project management practitioners to deliver successful IT projects in their organisations. Additionally, project governance board can use the conceptual information technology project management assurance framework as a guide to conduct project assurance reviews. The framework has IT project assurance processes which can assist the project governance board to assess whether organisations are doing things right in order to deliver successful IT projects.

Furthermore, the value of the framework is that it assists organisation's realising return on IT investment. Failed IT projects cause organisations to waste huge amounts of money. The effective utilisation of the conceptual information technology project management assurance framework can assist organisations in implementing successful IT projects. Successful IT projects enable organisations to achieve their strategic objectives and goals, create business value, increase performance and productivity, improve service delivery, create competitive advantage and realise return on investment (ROI).

This research contributes knowledge to the project management curriculum of the education and training institutions. These institutions can incorporate the concept of IT project assurance in their project management curriculum to create competent project assurance experts in the IT industry.

Finally, none of the project management best practices and standards have provided guidance on project auditing and assurance. Therefore, the research value is the contribution to the body of knowledge with regards to project auditing and assurance.

1.8 LAYOUT OF THE THESIS

This thesis is structured in seven sections, namely:

Section 1: Literature review

Section 1 consists of the following chapters:

Chapter 1 provides the introduction and background of the research, research problem and research question, research scope, research objectives, research methodology, research value and the thesis layout.

Chapter 2 provides the concept of auditing and the relationship between auditing, information technology (IT) auditing and project auditing.

Chapter 3 describes the causality between information technology project auditing and project success. The main objective is to determine whether a positive relationship between IT project auditing and project success exists.

Section 2: Development of a conceptual information technology project management assurance framework

Section 2 consists of the following chapters:

Chapter 4 develops a conceptual information technology project management assurance framework which can be used in both public and private sector organisations. The chapter also develops the high-level IT project assurance processes. The project assurance processes can be used in each project assurance gate review to ensure the successful delivery of the IT project.

Chapter 5 explains how to execute the IT project assurance review. The decision-making guide, which is used by the project governance, is described. The guide is used to determine whether to proceed to the next phase within the IT project life cycle. The flow charts for each IT project assurance review are also discussed.

Section 3: Research methodology and design

Section 3 consists of the following chapter:

Chapter 6 provides the research methodology to validate the conceptual information technology project management assurance framework. The research philosophical assumptions are discussed. The research approach and a research design process are also discussed.

Section 4: Results of qualitative data analysis

Section 4 consists of the following chapter:

Chapter 7 provides the qualitative data analysis results. The focus group discussion is used as a qualitative method to validate the conceptual IT project management assurance framework.

Section 5: Motivation of using quantitative research method

Section 5 consists of the following chapter:

Chapter 8 describes the motivation of using the quantitative research method to validate the conceptual IT project management assurance framework.

Section 6: Research result and findings

Section 6 consists of the following chapters:

Chapter 9 provides the descriptive data analysis, analysis of variance (ANOVA), present results, and findings from the data collected from the survey questionnaires.

Chapter 10 provides the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The Structural equation modelling (SEM) analysis on how the conceptual IT project management assurance framework fits the data is also discussed.

Section 7: Research conclusion

Section 7 consists of the following chapter:

Chapter 11 provides the research conclusions, a summary of the research findings, research contributions, research limitations, future research and self-evaluation of the research.

The layout of the thesis is shown in figure 1-1 below.

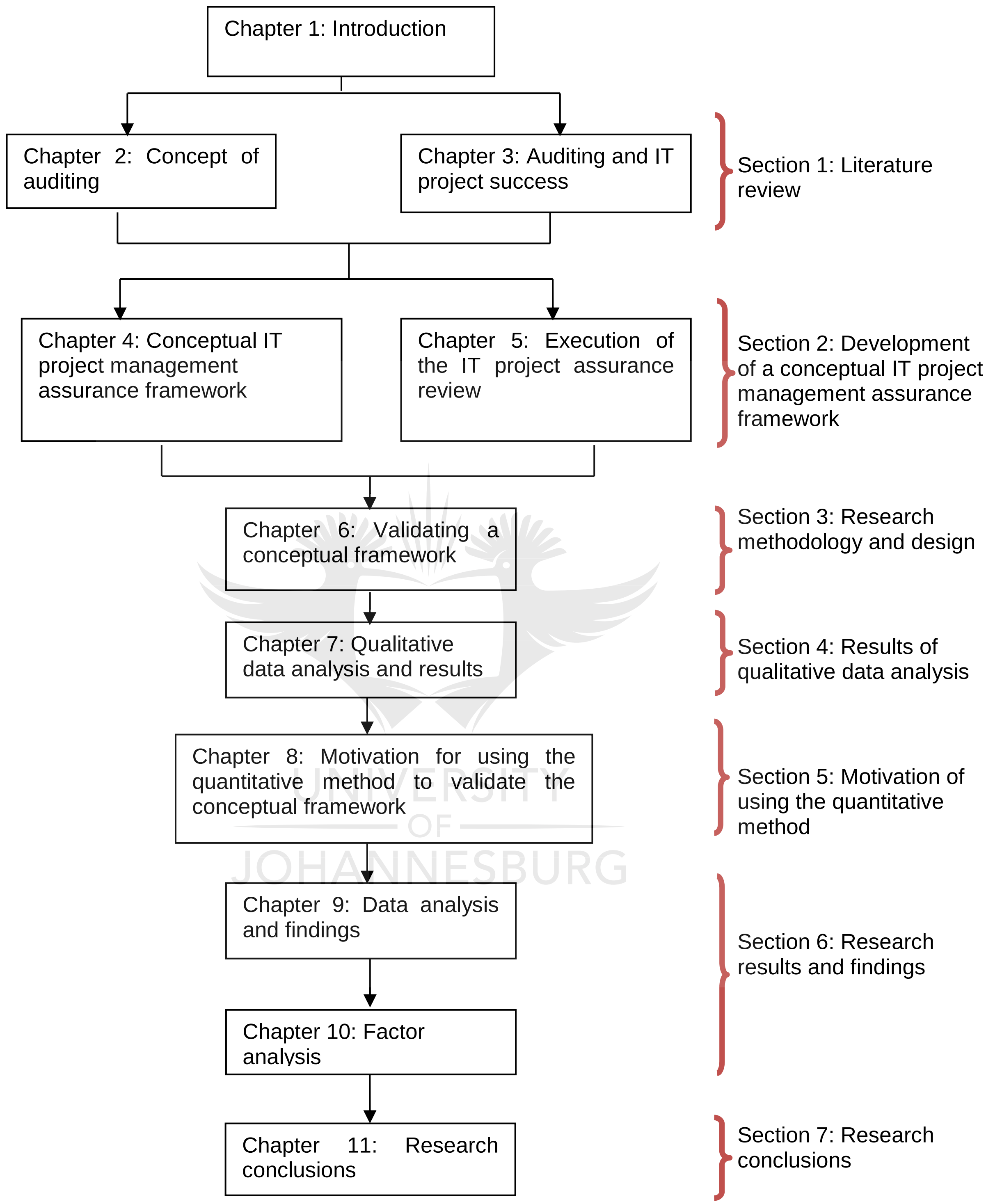

Figure 1-1: Layout of the thesis

CHAPTER 2: CONCEPT OF AUDITING

2.1 INTRODUCTION

The overall goal of this chapter is to gain understanding in the concept of auditing and to create a relationship between auditing (i.e. referred to as general auditing), information technology (IT) auditing and project auditing. The first objective of this chapter is to analyse auditing definitions in order to determine whether there are areas of common understanding in the literature. The second objective is to analyse auditing in information technology and create a link between general auditing and information technology. The third objective is to analyse project auditing definitions and to create a link between project auditing and general auditing. The fourth objective is to create a relationship between general auditing, information technology auditing and project auditing.

The next section aims at understanding auditing by analysing various definitions in the literature.

2.2 DEFINITIONS OF AUDITING

The term 'audit' is derived from the Latin word *audire*, which means "to hear". Prior to the 18th century auditors used to listen to the accounts read over by an accountant, judge the facts and thereafter, on the basis of their examination, announce the results of the organisation to the owner. This practice of checking activities was known to have existed in the ancient Egyptian, Greek and Roman civilizations (Spicer & Pegler, 1985). According to Brown (1962), auditing as a discipline at that time was restricted to performing detailed verification of every transaction, and its original objective was to detect and prevent fraud and errors.

Auditing evolved and grew rapidly after the industrial revolution in the 18th century and with the growth of the joint stock companies' ownership and management became separate so as to create transparency and accountability (Porter, Simon & Hatherly, 2005). The shareholders who were the owners needed a report from an independent expert on the accounts of the company. This change shifted the audit objective to verification of truth and fairness of the financial statements rather than detection of errors and fraud (Porter et al., 2005). The 1970s marked the development in technological advancement and the size of organisations increased. The audit approach shifted from using computing auditing tools to verifying transactions in the book of accounts. This approach placed auditor reliance on the organisation's internal controls during the auditing process.

These internal controls are important in financial reporting to provide high-quality information that becomes useful for decision making. According to Turley and Cooper (2005), in the mid-1980s, a risk-based auditing approach was developed where an auditor focused on those areas which were more likely to contain errors. In 1990s to date, auditing focuses on enhancing the credibility of financial statements and providing value-added services such as reporting on irregularities, identifying business risks and advising management on the internal control environment (Cosserat, 2004). The evolution of auditing is summarised in table 2-1.

Table 2-1: Evolution of auditing

Period (Year)	Auditing focus areas	References
Prior to 1840	• Detecting errors and fraud	Brown, 1962; Spicer & Pegler, 1985
1840s - 1920s	• Reliance on internal control • Usage of sampling technique • Collection of evidence • Emphasis on the truth and fairness of financial statements	Porter et al., 2005
1920s - 1970s	• Use computing tools to verify transactions in the book of accounts	Porter et al., 2005
1970s - 1990s	• Put in place a risk-based auditing approach	Turley & Copper, 2005
1990s to date	• Enhance the credibility of the financial statements • Provide value-added services such as reporting on irregularities, identifying business risks and advising management on the internal control environment	Cosserat, 2004

As the scope of auditing has kept on expanding, auditing is defined differently in the literature. The following are some definitions:

a) "Auditing is a systematic examination of books and records of a business or other organisation, in order to ascertain or verify to report upon the facts regarding its financial operation and the result thereof" (Montgomery, 1913:9).

Auditing is concerned with the scrutinizing records of the business accounts with a view to validate correctness of the entries recorded in the books of accounts and of the result of the organisation's business.

b) "Auditing is such an examination of books of accounts and vouchers of business, as will enable the auditor to satisfy himself that the balance sheet is properly drawn up, so as to give a true and fair view of the state of affairs of the business and that the profit and loss account gives a true and fair view of the profit/loss for the financial period, according to the best of information and explanation given to him and as shown by the books; and if not, in what respect he is not satisfied" (Spicer & Pegler, 1985:231).

Auditing involves inspection of books of accounts to verify whether the balance sheet is accurate in providing the truth and fairness of the business' position while the profit and loss account gives the financial position of the organisation in terms of loss/profit in a certain financial period.

c) "Auditing is a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those assertions and established criteria, and communicating the results to interested users" (Eilifsen, Messier, Glover & Prawitt, 2006:6).

Auditing process follows a structured plan where accounting records and evidence are analysed by the auditors. The auditors also examine the evidence for the assertion presentation and disclosure to determine if the accounts are described in accordance with the applicable financial reporting framework, and the legal and regulatory requirements. The communication of the auditor's opinion (i.e. audit report) is submitted to intended users.

d) "Auditing is the process of reviewing the financial information prepared by the management of a company to determine that it conforms to a particular standard" (Stuart, 2012:2).

Auditing is concerned with compliance. Auditing process examines the financial information of the company to determine whether it complies with legal and regulatory requirements.

The following are areas of common understanding from the above definitions (depicted from a literature review):

i) Examination: The examination of books of accounts in an audit is not only to know their mathematical accuracy but also a critical examination of the books of accounts so as to establish the accuracy, truthfulness, completeness and compliance with regulations of the accounts.

ii) **Systematic process:** Auditors prepare a systematic plan for any type of audit and follow it to audit an organisation's books of records.

iii) **Evidence:** Evaluation of evidence assertions about the business actions is necessary in auditing because it helps an auditor in forming and supporting an opinion on the financial statements as well as determining if the management assertions comply with laws and regulations.

iv) **Give a true and fair view of the state of affairs:** Auditors give their opinions on the fair presentation of an organisation's financial statements, which show the performance and financial position of an organisation in a financial period.

v) **Compliance:** It deals with complying with laws, rules, regulations and contractual obligations to which the organisation business processes are subjected.

vi) **Communicating the results:** An auditor prepares an audit report which states a true and fair view of the state of affairs of the organisation, and communicates the results to the intended users such as the board of directors, management as well as other stakeholders and shareholders.

Based on the analysis of the definitions provided, auditing can be defined as a systematic process for examining accounts or business records, collecting and evaluating evidence regarding the organisational assertions in complying with laws and regulations so as to give a true and fair view of the state of affairs, and communicating the results to the board of directors, management as well as other stakeholders and shareholders of the organisation.

According to the above analysis of auditing and the evolution of auditing, it entails that the major auditing requirements are:

- **To ensure compliance**: Auditors are responsible to evaluate whether an organisation is complying with legal and regulatory requirements.
- **To evaluate the system of internal controls**: Auditors are responsible for testing controls in financial statement audits and controls over financial reporting for both public and private organisations. This audit activity prevents and detects fraud/misappropriations, and protects the organisation's resources.

- **To ensure effective risk management**: Auditors are responsible for providing assurance on risk management processes, risk assessment, evaluation of the reporting of risks and reviewing of the effectiveness of controls.

Since general auditing is always done once a year as required by the regulatory agency, there is another type of audit which is done throughout the year (i.e. on a frequent basis) called continuous auditing. Continuous auditing has advantages other than general auditing that include early detection of errors and fraud, an increased ability to mitigate risks, early presentation of the final accounts at the end of the year and increased efficiency in achieving an organisation's goals and strategic objectives (Coderre et al., 2005; Kanavaris, 2013; Spicer & Pegler, 1985).

The following section discusses the concept of continuous auditing in more detail.

2.3 CONTINUOUS AUDITING CONTEXT

Continuous auditing (CA) was first demonstrated in 1991 by Dr. Miklos Vasarhelyi, an expert in the field of CA at the AT&T Bell Labs (Vasarhelyi & Halper, 1991). Since then, several bodies have issued guidance on CA such as the Canadian Institute of Chartered Accountants (CICA) and the American Institute of Certified Public Accountants (AICPA) (CICA/AICPA, 1999). In 2005, the Institute of Internal Auditors (IIA) issued a Global Technology Audit Guide (GTAG) on CA (Coderre, Verver & Warren, 2005). Continuous auditing deals with continuous business process control monitoring and continuous assurance (Alles, Kogan & Vasarhelyi, 2002; Brennan, Kogan & Vasarhelyi, 2006; Elliot, 2002; Alles, Kogan & Vasarhelyi, 2008). Continuous auditing provides greater transparency, effectively manage risk and performance, and provide continuous assurance to stakeholders (Alles et al., 2008; KPMG Australia, 2009). Continuous audit also provides an early warning detection system, fast correct control activities as well as to ensure compliance with policies, procedures and regulations (Handscombe, 2007; Vasarhelyi & Halper, 1991). Alles et al. (2008) argue that the concept of continuous audit has increasingly moved from theory into practice. Their research study on putting continuous audit into theory and practice reveals that more than 50 percent of U.S. companies use continuous auditing techniques and 31 percent of the rest have already made plans to follow suit. Their research further reveals that continuous audit in various companies incorporates continuous business process control monitoring and continuous assurance, and it has become a tool for internal auditors.

There are various definitions of continuous auditing in literature. The following are some definitions:

a) “Continuous audit is one where the auditor’s staff is occupied continuously on the accounts the whole year around, or where the auditor attends at intervals fixed or otherwise during the currency of the financial year, and performs an interim audit” (Spice & Pegler, 1985).

Continuous audit is conducted by an auditor throughout the financial year instead of at the end of the financial year. Thus, the accounts in such a case are subjected to audit as and when they are prepared.

b) “Continuous auditing is a methodology that enables independent auditors to provide a written assurance on a subject matter, for which an entity’s management is responsible, using a series of auditors’ reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter” (CICA & AICPA, 1999).

Continuous audit provides an ability of auditors to report on events in a real-time (i.e. frequent basis) which can provide significant benefits to the users of audit reports. The main benefits of continuous auditing relate to enhanced relevance and timeliness of audit results.

c) “Continuous auditing is any method used by auditors to perform audit-related activities on a more continuous or continual basis” *(*Coderre, Verver & Warren, 2005).

Performing audit-related activities on a continuous basis result in discovering errors and frauds easily and quickly.

From the above definitions of continuous auditing, the following are areas of common understanding:

Continuous process: The continuous aspect of continuous auditing and reporting refers to the real-time capability for information to be checked and shared. It highlights that the information is able to be verified on a frequent basis for errors, fraud and inefficiencies.

Therefore, continuous auditing can be defined as the process of engaging an independent auditor to perform auditing activities on a frequent basis in order to provide real-time data assurance, internal controls and risk monitoring in compliance with applicable laws and regulations, which result in increasing efficiency in achieving an organisation’s strategic objectives.

Continuous auditing and general auditing share similarities and differences as shown in table 2-2.

Table 2-2: Comparison between general auditing and continuous auditing

Characteristics	General auditing	Continuous Auditing
Systematic process	X	X
Continuous process		X
Examination	X	X
Collect and evaluate evidence	X	X
Give a true and fair view of the state of affairs	X	X
Compliance	X	X
Communicating the results	X	X

Source: Author

From table 2-2, the similar characteristics between general auditing and continuous auditing include a systematic process, examination, collecting and evaluating evidence, giving a true and fair view of the state of affairs, compliance and communicating the results. The difference is that general auditing involves the auditing of financial statements which is conducted once a year as required by regulatory agencies. Continuous auditing is conducted on a frequent basis.

The following section describes auditing standards which are applied in auditing activities.

2.4 AUDITING STANDARDS

Auditing standards provide a way to measure the quality of audit and the objectives achieved in the auditing. In the auditing activities, auditors are guided by international auditing standards, as shown in table 2-3, and national auditing standards. Different countries have their own national auditing standards which are customised from international auditing standards. These national auditing standards are diverse; therefore, they are not discussed in this chapter.

Table 2-3: International auditing standards

Auditing standards	Issuing organisation	Targeted companies	Purpose
International Standard of Supreme Audit (ISSA) (INTOSAI, 2010)	International Organisation of Supreme Audit Institutions (INTOSAI) in Cuba in 1953	Public entities	To set the standards for auditing government entities.

Auditing standards	Issuing organisation	Targeted companies	Purpose
Statements on Auditing Standards (SASs) (Hall, 2011)	American Institute of Certified Public Accountants (AICPA) in USA in 1972	Public and private companies	To provide auditors with guidance on methods of investigating new clients and procedures for collecting information from attorneys regarding contingent liability claims against clients.
International Standards on Auditing (ISA). (Hayes, Dassen, Schilder & Wallage, 2005).	International Auditing and Assurance Standards Board (IAASB) of International Federation of Accountants (IFAC) in the USA in 1978	Public and private companies	To set high-quality international standards of auditing that are applied by auditors in reporting on historical financial information.
Public Company Accounting Oversight Board (PCAOB) (Sarbanes-Oxley Act,2002)	Sarbanes-Oxley Act of 2002 in the USA	Public companies	To oversee the audits of public companies and other issuers in order to protect the interests of investors and further the public interest in the preparation of informative, accurate and independent audit reports.

The following section explains different types of audit.

2.5 TYPES OF AUDITING

In the literature, there are various types of auditing:

a) Compliance auditing: It is conducted to determine whether the auditee is following specific procedures, rules or regulations set by higher authorities (Arter, 2003).

b) **Financial statements auditing:** It is conducted to determine whether the financial statements are stated in accordance with specified criteria. The criteria may be the International Financial Reporting Standards (IFRS), general accepted accounting principles and national laws. This type of audit provides assurance that management has presented a 'true and fair' view of a company's financial performance and position (PWC, 2013).

c) **Operational auditing:** It reviews an organisation's operating procedures to evaluate the effectiveness and efficiency of the operations. Effectiveness is a measure of whether an organisation achieves its goals and objectives. Efficiency shows how well an organisation uses its resources to achieve its goals (Hayes et al., 2005).

d) **Information systems (IS)/IT auditing:** It addresses the internal control environment of automated information processing systems and how these systems are used. IS audits typically evaluate system input, output and processing controls, backup and recovery plans, and system security as well as computer facility reviews (Arens, Elder & Beasley, 2008; ISACA, 2012).

e) **Performance auditing:** It is an independent, objective and reliable examination of whether government undertakings, systems, operations, programmes, activities or organisations are operating in accordance with the principles of the economy, efficiency and effectiveness, and whether there is room for improvement (ISSAI 300, 2013).

f) **Project auditing:** It focuses on the audit within the project management environment, measures results and identifies the contribution causes of those results (Hill, 2013:465).

g) **Communication auditing:** It focuses attention on the process of communication in an organisation and the improvement thereof (Botha & Boon, 2003).

h) **Quality auditing:** It is an audit that examines quality aspects of a product, process or system (Arter, 2003). Quality audits are essential to verify the existence of objective evidence showing conformance to required processes, to assess how successfully processes have been implemented, and to judge the effectiveness of achieving any defined target levels in the organisation.

i) **Forensic auditing:** It is an examination and evaluation of a firm's or individual's financial information for use as evidence in court. A forensic audit can be conducted in order to prosecute a party for fraud, embezzlement or other financial claims (Arens, Elder & Beasley, 2008).

j) Follow-up auditing: These are audits conducted approximately six months after an internal or external audit report has been issued. They are designed to evaluate corrective action that has been taken on the audit issues reported in the original report (Hill, 2013:495).

Based on the findings of a literature review in section 2.3 and 2.5, the application of the types of audit to general auditing and continuous auditing is as shown in table 2-4.

Table 2-4: Application of the types of audit in general and continuous auditing

Types of audit	General auditing	Continuous auditing
Compliance audit	X	X
Financial statement audit	X	
Operational audit	X	X
Information Systems audit	X	X
Performance audit	X	X
Project audit		X
Communication audit	X	X
Quality audit	X	X
Forensic audit	X	X
Follow-up audit	X	X

Source: Author

According to table 2-4, the financial statement audit is conducted as part of general auditing and is not a part of continuous auditing. Project audits can be conducted continuously during each project phase for earlier detection of errors as well as identification and mitigation of project risks. The compliance audit, information systems audit, operational audit, performance audit, quality audit, communication audit, forensic audit and follow-up audit can all be applied to both general auditing and continuous auditing.

This research focuses on the auditing IT project management in public and private sector organisations. Therefore, two types of audit are chosen, namely an IT audit and a project audit.

2.6 INFORMATION TECHNOLOGY AUDIT

The concept of an information technology (IT) audit is also referred to as an information systems (IS) audit. The main objective of an IT audit is to evaluate an auditee's computerised information system (CIS) in order to ascertain whether it produces timely, accurate, complete and reliable information outputs as well as ensuring confidentiality, integrity, availability, reliability of data and compliance with legal and regulatory requirements (ASOSAI, 2003). IT auditing has gone through numerous changes, largely due to advances in technology and the alignment of IT with business strategy to achieve an organisation's goals and strategic objectives (Ghiran, Silaghi & Tomai, 2011). This alignment increases the demand for control mechanisms that can protect the CIS. The protection enhances the organisation's business processes. The next section analyses the various definitions of an information technology (IT) audit.

2.6.1 Definitions of Information Technology Audit

An information technology (IT) audit is defined as:

a) "IT/IS auditing is a process for discovering, monitoring and evaluating an organisation's information resources in order to implement, maintain, or improve the organisation's management of information" (Buchanan & Gibb, 1998).

   IT audit involves reviewing an organisation's resources to ensure that its information is managed properly.

b) "IT auditing is a process of collecting and evaluating evidence to determine whether a computer system safeguards assets, maintains data integrity, achieves organisational goals effectively, and consumes resources efficiently" (Weber, 1998).

   Thus, IT auditing is a process of ensuring that the computer assets (both hardware and software) are protected from damage or destruction, unauthorised use and being stolen. The state of data integrity means the data are accurate, complete and consistent. The organisation needs to use resource efficiently to achieve its goals effectively.

c) "IT auditing is an independent and objective assurance and consulting activity performed with the aim of analysing whether the risks and controls related to the information systems are properly managed" (Lamboglia & D'Onza, 2014).

   Management of risk and controls in the information system is necessary in safeguarding an organisation's information assets and maintains its data integrity.

The definitions above have areas of common understanding namely:

i) Process: It implies that procedures or methods are followed during the auditing of an information system. The process involves the collection and evaluation of evidence, monitoring, and the assessment and management of risks and controls related to the information system.

ii) **Information resources:** The information resources consist of people, application systems, technology, facilities and data. All of these resources need to be used efficiently to achieve the organisation's goals and strategic objectives effectively.

iii) **Information assets:** IT auditing aims to determine whether information systems safeguard information assets and maintain data integrity.

IT auditing can therefore be defined as a process of obtaining and evaluating evidence to determine if information systems protect information assets, maintain data integrity as well as manage risks and controls in accordance with applicable laws and regulations. These actions will result in an organisation using its resources effectively to achieve its organisational goals and strategic objectives.

The analysis of IT auditing differs from that of general auditing as depicted in table 2-5.

Table 2-5: Comparison between general auditing and IT auditing.

Characteristics	General auditing	IT auditing
Process	X	X
Information resources		X
Information assets		X
Examination	X	X
Give a true and fair view of state affairs	X	X
Collect and evaluate evidence	X	X
Communicate the results	X	X
Compliance	X	X

Source: Author

Based on the findings of a literature review in section 2.3 and 2.6, table 2-5 illustrates that general auditing and IT auditing share similar characteristics, including (i) the process, (ii) both give a true and fair view of the state of affairs, (iii) both collect and evaluate evidence, (iv) both communicate the results and (v) both comply. General auditing deals with the examination of the book of accounts while IT auditing deals with the examination of information systems to determine whether there are protection of information assets and effective use of information resources to achieve an organisation's strategic objectives.

The literature shows that a growing number of organisations have applied the Control Objectives for Information and Related Technology (COBIT) good-practice framework to operational audits, compliance audits, IT controls audits and financial statement audits (Lamboglia & D'Onza, 2014;

Rozek, 2008; Tuttle & Vandervelde, 2007). Therefore, the following section discusses COBIT and its application in auditing.

2.6.2 Control Objectives for Information and Related Technology (COBIT)

COBIT is a framework developed by the Information Systems Audit and Control Association (ISACA), and published by the IT Governance Institute for IT Governance. COBIT development started in 1994, with a first version published in 1996 and subsequent versions in 1998, 2000, 2005 and 2012 (ISACA, 2012) as shown in figure 2-1. COBIT provides managers, auditors and IT users with a set of generally accepted best practices which are useful for enterprises of all sizes, whether commercial, not-for-profit or in the public sector (ISACA, 2012).

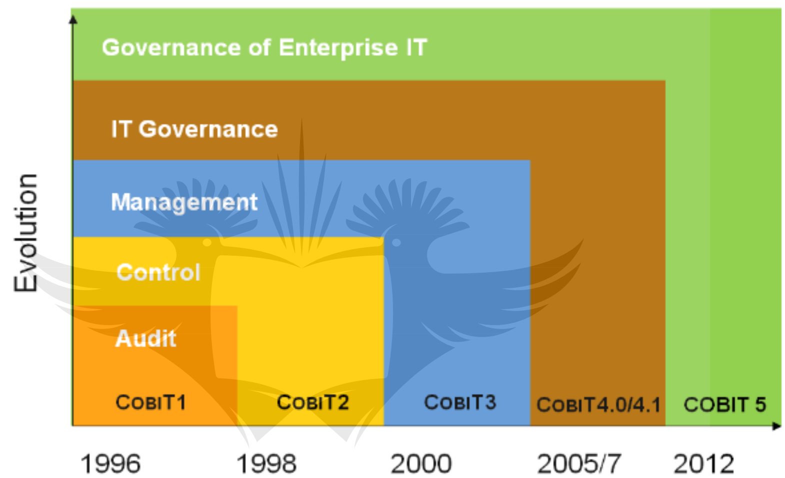

Figure 2-1: COBIT evolution (Source: ISACA, 2012)

Furthermore, COBIT 5 provides a comprehensive framework that assists enterprises in achieving their goals and delivering value through effective governance and management of IT enterprises. COBIT 5 has developed processes for the governance and management of enterprise IT. Governance processes deal with governance objectives such as value delivery, risk management and resource optimisation (ISACA, 2011). The domains for governance processes are (i) evaluate - evaluating strategic options, (ii) direct - providing direction to IT and (iii) monitor - monitoring the outcome. The domains for management of enterprise IT are align, plan and organise (APO), build, acquire and implement (BAI); deliver, service and support (DSS); and monitor, evaluate and assess (MEA).

The findings in a literature review revealed that COBIT5 framework has been applied in auditing (Bernroider & Ivanov, 2011; Lamboglia & D'Onza, 2014; Rozek, 2008; Tuttle & Vandervelde, 2007). Moreover auditing requirements involve ensuring compliance with legal and regulatory requirements, managing risks and evaluating the system of internal controls (as discussed in section 2.2). Content analysis has been conducted to identify COBIT 5 processes which are related to auditing requirements. The identified COBIT 5 processes are then mapped with auditing requirements as illustrated in table 2-6.

Table 2-6: Mapping of auditing requirements with COBIT 5 processes

Auditing requirements	COBIT 5 processes
To ensure compliance with legal and regulatory requirements	APO01.08:Maintain compliance with policies and procedures. APO10.05:Monitor supplier performance and compliance. MEA03.01:Identify compliance requirements. MEA03.02:Optimise response to external requirements. MEA03.03:Confirm external compliance. MEA03.04:Obtain assurance of external compliance.
To ensure effective risk Management	EDM03.01: Evaluate risk management. EDM03.02: Monitor Risk Management. APO10.04: Manage supplier risks. APO12.02: Analyse risk. APO12.03: Maintain risk profile. APO12.04: Articulate risk. APO12.05: Define a risk management action portfolio. APO12.06: Respond to risk. APO13.02: Define and manage an information security risk treatment plan. BAI01.10: Manage programme and project risk. BAI02.03: Manage requirements risk.
To evaluate the system of internal controls	MEA02.01: Monitor internal controls. MEA02.02: Review business process controls effectiveness. MEA02.03: Perform control self-assessments. MEA02.04: Identify and report control deficiencies. BAI01.06: Monitor, control and report on programme Outcomes. BAI01.11: Monitor and control projects.

Auditing requirements	COBIT 5 processes
	APO11.04:Perform quality monitoring, control and review.

The following section explains auditing in the project perspective.

2.7 PROJECT AUDITING

Project auditing can be a part of the project management process in ensuring that the project manager has put in place both business and technical processes that are likely to result in a successful project (McDonald, 2002). According to Reusch (2011), a project audit determines whether the project meets an organisation's strategic requirements and is based on a business case, contribute to project financial management, human resources management, stakeholder engagement and social responsibility. Projects are also auditable with regard to their compliance with statutory, regulatory and corporate guidelines.

PRINCE2 (an acronym for PRojects IN Controlled Environments) is a project management method (PRINCE2, 2009). Project assurance in the PRINCE2 project methodology provides an audit trail that checks whether the project delivers value to the organisation, the products meet the users' needs products and quality products are delivered (PRINCE2, 2009). There is no guidance in ISO 21500 (ISO 21500, 2013) on project auditing, or for that matter, IT project auditing. ISO 21500 can be used as a reference in audit if the organisation project management practices comply with ISO 21500 (Zandhuis & Stellingwerf, 2013). Project management body of knowledge (PMBOK) is a good practice within the profession of project management (PMI, 2017:2). In the PMBOK (PMI, 2017), project auditing is discussed very little under the following knowledge areas: (i) project quality management, (ii) project risk management, (iii) configuration management and (iv) project procurement management. PMI Governance Guide (2016) has a short mention of audits at the organisational level. A guide book of project and programme management for enterprise innovation by the Project Management Association of Japan (Ohara, 2005) does not mention project management auditing at all. However, none of these project management standards have given guidance for project auditing or for IT project auditing.

There are various definitions of project auditing as analysed in the next section.

2.7.1 Definitions of Project Auditing

The following are some definitions of project auditing:

a) "Project management auditing is an examination designed to determine the true status of work performed on a project and its conformance with the project statement of work, including schedule and budget constraints" (Ruskin, 1984:279).

Project management auditing is a review of project progress in accordance with an agreed project plan. The review of project progress determines the project performance which assist project governance board in decision making about the project.

b) "Project audit is an independent assessment or analysis of a project, program or Project Management Office (PMO) to verify compliance to company or industry standard for project and program management" (IAPPM, 2008).

Project audit involves examination of project to validate its conformance with project management standards. Project auditing inspects management of a project, its methodology, its techniques, its procedures, its documents, its properties, its budgets, its expenses and its level of completion.

c) "Project auditing is an activity that has unique connotation and context across various industries and within different professional disciplines. An audit within the project management environment measures results and identifies the contributing causes to those results" (Hill, 2013:465).

Project auditing evaluates the project deliverables and determines the factors which have contributed to the project outcome. Project auditing also deals with the structured examination of how the project is managed, and its corresponding project management plans

The areas of common understanding in the above definitions of project auditing are:

i) **Examination:** The assessment or review of the management of a project and evaluation of project progress against project work plan help to determine factors contributing to project results.

ii) **Project management:** Project auditing assesses the management of projects, including the methodology as well as the project results against the project work plan.

iii) **Compliance:** The verification of project management determined if it complies with industry standards as well as legal and regulatory requirements.

Project auditing can therefore be defined as a process of reviewing the management of a project, evaluating project results against the project work plan and its compliance with project management standards in order to ensure project success. Table 2-7 illustrates the comparison between general auditing and project auditing.

Table 2-7: Comparison between general auditing and project auditing.

Characteristics	General auditing	Project auditing
Process	X	X
Examination	X	X
Give a true and fair view of state affairs	X	X
Collect and evaluate evidence	X	X
Communicate the results	X	X
Compliance	X	X
Project management		X

Source: Author

From table 2-7 it is clear that general auditing and project auditing share similar characteristics such as process, examination, giving a true and fair view of the state of affairs, collecting and evaluating evidence, compliance with laws and regulations, and communicating results to intended users. General auditing deals with the auditing of financial statements where auditors express that financial statements are presented fairly and are in accordance with international accepted accounting frameworks. The financial audit is performed once in a financial year because it is required by regulatory agencies while project auditing reviews the management of a project.

The following section discusses the various types of project audits.

2.7.2 Types of Project Audits

There are various types of project audits in the literature, namely:

a) **Pre-project audit:** This audit validates project readiness to start and it facilitates the transition from the project planning phase to the project execution. It aims at viability of achieving the project activities and the implementation strategy and ensures a commitment of funds to a project (Duffy & Thomas, 1989; Hill, 2013).

b) **Mid-project audit:** During the project execution phase, this audit assesses the performance of a project (i.e. project health check). It aims at reviewing an ongoing project execution, diagnoses its problems and recommends how to improve the project performance (Hill, 2013).

c) **Post-project audit:** This type of audit is conducted at the closing phase of the project life cycle to determine if the project is ready for closure. It aims at defining and recording the lesson learnt following the completion of the project and so improves project performance (Hill, 2013). It also reviews the benefits realisation of the implemented project (Coderre, Verver & Warren, 2005).

d) **Technical audit:** This audit aims at evaluating deficiencies or areas of improvement in a process or system. Technical audits are conducted during the project planning phase in conjunction with pre-project audits. It covers the technical aspects of the project implemented in the organisation (Hill, 2013).

e) **Customer satisfaction audit:** It involves an examination of the customer business relationship that identifies how well the customer perceives the project progress toward the achievement of desired objectives (Hill, 2013). This type of audit may be performed during the performance and post-project audits.

f) **Project recovery audit:** This audit is similar to the combined content of the project management audit and the project performance audit, but with its focus on the indicators of unsatisfactory project performance (Hill, 2013).

g) **Project resource utilisation audit:** It involves the examination of the fulfillment of resource allocation and the timely assignment of resources for the accomplishment of a specific task. It also includes the examination of the effectiveness of project managers in assigning resources during the implementation of the project in order to meet project objectives. The project resource utilisation audit does not examine resource performance (Hill, 2013).

h) **Project team performance audit:** Auditing of project team performance involves a review of project work assignments and their alignment with individual technical and professional competencies of project team resources. It also examines the effectiveness of project manager and technical leader supervision (Hill, 2013). Project team behaviour audit is necessary in the project team performance audit because the project team is critical to the success of the overall project (Cascarino & Esch, 2007).

i) **Vendor and contractor audit:** It is an audit that is conducted within the vendor or contractor project management environment (Hill, 2013; Protiviti, 2013). This audit includes the vendor and contractor management plan, contract compliance audit, contract management review, contractor performance audit and Procure to Pay process review.

j) **Project management methodology audit:** This audit examines the use of and validates the content and effectiveness of the established project management methodology. It is a review that transcends individual projects and project managers to gain a perspective of the application of project management processes and practices across all projects within the relevant organisation (Hill, 2013).

From the above discussion, types of project audit can be grouped into three categories, namely pre-project audit, project performance audit/project health check audit and post-project audit as shown in table 2-8.

Table 2-8: Summary of project audit areas within three project audit categories

Pre-project audit areas	Project performance audit areas	Post-project audit areas
• Business case • Project Charter • Project management plans: i. Project integration plan ii. Project scope management plan iii. Project cost management plan iv. Project time management plan v. Project resource management plan vi. Project risk management plan vii. Project procurement management plan viii. Project stakeholder management plan ix. Project quality management plan x. Project communications plan xi. Vendor and contractor management plan xii. Business support plans. • Project management methodology • Technical audit	• Project team performance • Project resources utilisation audit • Project contract performance • Project quality assurance audit • Project recovery audit • Project risk management plan • Project cost and schedule specified in the work plan	• Customer satisfaction audit • Project team closeout • Project performance closeout • Vendor and contractor closeout

Source: Hill, 2013; PMI, 2017

Based on the project management knowledge areas (PMI, 2017) and discussion on types of project auditing, the following areas can also be included in the project auditing:

a) *Project team ethical behaviour management plan:* The project success has been measured through success in project management processes. There are elements of human nature that can either have a positive or negative effect on a project outcome. It is important to handle them properly (APM, 2014). Therefore, another direction to measure project success is to include ethical behaviour of project team members because they are important in project implementation and management. The examination of project team ethical behaviour can be included in a pre-project audit and project performance audit.

b) *Project social responsibility management plan:* Projects can only be called successful if they fulfil the criteria of social responsibility (Khan & Reusch, 2013). Guidance on social responsibility encourages the implementation of best practice in social responsibility to private and public sector organisations (ISO 26000, 2010). The examination of project social responsibility management can be included in a pre-project audit.

c) *Project benefits realisation management plan:* Benefits realisation management practices aim to ensure the alignment among project outcomes and business strategies, and have been shown to increase project success across different countries and industries (Serra & Kunc, 2014). The project benefits realisation can be included in project performance audit and in a post-project audit (PMI, 2017).

d) *Project conflict management plan:* Conflict in project management is inevitable. For example, the potential for conflict in information systems development projects is usually high because it involves individuals from different backgrounds and orientations working together to implement project tasks. The conflicts in project team members can be related to differences in values, attitudes, needs, expectations, perceptions, resources and personalities. Proper skills in dealing with conflict can assist project managers and other organisation members to handle and effectively resolve conflicts which can lead to project success. Project conflict management can be included in pre-project and project performance audits.

e) *Project sustainability management plan:* Sustainability management can be effectively integrated into project management practices. This approach would assure project managers to consider sustainability in projects as an important component throughout the project life cycle. It also enables the delivery of sustainable outcomes. Project sustainability management can be included in pre-project and post-project audits.

f) *Project fraud and corruption prevention plan:* Fraud arises from unethical behaviour. Unethical behaviour has been at the root of every corporate scandal such as Enron, Parmalat, WorldCom and others (Bekker & Steyn, 2007). Thus, promoting ethics and fighting fraud, corruption, theft and other acts of misconduct during the project management are inevitable. The project fraud and corruption prevention plan can be included in the pre-project audit.

The following section provides a relationship between auditing (i.e. referred to as general auditing), information technology auditing and project auditing.

2.8 RELATIONSHIP BETWEEN GENERAL AUDITING, INFORMATION TECHONOLOGY AUDITING AND PROJECT AUDITING

The objective of this section is to determine whether there is a relationship between general auditing, IT auditing and project auditing. As explained in the previous sections, general auditing deals with financial statement audits, IT auditing deals with safeguarding information systems to protect information assets and to maintain data integrity, while project auditing deals with auditing the management of a project. Table 2-9 illustrates the relationship between general auditing, IT auditing and project auditing.

Table 2-9: Relationship between general auditing, IT auditing and project auditing

Characteristics	General auditing	IT auditing	Project auditing
Process	X	X	X
Examination	X	X	X
Give a true and fair view of state affairs	X	X	X
Collect and evaluate evidence	X	X	X
Communicate the results	X	X	X
Compliance	X	X	X
Project management			X
Information resources		X	
Information assets		X	

Source: Author

From table 2-9, the following are characteristics which show that, there is a relationship between general auditing, IT auditing and project auditing:

a) Process: General auditing, IT auditing and project auditing prepare and follow a structured plan (i.e. audit plan) during the auditing activities.

b) **Examination:** This is another area of relationship where auditing aims at reviewing business records of an organisation in a particular period.

c) **Give a true and fair view of the state of affairs:** Auditors in these types of auditing are required to give an opinion showing the current performance and position of the organisation.

d) **Collect and evaluate evidence:** During the auditing activities in general auditing, IT auditing and project auditing, auditors are required to obtain and evaluate evidence for supporting their opinion. Auditors also review the system of internal control and risk management to determine whether reports are presented fairly.

e) **Communicate the results:** At the end of auditing activities, auditors prepare audit reports and submit them to the intended users.

f) **Compliance:** General auditing, IT auditing and project auditing verify whether the organisation's business processes comply with legal and regulatory requirements.

IT project auditing can therefore, be defined as a systematic process of continuous examining the management of a project, collecting and evaluating evidence to determine whether the project management complies with best practice and standards, establishing project management criteria in order to give a true and fair view of the state of a project, and communicating the results to intended users. This definition is used throughout the study.

2.9 CONCLUSION

The overall goal of the chapter was to understand auditing and to create a relationship between auditing (i.e. referred to as general auditing), information technology (IT) auditing and project auditing.

The chapter analysed various definitions existing in the literature to gain an understanding of what auditing entailed. It also identified different auditing standards used in the industry. Prior to 1840, the auditing approach started from the detection and prevention of fraud and errors. During the Industrial Revolution, the approach of auditing changed to the verification of transactions so as to present a true and fair view of the state of affairs. In the development of technologies, auditing practices shifted to using computing tools to verify transactions and preparing financial statements. In 2018, the scope of auditing expands which causes auditing objectives to shift to the examination of internal controls and risk management.

The chapter also analysed continuous auditing and found that it showed similarities with general auditing. The main difference was that general auditing was being conducted once a year as required by regulatory agencies while continuous auditing was conducted throughout the year. The chapter found that general auditing differed from IT auditing, as general auditing was an assurance expressed by auditors that financial statements were being presented fairly and were in accordance with internationally accepted accounting frameworks while IT auditing evaluated evidence to determine if information systems protected information assets and maintained data integrity. The analysis also found that IT auditing concepts were adopted from financial audit aspects.

The auditing from a project perspective was analysed in the chapter in which various types of project audits were discussed in more detail. These types of project audit include pre-project audits, project performance audits and post-project audits. It also found that general auditing differed from project auditing. The chapter identified and discussed the relationship between general auditing, IT auditing and project auditing.

It can be concluded that there is a relationship between general auditing, IT auditing and project auditing. The six common characteristics, which show the relationship between these auditing types, are process, examination, giving a true and fair view of the state of affairs, collecting and evaluating evidence, compliance and communication of the results.

The next chapter determines the causality between project auditing and IT project success

CHAPTER 3: AUDITING AND INFORMATION TECHNOLOGY PROJECT SUCCESS

3.1 INTRODUCTION

The overall goal of this chapter is to determine the causality between auditing and IT project success. The first objective of this chapter is to analyse project success and to determine whether there are areas of common understanding in the literature. The second objective is to determine whether a positive relationship between IT project auditing and project success exists.

The next section aims at understanding project success by analysing various definitions in the literature.

3.2 DEFINITIONS OF PROJECT SUCCESS

Various research studies analysed project success based on a variety of dimensions and perceptions of project success. Morris and Hough (1987) argue that project success included two components: (i) project success criteria and (ii) project success factors. Project success criteria are the measures for determining whether a project is successful or not. Project success factors are factors that contribute to achieving project success. These success criteria are focused more on the implementation phase of a project life cycle.

During the period of 1960 to 1980, research studies focused on investigating success criteria for measuring project management success, and focus within the project life cycle was on the implementation phase. The traditional view of project management success was associated with meeting the time, cost and quality objectives coined by Dr. Martin Barnes (in 1969) as the 'iron triangle' or 'triple constraints' or 'golden triangle' (Atkinson, 1999; Belassi and Tukel, 1996; Cooke-Davies, 1990; Pinto & Slevin, 1988a). According to Atkinson (1999), over the last 50 years the 'iron triangle' was used to measure the success of project management. He proposed success criteria for IT project management as meeting the time, cost and quality. Baker, Murphy and Fisher (1983) argue that project management success criteria could not only be cost, time and quality. Their study proposed project management success criteria as: (i) client satisfaction, (ii) budget, (iii) schedule, (iv) performance and (v) effectiveness.

According to De Wit (1988), for measuring success, there is a need to distinguish between the success of the project and the success of the project management activity. He proposed three success criteria for project management success as cost, schedule and technical performance. He identified project success criteria were project functionality (i.e. financially and technically), project management (i.e. schedule, budget and technical specifications) and contractors' commercial performances. Pinto and Slevin (1988a) found the project success criteria as (i) meeting time, (ii) meeting cost, (iii) performance, (iv) use, (v) satisfaction and (vi) organisational effectiveness. Project management success criteria are summarised in table 3-1.

Table 3-1: Success criteria for project management success (1960s - 1980s)

Martin Barnes (1969)	Baker, Murphy and Fisher (1983)	De Wit (1988)	Pinto and Slevin (1988a)
• Time • Cost • Quality	• Client satisfaction • Budget • Schedule • Performance • Effectiveness	• Cost performance • Schedule performance • Technical performance • Contractors' performance • Project functionality • Project management	• Time • Cost • Performance • Use of project product • Client Satisfaction • Organisational effectiveness

In the period of 1980 to 1990, the emphasis in project success was on developing critical success factors (CSFs). Project critical success factors are elements of the project or the management thereof that can be influenced to increase the chance of achieving a successful outcome (Turner, 2013:74). The focus within the project life cycle was on the planning phase (Baker et al., 1983; Kerzner, 1987).

Slevin and Pinto (1986) developed ten CSFs that included (i) project mission, (ii) top management support, (iii) schedule/plans, (iv) client consultation, (v) personnel, (vi) technical tasks, (vii) client acceptance, (viii) monitoring and feedback, (ix) communication and (x) troubleshooting. The developed list of CSFs was empirically tested by Pinto and Slevin (1988b; 1988c) and 14 CSFs were identified as shown in table 3-2 below.

Kerzner (1987) defines CSFs as elements which should exist within the organisation in order to create an environment where projects may be managed with excellence on a consistent basis. In his study, he developed CSFs that included (i) corporate understanding of project management, (ii) executive commitment to project management, (iii) organisational adaptability, (iv) project manager selection criteria, (v) project managers' leadership styles and (vi) commitment to planning control. The corporate understanding of project management into executive levels, senior levels and functional levels contribute in achieving project success.

Morris and Hough (1987) develop a comprehensive framework on preconditions of project success. They develop CSFs that included (i) attitudes, (ii) project definition, (iii) external factors, (iv) finance, (v) organisation and contract strategy, (vi) schedule, (vii) communication and control, (viii) human qualities and (ix) resources management.

The summary of critical success factors is shown in table 3-2 below.

Table 3-2: Critical Success Factors for project success (1980s-1990s)

Baker, Murphy and Fisher (1983)	Morris and Hough (1987)	Kerzner (1987)	Pinto and Slevin (1986; 1988b; 1988c)
• Clear goals • Goal commitment of project team • On-site project manager • Adequate funding • Adequate project team capability • Accurate initial cost estimates • Minimum startup difficulties • Planning and control techniques • Task orientation • Absence of bureaucracy	• Project definition • External factors • Finance • Organisation and contract strategy • Schedule • Communications and control • Human qualities • Resources management	• Corporate understanding of project management • Executive commitment to project management • Organisational adaptability • Project manager selection criteria • Project manager's leadership style • Commitment to planning and control	• Project mission • Top management support • Schedule/plans • Client consultation • Personnel • Technical tasks • Client acceptance • Monitoring & feedback • Communication • Characteristics of the project team leader • Power and politics • Environmental events • Urgency • Trouble-shooting

In the period of 1990 to 2000, there was an emergence of critical success factors frameworks, and the view of project success included both project and product success (Davis, 2014). Success varied with time over project and product life cycles (Shenhar, Levy & Dvir, 1997). Most authors of CSFs classified them into common themes to enable readers to clearly see what category certain CSFs belonged to. The focus was on the planning and initiation phases within the project life cycle.

Pinto and Mantel (1990b) group the ten CSFs developed by Pinto and Slevin (1986) into strategical and tactical stages. The strategical stage included mission, top management support and schedule/plans. The tactical stage included client consultation, personnel, technical tasks, client acceptance, monitoring and feedback, communication and troubleshooting. Belassi and Tukel (1996) develop their own CSFs framework and grouped it into common themes which included (i) factors related to a project, (ii) factors related to a project manager and team, (iii) factors related to an organisation and (iv) factors related to the external environment.

Shenhar et al. (1997) identify dimensions of success which included project efficiency, impact on customers, business and direct success, and preparing for the future. The study also identified three categories of success: (i) meeting design goals, (ii) impact on the customer, and (iii) benefits to the organisation. They noted that meeting design goals (time, budget and performance) was not a homogeneous dimension. Time and budget comprised one dimension, as it was resource-related, but meeting specifications related to customer satisfaction.

According to Baccarini (1999), project success comprised two components; those were project management success, which dealt with project process, and product success which dealt with a project's product. He develops a logical framework method (LFM) which assisted in understanding project management success and product success. The identified project management success criteria were (i) meeting time, cost and quality objectives, (ii) stakeholder satisfaction and (iii) quality of project management process. Product success criteria included (i) meeting the organisational strategic objectives (project goals), (ii) satisfaction of users' needs (project purpose) and (iii) satisfaction of stakeholders' needs related to the product.

According to Atkinson (1999), over the last 50 years, the 'iron triangle' was used to measure the success of project management. He proposed the square route model (as shown in figure 3-1) for project success criteria which included (i) the iron triangle, (ii) benefits to the organisation, (iii) benefits to the stakeholder community and (iv) an information system.

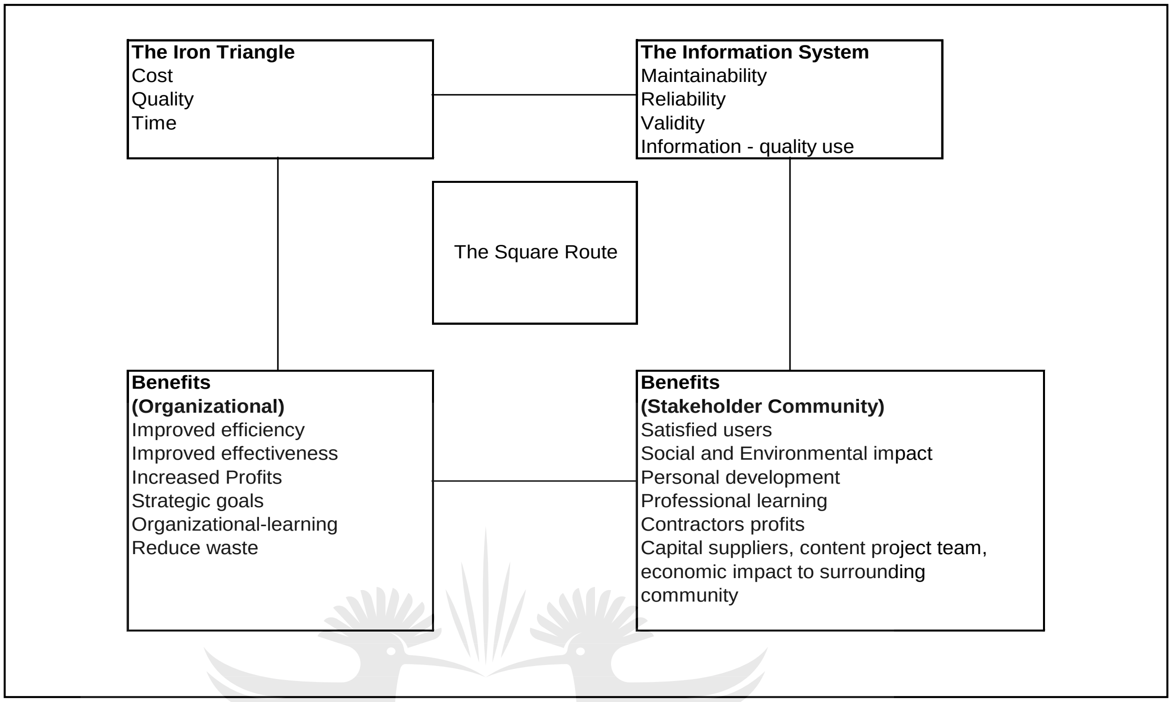

Figure 3-1. The square route (Atkinson, 1999)

Based on the square route model, benefits realisation of project product to organisations can be measured by improved efficiency, effectiveness, increased profits and organisational learning. Benefits of the project to the stakeholder community can be measured by the satisfaction of the users, their social and environmental impact, personal development, contractors' profits, capital suppliers, a content project team as well as an economic impact on the surrounding community. The IT project success criteria include (i) maintainability, (ii) reliability, (iii) validity and (iv) the quality of the information used. The success criteria for information technology developed by Wateridge (1998) included (i) meeting user requirements, (ii) achieving the set purpose, (iii) timescaling, (iv) budgeting, (v) happy users and (vi) quality. The critical success factors for project success are summarised in table 3-3 below.

Table 3-3: Critical Success Factors for project success (1990s - 2000s)

Pinto and Mantel (1990b)	Belassi and Tukel (1996)	Shenhar, Levy and Dvir (1997)	Baccarini (1999)
Factors related to strategic stage • Project mission • Top Management support • Schedule/plans **Factors related to tactical stage** • Client consultation • Personnel recruitment • Technical tasks • Client acceptance • Monitoring and feedback • Communication • Trouble-shooting	**Factors related to project** • Size and value • Density of a project • Uniqueness of project activities • Life cycle • Urgency **Factors related to Project manager** • Ability to delegate authority • Ability to tradeoff • Ability to coordinate • Perception of his role & responsibilities • Competence • Commitment **Factors related to project team members** • Technical background Communication skills	• Project efficiency • Impact on the customer • Business and organisational success • Preparing for the future	**Factors related to project management success** • Meeting time, cost and quality • Stakeholders satisfaction • Quality of project management process (including post-audit analysis) **Factors related to product success** • Meeting project owner's strategic organisational objectives • Satisfaction of user's needs • Satisfaction of stakeholder's needs

	• Trouble shooting • Commitment **Factors related to organisation** • Top management support • Project organisational structure • Functional managers' support • Project champion **Factors related to external environment** • Political environment • Economic environment • Social environment • Technological environment • Nature • Client • Competitors • Sub-contractors		

In the period of 2000 to present, the emphasis is on strategic project management, and project success involves all phases of the project life cycle. This emphasis moves the project success view from an organisation's tactical level to the strategic level. The focus in project success is in project management success, project success, product success, programme success and portfolio success.

Müller (2003) and Turner (2004) propose dimensions of project success which focused on the project owner. The owner is responsible for the project delivering the organisation's strategy. The owner affects the view of a project within an organisation which can affect project success. These dimensions include (i) the owner is to give guidance to the project, (ii) project success criteria to be agreed upon before the project starts, (iii) collaboration between the project manager and the owner and (iv) the project performance report to be submitted regularly to the project owner. Müller and Jugdev (2012) introduce the psychological predisposition of a project owner as a new critical success factor.

Misra, Kumar and Kumar (2009) identify critical success factors for agile software development such as organisational factors (i.e. customer commitment, decision time, team size, team distribution, corporate culture, planning and control, dynamism and uncertainty, safety criticality and reliability) and factors related to people (i.e. competency, personal characteristics, communication and negotiation, team composition, societal culture, and training and learning).

Marnewick (2013) identifies factors that influence project success which included (i) adequate handling of change, (ii) good communication between teams and customers, (iii) good communication between project team members, (iv) adequate project manager competency, (v) maximum support of innovative technology, (vi) adequate user understanding of technology, (vii) positive executive support, (viii) clear business objectives, (ix) good understanding of users' needs, (x) frequent user involvement, (xi) adequate change control processes, (xii) appropriate formal methodologies, (xiii) clear requirements definition and (xiv) correct auditing of processes.

The Standish Group (2016) studies success and failure of IT projects. The study identified project success factors which included (i) executive management support, (ii) user involvement, (iii) optimisation, (iv) skilled human resources, (v) project management expertise, (vi) an agile process, (vii) clear business objectives, (viii) emotional maturity, (ix) execution, and (x) tools and infrastructure.

The other focus in the 21st century is on stakeholders' active involvement in the project. Davis (2014) identifies a project manager as being the most highly referenced stakeholder among the project team, client, contractor, project sponsor, top management, organisation owner, project leader, supplier and external stakeholders. The study also identified three groups of stakeholders, namely (i) senior management, (ii) the project core team and (iii) project recipients. The study proposed five project success factors being (i) communication, (ii) time, (iii) stakeholder satisfaction, (iv) making use of finished product/acceptance and (v) cost/budget.

Another study on CSFs for IT projects was conducted by Almajed and Mayhew (2013). They investigate critical success factors of IT projects in Saudi Arabian public organisations. They identified critical success factors as (i) top management support and commitment, (ii) project management, (iii) project team competency, (iii) communication management, (iv) strategic planning, (v) training and education, (vi) partners and suppliers management, and (vii) stakeholders' management. Ahimbisibwe et al. (2015) studies critical success factors for software development projects from the 148 identified publications. They proposed CSFs for software development projects as shown in table 3-4.

The summary of critical success factors are as shown in table 3-4.

Table 3-4: Critical Success Factors for project success (2000s to present)

Müller (2003); Turner (2004)	Marnewick (2013)	Standish Group (2016)	Almajed and Mayhew (2013)	Ahimbisibwe, Cavana and Daellenbach (2015)
• High level of collaboration between project manager and project sponsor/owner • Stakeholders to have common understanding on project success criteria before project starts • Regular project performance reports to be submitted to the project owner • Owner giving guidance as to how the project should be best achieved	• Good communication between project team members • Good communication between team and customers • Clear business objectives • Clear requirements definition • Good understanding of user's needs • Adequate project manager competency • Positive executive support	• Executive management support • User involvement • Optimisation • Skilled human resources • Project management expertise • Agile process • Clear business objectives • Emotional maturity • Execution • Tools and infrastructure	• Top management support and commitment • Project management • Project team competency • Communication management • Strategic planning • Training and education • Partners and suppliers management • Stakeholders' management	• Top management support • Organisational culture • Project planning and controlling • Leadership • Change management • Vision and mission • Internal project communication • Project team commitment • Team's expertise • Team's experience • Team composition • User participation • User support • Customer training and education
• Psychological predisposition of the project owner towards the project	• Adequate handling of change • Frequent user involvement • Adequate change control processes			• Customer experience • Technical complexity • Technological uncertainty • Relative project size

Müller (2003); Turner (2004)	Marnewick (2013)	Standish Group (2016)	Almajed and Mayhew (2013)	Ahimbisibwe, Cavana and Daellenbach (2015)
	• Appropriate formal Methodologies • Adequate user understanding of technology • Correct auditing of processes • Maximum support of innovative technology			• Urgency • Specification changes • Project criticality • Reliability • Easy to use • Flexibility • Functionality • User satisfaction • Team satisfaction • Top management satisfaction • Overall quality of software delivered

The evolution of project success is as summarised in table 3-5 below.

Table 3-5: Evolution of project success

Period (Year)	Focus areas	References
1960s-1980s	• Project management success. • Developed success criteria for measuring project management success based on 'iron triangle' constraints.	Baker, De Wit (1988); Murphy & Fisher (1983); Pinto & Slevin (1988a)
1980s-1990s	• Project success • Developed project Critical Success Factors	Kerzner (1987); Morris & Hough (1987); Slevin & Pinto (1986,1988b,1988c)
1990s-2000s	• Project success and Product success • Developed project and product critical success factors frameworks and categorised them into common themes.	Atkinson (1999); Baccarini (1999); Pinto & Mantel (1990b); Shenhar, Levy & Dir (1997); Wateridge (1998)
2000s to present	• Strategic project management success, project success, product success, programme success, portfolio success and organisational impact (i.e. business success and strategic success)	Ahimbisibwe et al. (2015); Almajed & Mayhew (2013); Davis (2014); Müller (2003, 2012); Turner (2004); Mistra et al. (2009); Marnewick (2013); Standish Group (2016)

Based on the evolution of project success from 1960s to present as shown in table 3-5, project success has been defined differently in the literature. The following are some definitions:

a) "Project success is defined as meeting project schedules, budget, achieving predefined project goals and meeting customer satisfaction criteria" (Pinto & Slevin, 1988a).

The definition highlights the traditional measures of project success focused on 'iron triangle' elements such as time (schedule), cost (within budget) and quality (meeting project objectives). The definition also advocates that project success not only evolves iron triangle elements but also that satisfaction of clients' needs is crucial.

b) “Project success is the satisfaction of stakeholder needs and is measured by the success criteria as identified and agreed at the start of the project” (APMBOK, 2012)

When project is initiated, there is a need to establish and agree on criteria of a successful project which also incorporates satisfaction of stakeholders’ requirements. The agreed criteria can be used to measure success of a project in each phase of a project life cycle.

c) “ A project is successful if it is completed within an allocated time period, within the budgeted cost, at the proper performance or specification level, with acceptance by the customer/user, with minimum or mutually agreed upon scope changes, without disturbing the main workflow of the organisation and without changing the corporate culture” (Kerzner, 2013).

Project success criteria such as the iron triangle (i.e. cost, time and quality) are also highlighted. Apart from the iron triangle of time, cost and quality, other dimensions such as customer/user acceptance, corporate culture and project scope affect the success of a project.

d) “Project success is measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and senior management (PMI, 2017).

It highlights the traditional view of project management success of considering ‘iron triangle’ elements such as scope, time, cost and quality. The definition also incorporates risk and resources as additional measures for project success.

From the above definitions of project success, it is clear that there are areas of common understanding as follows:

i) **Time:** Time is one of the ‘iron triangle’ elements. Project management is said to be successful if it is delivered within the planned timeframe.

ii) **Cost/budget:** Cost is another element of the ‘iron triangle’ that needs to be reported, managed and forecast throughout the project life cycle. Therefore, project management success is realised when the final product is delivered within a planned budget and cost framework.

iii) **Schedule:** Schedule is another element of the ‘iron triangle’ which is a predictive process of estimating and assigning the duration of activities based on available resources. The project management is successful when delivered on agreed schedule.

iv) **Scope:** Scope is another element of the 'iron triangle' used as a variable to measure project management success. The scope of the project is agreed upon during the project planning stage, but sometimes the project scope can change during the project execution. The project team needs to agree and update the scope of a project in order to increase the likelihood of a project succeeding.

v) **Success criteria**: These are measures used to judge the success or failure of a project throughout the project life cycle. The project team needs to develop and agree upon project success criteria at the start of a project.

vi) **Satisfaction of customer/user needs:** The satisfaction of customer/user needs determines product success (i.e. final project product acceptance, use and its effectiveness) in the organisation.

vii) **Satisfaction of stakeholders' needs:** The satisfaction of stakeholders' needs related to project product determines organisational strategic success.

viii) **Project goals:** Meeting project goals and objectives results in achieving organisational goals, benefits realisation and return on investment. These achievements determine business success in the organisation.

According to the above analysis of project success definitions, project success can therefore be defined as meeting the agreed criteria of project success, meeting the satisfaction of customers' and stakeholders' needs, and results in achieving organisational goals and strategic objectives. This project success definition is illustrated as shown in figure 3-2.

Tactical level ⟷ **Strategic level**

Project success		**Product success**	**Organisational impact**	
Process success	Project management success	Deliverables success	Business success	Strategic success
• Process alignment with best practices and project purpose • Process integration	• Time • Cost • Schedule • Scope	• Specifications • Requirements • Acceptance • Quality • Use • Effectiveness • Satisfaction	• Goals and objectives • Benefits realisation • Return on investment	• Business development and growth • Strategic position in the market and industry • Competitive advantage • Other strategic gain

Figure 3-2:Broader view of project success (adapted from Bannerman, 2008)

The following section discusses the factors, which influence project success.

3.3 FACTORS INFLUENCING PROJECT SUCCESS

Projects often possess a set of critical success factors which, if addressed, increase the likelihood of the successful completion of a project. On the other hand, if these factors are not taken seriously, it might lead to the failure of the project. In literature, there are various factors influencing project success. Chow and Cao (2008), Misra et al. (2009), Sudhakar (2012) and Ahimbisibwe et al. (2015) group the factors that influence project success for software development projects into (i) organisational factors, (ii) project team factors, (iii) customer factors, (iv) product factors, (v) project management factors, (vi) external environment factors, (vii) technical factors and (viii) project factors. These factors are also generic to other projects in influencing project success (Baccarini et al., 1999; Belassi et al., 1996). The factors are discussed in more detail below.

3.3.1 Organisational Factors

Organisational factors continue to influence information technology project success as discussed in various literature on project management. These organisational factors are as shown in figure 3-3 below.

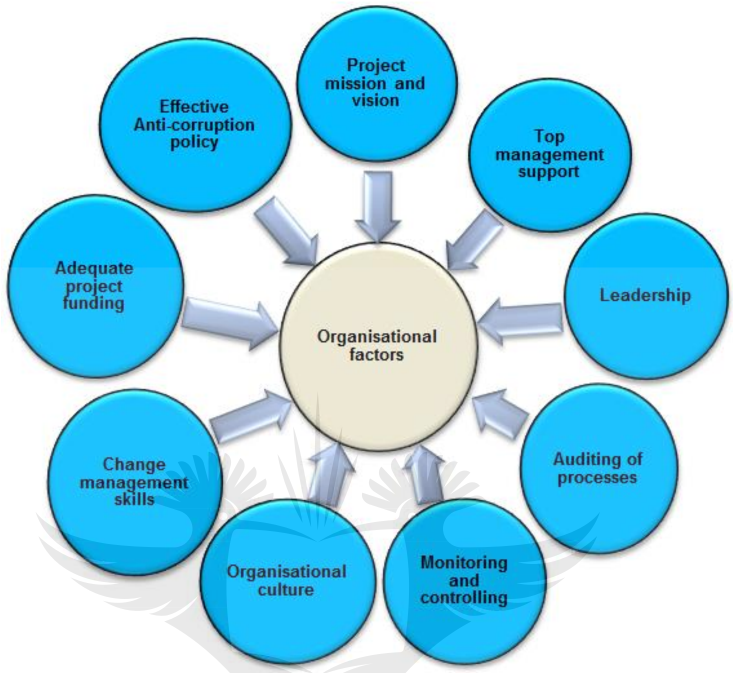

Figure 3-3: Organisational factors influencing project success

The factors which tend to influence project success within an organisation are discussed next.

- **Project vision and mission:** The vision and mission of any project are derived from organisational vision and mission which determine mid-term and long-term organisational goals. Project requirement definition, clear project goals and clear business objectives are important in formulating the project vision and mission. The project vision and mission provide the strategic direction of the project and have an impact on the success of the project (Ahimbisibwe et al., 2015; Pinto & Slevin, 1987).

- **Top management support:** Top management support (i.e. willingness to provide the necessary resources and authority/power) is among the critical success factors that influence project success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013, 2014; Baccarini & Collins, 2003; Belassi & Tukel, 1996; Chow & Cao, 2008; Kerzner, 1987; Marnewick, 2013; Pinto & Slevin, 1987; Sudhakar, 2012; Standish Group, 2016). Top management needs to develop and put in place critical success processes which contribute to the project success

(Zwikael & Globerson, 2006). The commitment of top management ensures close monitoring and controlling of project progress until its successful completion.

- **Leadership:** Good leadership during the project leads to project success (Baccarini, Salm & Love, 2004; Kerzner, 1987; OGC, 2005; Thite, 1999; Turner & Müller, 2005). Good leadership entails that the project manager and project steering committee are committed in providing direction to the project team, which, in turn, leads to project success.

- **Auditing processes:** The study of longitudinal analysis of ICT project success (Marnewick, 2012) and the Prosperus report (Marnewick, 2013) identify fourteen critical success factors of project success which included the correct auditing processes. Auditing processes was also among the factors influencing the outcome of projects (Sonnekus & Labuschagne, 2003, 2004). Marnewick and Erasmus (2014) argue that project audits should take place during the project life cycle and the results of the audit be incorporated into the project, ensuring the successful completion of the project and delivery of a product.

- **Organisational culture:** The culture of an organisation represents certain predefined policies which guide the employees and give them a sense of direction, making them successful in the workplace. Therefore, the organisational culture influences project success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2014; Misra et al., 2009).

- **Monitoring and controlling:** Monitoring and controlling project progress and performance throughout the project life cycle and providing feedback can ensure project success (Ahimbisibwe et al., 2015; Pinto & Slevin, 1989).

- **Change management:** Change management entails the process, tools and techniques to manage change in order to achieve organisational goals and strategic objectives (Creasey, 2007). The application of information technology in the organisation's business processes always brings change in the business operations. Therefore, change management strategies and skills are important within the organisation to ensure successful project implementation (Ahimbisibwe et al., 2015; Nasir & Sahibuddin, 2011).

- **Adequate project funding:** Project financing has a significant impact on project implementation. Adequate project funding throughout the project life cycle influences project success (Baker et al., 1983; Morris & Hough, 1987).

- **Effective anti-corruption policy:** According to Kwak (2002), the corruption factor affects project success. The organisation needs to incorporate an effective anti-corruption policy (a zero tolerance policy on fraud and corruption) during the project life cycle. This policy binds all stakeholders (i.e. project team members, customers/end-users, contractors, suppliers etc.) including top management who are involved in the project in order to ensure the successful completion of a project.

3.3.2 Project Team Factors

The project team is responsible for planning and executing the project activities throughout the project life cycle. It consists of a project manager and project team members, who are brought in to deliver their tasks according to the project schedule. Project team factors influencing project success are as shown in figure 3-4.

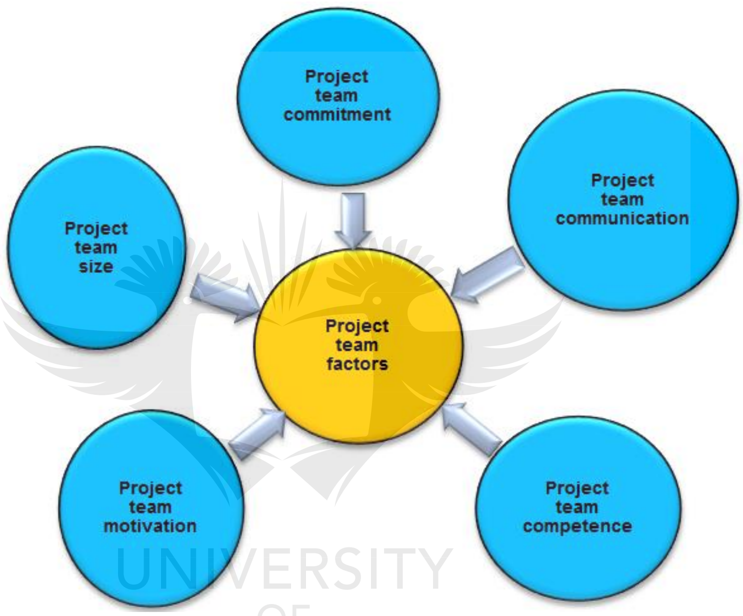

Figure 3-4: Project team factors influencing project success

Therefore, a project team is critical in project success as discussed in the following factors:

- **Project team commitment:** The commitment of the project team throughout a project's life cycle ensures project success (Baker et al., 1983; Belassi & Tukel, 1996; Standing, Guilfoyle, Lin & Love, 2006).

- **Project team effective communication:** The effective communication among project team members, stakeholders and top management contributes to successful projects (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013; Marnewick, 2013; Procaccino, Verner, Overmyer & Darter, 2002; Sudhakar, 2012).

- **Project team competence:** The project team is responsible for meeting project objectives, the project schedule, budget, scope, assessing and managing risks, and leading the initiative to the successful completion of a project. Therefore, to implement a project successful, the project manager and team members need to be competent in both technical and soft skills (Baker, Murphy & Fisher, 1983; Chow & Cao, 2008; Prabhakar, 2008; Rezania & Lingham, 2009; Marnewick, 2013).

- **Project team motivation:** Motivating the project team is a leading factor affecting the productivity throughout the project life cycle. Chow and Cao (2008) found that team members with great motivation positively influenced the perceived success of the agile software development projects. Therefore, the project manager needs to motivate his/her project team members to be committed to the success of the project. Project team motivation increases the chances of project success (Rickards, Chen & Morger, 2001).

- **Project team size:** A small-sized project team is more efficient and effective which increases the likelihood of project success (Chow & Cao, 2008; Cockburn, 2007; Highsmith, 2010).

3.3.3 Customer Factors

The customer of a project is referred to as the end-user of the final project product. In the literature, there are customer factors that influence project success as shown in figure 3-5 and discussed below.

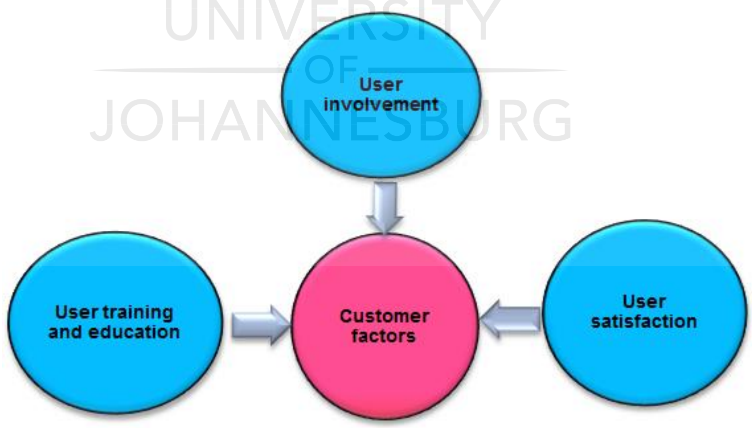

Figure 3-5: Customer factors influencing project success

- **User involvement:** User involvement throughout the project life cycle is regarded as one of the important requirements for a successful project (Ahimbisibwe et al., 2015; Chow & Cao, 2008; Marnewick, 2013; Sauer & Cuthbertson, 2003; Standish Group, 2016).

- **User satisfaction:** User satisfaction measures how the final project product meets expectations. The user satisfaction is essential in project success (Ahimbisibwe et al., 2015; Baccarini, 1999; DeLone & McLean, 1992). The project is said to be successful when the end-user accepts and uses the product and the product brings positive benefits to the organisation (Holland & Light, 1999; Kerzner, 2013; Pinto & Slevin, 1988b, 1988c, 1989).

- **User training and education:** Marnewick (2013) argues that adequate user understanding of technology is among the critical success factors of the outcomes of a project. Therefore, continuous training and education to users increase the chances of project success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013; Beynon-Davies, 1999; Cooke-Davies, 2002; Ika, Diallo & Thuillier, 2012; Misra et al., 2009; Wong & Tein, 2004).

3.3.4 Product Factors

Product success factors include meeting project goals and the project purpose, and they have organisational benefits, accuracy of output, reliability of output, functionality and quality of delivered product as shown in figure 3-6.

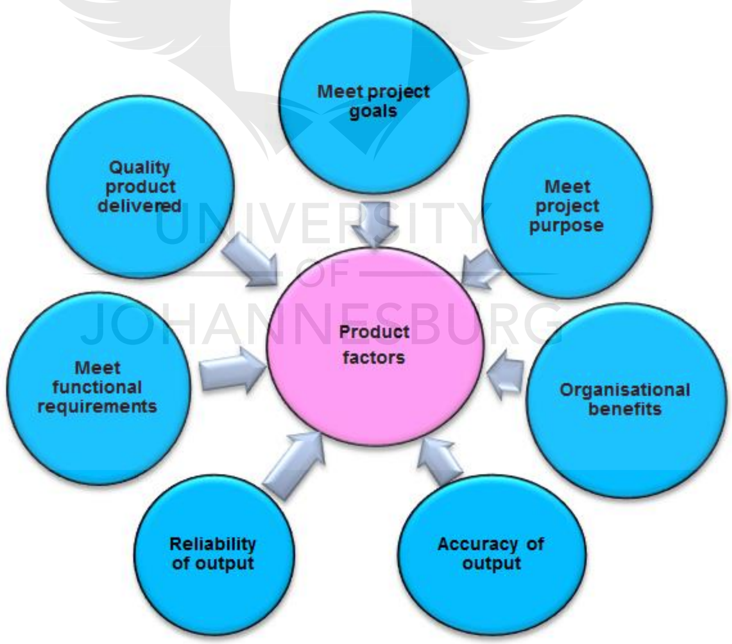

Figure 3-6: Product factors influencing project success

These product factors identified in literature that influence project success are discussed below.

- **Meet project goals:** The project is said to be successful when it has met the project goals and objectives as well as the project owner's strategic organisational objectives.

- **Meet project purpose:** Project product is successful when it has met the project purpose and satisfied users' requirements and stakeholders' expectations.

- **Organisational benefits:** According to Bannerman (2008), product success has a positive impact on business and strategic success. This success benefits the organisation in realising return on investment, business growth, competitive advantage and positioning the organisation for future opportunities (Shenhar, Renier & Wideman, 1996; Shenhar et al., 1997).

- **Accuracy of output:** This factor is specific to software development projects. When the final project product is able to provide accurate output, then it entails the product is implemented successfully in the organisation. Product success is a critical factor in the project success as evidenced by Ahimbisibwe et al. (2015), Atkinson (1999) and Bacarrini (1999).

- **Reliability of output:** Reliability, confidentiality, availability and data integrity are specific to software development projects. The reliability of output entails project product success, hence contributing to project success (Atkinson, 1999; Jun, Qiuzhen & Qingguo, 2011; Kamal 2006; Misra et al., 2009; Shenhar et al., 2002).

- **Meet functional requirements:** This means that the delivered final project product has met the customer's or end-user's functional requirements. The product functionality has an impact on project success (Jun et al., 2011; Kamal, 2006; Sheffield & Lemétayer, 2013).

- **Quality product delivered:** Delivering a good product or good project outcomes influences project success (Chow & Cao, 2008; Sheffield & Lemétayer, 2013; Sudhakar, 2012). The quality product delivered ensures (i) the developed project product is reliable and easy to use, (ii) it meets the user's intended functional requirements, (iii) it produces quality information and (iv) it satisfies the requirements set by users, top management and the project team.

3.3.5 Project Management Factors

Project management factors have a significant impact on IT project success. These factors are as shown in figure 3-7.

Figure 3-7: Project management factors influencing project success

The project management factors that influence project success are discussed below.

- **Project management knowledge:** Project teams need to have skills in project management and apply them throughout the project life cycle to increase the likelihood of project success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013, 2014; Baccarini, 1999; Baccarini et al., 2004; Bourne & Walker, 2008; Dezdar & Ainin, 2012).

- **Project management maturity level:** An organisation's effectiveness partly depends on the success of its projects. The studies on the relationship between project management maturity levels on PMI knowledge areas and perceived organisational performance revealed a significant relationship between project maturity level and organisational performance which increased the chances of project success (Besner & Hobbs, 2012, 2013; Jiang, Klein, Hwang, Huang & Hung, 2004; Yazici, 2009a, 2009b). Therefore, project management maturity level in the organisation contributes to achieving project success.

3.3.6 External Environment Factors

The factors related to external environment affect project in its phases of project life cycle (Pinto & Slevin, 1989). Conducive external environment contributes in achieving project success. The external environment factors are as shown in figure 3-8.

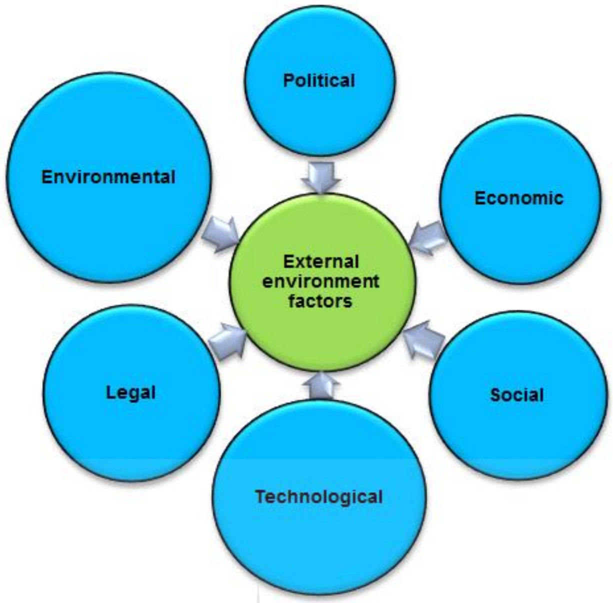

Figure 3-8: External environment factors influencing project success

The external environment factors that influence the project success are as follows:

- **Political:** Political factors refer to the political risks and political stability of a country. The political environment can affect projects in different ways and sometimes it presents opportunities as well. The political risks and stability have a significant impact on project success in developing countries. However, political grievances may ultimately result in political instability or violence, increasing the political risk for foreign companies operating in the country. For instance, the unpredictable political risks and instability in Libya have led to failure on Chinese contracted projects (Zhang & Wei, 2012). From a project perspective, political factors contribute to project success and return of capital investment (Belassi & Tukel, 1996).

- **Economic:** Economic factors relate to changes such as costs and prices of goods, interest rates, wage rates, exchange rates and the rate of inflation in a country. The economic conditions of a particular country and the global economic state also have a significant impact on project success (Belassi & Tukel, 1996; Chen & Qu, 2011; Ika et al., 2011). This is evidenced by the developed countries (with a good state of the economy) who continue to fund developing and poor countries to implement various development projects (sometimes referred to as 'donor-funded projects'.

- **Social:** Social factors refer to human behaviour, cultural differences, beliefs, tribalism and other social structures. The social factors impact on project planning, management and implementation as well as the success of a project (Belassi & Tukel, 1996). According to the Human Development Report (2014), the development of human resources remains one of the main challenges in developing countries. Countries with low human development levels face skills shortages, including project management skills which are likely to impact negatively on project success. Wang and Liu (2007), in their study on cultural barriers in project management, found that Chinese enterprises faced difficulties in applying the Western project management approach which was different from the Chinese traditional culture. This resulted in the failure of some international development projects contracted by Chinese companies such as the Poland construction project (Wall Street Journal, 2012). Therefore, project teams need to incorporate cultural factors of a country's traditions, values, customs and beliefs during the project planning phase in order to ensure project success.

- **Technological:** The advance in technology and its uncertainty have an impact on project success (Ahimbisibwe et al., 2015; Belassi & Tukel, 1996). During the project implementation phase it may happen that newer technology has emerged and is more sophisticated than the existing technology. In this scenario, the technology management strategy is crucial to ensure the relationship between available and emerging technologies during the project life cycle (APMBOK, 2012). Therefore, the proper management of enabling technologies used to deliver projects, technologies used to manage projects and the technology of the project deliverables all contribute to project success.

- **Legal:** The legal environment refers to appropriate government policies pertinent to laws and regulations (Kwak, 2002). Project management needs to comply with laws and regulations. However, legislative changes take place from time to time which may affect the management of a project. Therefore, the project team needs to monitor the updated and latest laws and regulations throughout the project life cycle and incorporate them in the project management plans. This may contribute to achieving project success.

- **Environmental:** The external environmental factors are external environment events such as natural calamities, weather conditions, wars, terrorism attacks and sub-contractors which all may have an impact on project success (Belassi & Tukel, 1996; Kwak, 2002; Pinto & Slevin, 1989; Sudhakar, 2012). Project teams need to monitor external environment events throughout the project life cycle to ensure successful completion of projects.

The following section discusses the relationship between IT project auditing and project success.

3.4 RELATIONSHIP BETWEEN IT PROJECT AUDITING AND PROJECT SUCCESS

The objective of this section is to determine whether a positive relationship exists between IT project auditing and project success. In the previous section, various critical success factors influencing project success have been discussed. Nalewaik and Mills (2014:110) argue that the "use of critical success factors has been widely adopted as another approach by which to evaluate the health of projects". Therefore, auditing a project throughout its life cycle helps to identify project risks earlier, to trigger timely corrective actions and to improve project performance which increases the likelihood of the successful completion of the project and delivery of a good product (Marnewick & Erasmus, 2014; Meredith & Mantel, 2009).

In the literature are a number of theoretical and empirical studies which have revealed that the auditing of processes influences IT project success. Sonnekus and Labuschagne (2003), in their study, conducted interviews with IT managers of several industries to determine factors influencing IT project success. The results revealed that auditing of processes contributed 50.2% to project success in South Africa. Another study was conducted by Marnewick and Labuschagne (2009) on factors that influenced the outcomes of IT projects in South Africa. The study results revealed that auditing of processes contributed 32.4% to project success in South Africa. In the Prosperus report (Marnewick, 2013), the results revealed that auditing of processes contributed 22.9 % to project success in Southern African Development Community (SADC) countries and Nigeria as well, as summarised in table 3-6 below.

Table 3-6: Auditing influencing IT project success - empirical studies (2003-2013)

Year	Project success (% respondents)	Researched countries
2003	50.2	South Africa
2008	32.4	South Africa
2011	25.5	South Africa
2013	22.9	SADC countries and Nigeria

Source: Adapted from Joseph, Erasmus and Marnewick (2014)

In another study, Joseph and Marnewick (2014) propose structured equation modelling for determining ICT project management success. The study results revealed that a formal methodology should include practices and principles which facilitate the correct auditing of processes in project management.

Simon (2011), in his study on why new systems fail, argues that most organisations implemented IT projects and went live with an imperfect system. In order to refrain from the imperfect system, he proposed the advantages of IT project auditing into three phases (i.e. a pre-implementation audit, a mid-implementation audit and a post-implementation audit) as shown in table 3-7. Simon (2011) suggested that project auditing be conducted throughout the project life cycle to ensure project success.

Table 3-7: Advantages of IT project auditing

Project auditing phases		
Pre-implementation audit	**Mid-implementation audit**	**Post-implementation audit**
• Conducting organisation readiness assessment before starting a project, allows identifying pros and cons of the project. • Helps the top management to know the project risks in advance. • Continuous auditing of data ensures reports contain meaningful and accurate information.	Helps to identify functional, technical and people issues that may cause IT project implementation to fail.	Lessons learned from the project provide valuable insight into the organisation in the future project implementation.

Source: Simon (2011)

Huemann (2004) argues that, management audits of projects and programmes provide assurance on its quality and success. Huemann (2004) recommended the following:

(i) “Auditing of a project can be done regularly from the start of a project to its closing phase”,

(ii) “Transparent auditing processes and communication policies are necessary”, and

(iii) “Instead of ticking boxes whether a certain project management document exists or not, auditing requires drilling down to assess the quality and provide feedback”.

Another empirical study which is not directly related to IT projects has revealed that there is a positive relationship between auditing and project success. Sichombo, Muya, Shakantu and Kaliba (2009) investigated the benefits of technical auditing in Zambian construction projects. The study proposes benefits of technical auditing to be that it (i) provides client confidence, (ii) enhances accountability, (iii) reduces project costs and (iv) reduces dispute resolution periods. The study also conducted a survey to examine whether a technical audit could prevent unethical practices during the course of the projects. The study interviewed contractors, manufacturers, auditors, suppliers as well as consultancy and clientele sectors in Zambia. The study results revealed that 65% of the respondents stated that a project technical auditing could prevent unethical practices and influence project success. The study suggested technical auditing to be conducted by appointed technical auditors at the pre-contract stage (i.e. planning phase of a project life cycle) as well as at post-contract stage (i.e. project closing phase) in order to prevent unethical practices. According to this study, the regular technical auditing throughout the project life cycle influenced project success.

The above theoretical and empirical studies established the causality between IT project auditing and project success. Hence, both empirical and theoretical studies entail that IT project auditing is still important in influencing project success.

3.5 CONCLUSION

The overall goal of this chapter was to determine the causality between auditing and IT project success. The chapter analysed various definitions of project success to gain an understanding of what factors determined project success. The evolution of project success started in the period 1960 to 1980 where the focus within project success was on the implementation phase of a project life cycle. The project management success criteria were measured with the 'iron triangle', namely meeting time, cost and quality requirements. In the period 1980 to 1990, project success focused on both the implementation and planning phases of a project life cycle. The emphasis within project success was to develop critical success factor (CSF) lists. These CSF lists contributed to achieving project success. During the period 1990 to 2000 critical success factor frameworks emerged, and the view of project success included both project and product success.

These CSFs were categorised into common themes to allow examination of CSF interrelationships. From 2000 onwards to the present, the emphasis is on strategic project management (i.e. project management moves from an organisation's tactical level to the strategic level). The focus in project success now is on strategic project management success, project success, product success, programme success and portfolio success.

Some studies proposed dimensions of project success related to the project owner, satisfaction of customers' and stakeholders' needs, the commitment of top management and the project team as well as the correct auditing of processes.

The chapter also discussed in more detail factors influencing project success and were categorised into (i) organisational factors, (ii) project team factors, (iii) customer factors, (iv) product factors, (v) project management factors and (vi) external environment factors.

Lastly, a number of theoretical and empirical studies were discussed which had determined a positive relationship between project auditing and IT project success. Therefore, when IT projects are audited, they can increase the number of successful projects in the organisation.

The next chapter develops a conceptual IT project management assurance framework that can be used in public and private sector organisations.

CHAPTER 4: CONCEPTUAL INFORMATION TECHNOLOGY PROJECT MANAGEMENT ASSURANCE FRAMEWORK

4.1 INTRODUCTION

The previous chapters on auditing and project success have established that there exists a positive relationship between project auditing and IT project success. The overall goal of this chapter is to develop a conceptual information technology project management assurance framework that can be used in public and private sector organisations to deliver successful IT projects. The first objective is to conduct content analysis on the literature review of the previous chapters to identify possible components of the conceptual framework. The second objective is to discuss the components of the conceptual framework and the interaction amongst these components. The third objective is to come up with high-level IT project assurance processes.

The following section develops and discusses in more detail the components of a conceptual framework.

4.2 DEVELOPMENT OF A CONCEPTUAL FRAMEWORK

This section develops a conceptual information technology project management assurance framework. Miles and Huberman (1994:440) define a conceptual framework as "a visual or written product, that explains, either graphically or in narrative form, the main things to be studied, the key factors, concepts, or variables and the presumed relationships among them". According to Maxwell (2005:41), a conceptual framework is "something that is constructed, not found". He points out that the overall coherence of a conceptual framework "is something that you build, not something that exists ready-made". Conceptual framework is defined as "a network, or plane of linked concepts that together provide a comprehensive understanding of a phenomenon" (Jabareen, 2009:51).

A. Methods used to develop a conceptual framework

There are various methods, which are used to develop a conceptual framework such as a content analysis, a thematic analysis, a conceptual analysis, a discourse analysis, a semiotic analysis and a metaphor analysis (Jabareen, 2009). The description of these methods is shown in table 4-1.

Table 4-1: Different methods used to develop a conceptual framework

Method	Purpose	Advantages	Disadvantages
Content analysis	An approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytic rules and step by step models, without rash quantification (Mayring, 2000)	• Provides valuable historical insights over time through analysis of texts • Allows a closeness to text which can alternate between specific categories and relationships • Easy to interpret texts for purposes of creating relationship among concepts • Inexpensive method • It scores highest with regard to ease of replication	• Time consuming • Inherently reductive, particularly when dealing with complex text. • Difficult to automate or computerize.
Thematic analysis	Identify, analyse and report patterns (themes) within data (Braun & Clarke, 2006).	• Flexible method. • Suited to large data sets. • Interpretation of themes supported by data. • Allows for categories to emerge from data.	• Reliability is a concern due to wide variety of interpretations from multiple researchers. • Flexibility makes it difficult to concentrate on what aspect of the data to focus on. • Discovery and verification of themes and codes mesh together.
Conceptual analysis	Analyse concepts into their constituent parts in order to gain knowledge or a better understanding of a particular philosophical issue in which the concept is involved (Beaney, 2003).	• Produce concepts • Reconstruct a unified theoretical framework from the multidisciplinary literature	• Inadequate for theorizing the concepts that emerge from the text.

Method	Purpose	Advantages	Disadvantages
Discourse analysis	Study of the ways in which language is used in text and contexts (Woolgar, 1988)	• Provides a positive social and psychological critique of any phenomenon under the gaze of the researcher • It has a relevance and practical application at any given time, place and for any given people. • It allows to view problem from a higher stance and to gain a comprehensive view of the problem.	• Lack of prescription regarding how it should be done. • Does not provide a tangible answer to problems based on scientific research • Fail to provide a framework on how to analyse private manifestations of discourse.
Semiotic analysis	Identify content of signs, their use and the formation of meanings of signs at both the level of a single sign and the broader systems and structures formed by signs (Saussure, 1966)	• Establishes relationship of elements and production of meaning in a text	• Ignores the quality of the work itself • Not concerned with art, but rather with meaning and modes of cognition

Based on the advantages and disadvantages of each method that is used to develop a conceptual framework as illustrated in table 4-1, this research study used a content analysis to develop the conceptual framework from the comprehensive literature review. The framework lays down the foundation for the importance of the research problem and research question.

B. Components of the conceptual framework

The concepts can be derived from both inductive and deductive content analysis processes (Mayring, 2000). A deductive content analysis is used when concepts are derived, based on previous knowledge such as a literature review. An inductive content analysis is used when concepts are derived from data.

The deductive content analysis is selected and used to identify the components of the conceptual framework. The categories generated from content analysis are used as the main components of the conceptual framework. The following are steps used to identify the components of the conceptual framework:

- To refer research question and research problem

The link of identified concepts with the research question and research problem validates the reliability of the concepts (Mayring, 2000).

- To conduct a literature review to identify key concepts

The deductive content analysis process identifies the key concepts as project auditing, project life cycle, project governance, project success, project assurance and project deliverables. The reliability of these concepts is linked back to the research question and problem statement as well as theoretical definitions (Mayring, 2000).

- To create a relationship between the concepts

Maxwell (2005) points out that concept mapping is a useful technique for developing and displaying conceptual frameworks. The concepts were mapped to create relationships among the concepts as illustrated in figure 4-1.

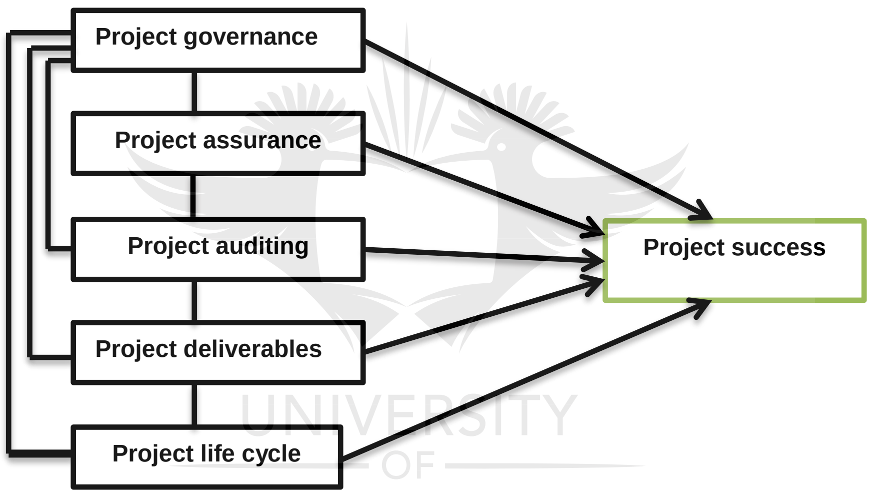

Figure 4-1: Concepts mapping

- To identify components of the conceptual framework

The new names of the components are provided and identified as the components of the conceptual framework as shown in table 4-2.

Table 4-2: Components of the conceptual framework

Identified concepts	New names of the components	Identified components
1. Project governance	1. Project governance	1. Project governance
2. Project success	2. IT project success	2. IT project success
3. Project assurance	3. Level 4:IT project assurance	3. Level 4:IT project assurance

4. Project auditing	4. Level 3:IT project auditing	4. Level 3:IT project auditing
5. Project deliverables	5. Level 2:IT project deliverables	5. Level 2:IT project deliverables
6. Project life cycle	6. Level 1:IT project life cycle	6. Level 1:IT project life cycle

Source: Author

The following section discusses the components of the conceptual information technology project management assurance framework.

4.2.1 Project Governance

Project governance is important in ensuring successful IT project delivery (Joslin & Müller, 2015). Project governance is "a framework, functions, and processes that guide project management activities in order to create a unique product, service, or result and meet organisational strategic and operational goals" (PMI Governance Guide, 2016). The Guide to the Project Management Body of Knowledge (PMBoK® Guide) points out that project governance enables organisations to consistently manage their projects, maximise the value of their project outcomes, align their projects with their business strategy and provide a framework for decision making (PMI, 2017).

According to Müller (2009), project governance comprises structures, processes and systems that oversee project progress, provide project support and guidance, monitor project performance and control project implementation activities as well as being responsible for decision making throughout the IT project life cycle. The following are inputs of project governance into the conceptual framework:

a) **Creates a framework for oversight:** Project governance oversees the implementation of the IT project activities and provides a decision-making framework throughout the IT project life cycle (Garland, 2009). Project governance also provides a forum for IT project conflict resolution.

b) **Approves the responsibilities of project team members:** Project team members are appointed by the project owner at the initiation phase, and their responsibilities are approved by the project governance board. Other project governance responsibilities are as illustrated in Appendix A.

c) **Approves the appointment and responsibilities of the project manager:** During the initiation phase, project governance approves the appointment and responsibilities of the project manager. Project governance also provides direction to the project manager and approves the project structure as developed by the project manager (Garland, 2009).

d) **Provides direction and guidance of best practice to the IT project:** Project governance approves the project management methodology (best practice) to be used during the IT project management process (Bannerman, 2008).

e) **Provides a link between corporate governance and IT project management:** Project governance ensures the IT project is aligned with the organisation's strategic and business objectives (PMI, 2017). The alignment helps the organisation to achieve its goals (Too & Weaver, 2014).

f) **Ensures transparency and accountability:** The project governance structure ensures transparency and accountability throughout the project life cycle for the successful delivery of the project (HM Treasury, 2007).

g) **Approves dissemination of the project status report:** Project governance approves the communication and reporting of the project status to internal and external stakeholders (HM Treasury, 2007).

h) **Provides decision making during the project assurance review:** Project governance provides guidance during the IT project assurance gates review process in order to ensure IT project success.

i) **Ensures full engagement of project stakeholders:** Project governance confirms the effective involvement and support of top management, the project team and other stakeholders. The involvement and support of top management and stakeholders influence project success (as discussed in chapter 3, section 3.2.1).

Project governance is a critical success factor for the delivery of projects (Biesenthal & Wilden, 2014; Garland, 2009; HM Treasury, 2007; Müller, 2009). Project governance interacts with each level of the conceptual framework as follows:

Level 1 - IT project life cycle: Project governance provides a framework within which project decisions are made throughout the project life cycle (Garland, 2009). The detailed project governance responsibilities to the conceptual framework are illustrated in Appendix A.

Level 2 - IT project deliverables: Project governance provides a framework within which project decisions are made throughout the project life cycle (Garland, 2009). Project governance reviews the progress report of deliverables against planned project activities, and then provides guidance. The detailed project governance responsibilities to the conceptual framework are illustrated in Appendix A.

Level 3 - IT project auditing: Project governance provides a framework within which project decisions are made throughout the project life cycle (Garland, 2009). Project governance reviews and approves IT project audit reports from each phase of the project life cycle. The detailed project governance responsibilities to the conceptual framework are illustrated in Appendix A.

Level 4 - IT project assurance: Project governance provides a framework within which project decisions are made throughout the project life cycle (Garland, 2009). Project governance appoints an independent project assurance team. The project assurance team conducts assurance gate reviews throughout the IT project life cycle and communicates the results to the project governance board. The other responsibilities of project governance are to review and approve IT project assurance gates review reports from the project assurance team. The detailed project governance responsibilities to the conceptual framework are illustrated in Appendix A.

Project governance is not going to be discussed in detail because it is not the main focus of this study.

4.2.2 Level 1: IT Project Life Cycle

In the literature, there are various project life cycles which provide a framework for managing projects (Kay, 2014; Kerzner, 2013; Ohara, 2005; PMI, 2017). PMI (2013:38) defines a project life cycle as a "series of phases that a project passes through from its initiation to its closure". Project life cycles differ depending upon the nature of a project and the industry involved. The generic project life cycle comprises the initiation, planning, execution, monitoring, controlling and closing phases (Kerzner, 2013; Ohara, 2005; PMI, 2017). This research study has adapted project life cycle from the Project Management Body of Knowledge (PMI, 2017) and the operation phase of a project life cycle from Ohara (2005) and Kay (2014) to create a new IT project life cycle. The conceptual framework comprises the IT project life cycle as shown in figure 4-2.

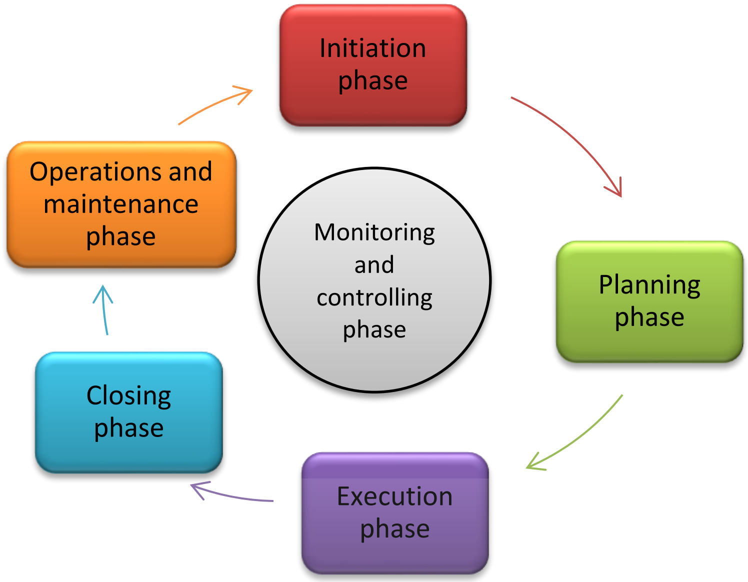

Figure 4-2: IT project life cycle

The phases of an IT project life cycle are discussed next.

a) Initiation phase: The initiation phase creates a business case which provides justification for carrying out the project (PMI, 2017). The business case shows expected costs and benefits of the project, aligns the project with the business strategy, identifies high-level risks and the project contribution to the organisation's goals (Kay, 2014). During the initiation phase the feasibility study is conducted to determine whether the project is feasible for investing. The project manager and team are appointed in the initiation phase. The key roles and responsibilities of the project team are listed. In this phase, the project charter is developed. The project charter is a document issued by the project initiator or sponsor who formally authorises the existence of the project and provides the project manager with the authority to apply organisational resources to the project activities (PMI, 2017). In the initiation phase, the project charter establishes strategic alignment of the IT project vision and mission with the organisational vision and mission. The project charter also establishes that the IT project is aligned with the organisation's strategic and business objectives. The initiation phase sets up a Project Management Office (PMO) with defined roles and responsibilities (Hill, 2013; Kay, 2014). Stakeholder register is created in initiation phase (PMI, 2017).

b) Planning phase: This phase develops project management plans that are used to carry out the project activities. The generic project management plans include the project scope management plan, the project time management plan, the project cost management plan, the project integration management plan, the project quality management plan, the project communication management plan, the project risk management plan, the change management plan, the project procurement management plan and the project stakeholder management plan (Ohara, 2005; PMI, 2017; APMBOK, 2012). Other project plans are those for project finance management, project value management, project objectives management, project information technology management, project organisational management, project strategy management, project product acceptance, project teams, project exception, project benefits realisation, and healthy, safety and environmental management (Ohara, 2005; PRINCE2, 2009; APMBOK, 2012). Apart from the generic project management plans, organisations can include other specific project management plans according to their business objectives.

c) **Execution phase:** The execution phase carries out the project activities defined during the project planning phase (PMI, 2017). During the execution phase all agreed project deliverables are implemented and accepted by the customer (APMBOK, 2012). The project manager coordinates all the project activities, mobilises stakeholders and resources and tracks the progress of each activity to ensure the successful implementation of the IT project.

d) **Closing phase:** During this phase the final IT project deliverables (as shown in Appendix A) are accepted and handed over to the project sponsor and the customer or end-user (PMI, 2017; APMBOK, 2012). Therefore, the project oversight authority (i.e. project governance or project steering committee) concludes that the project has met the goals established beforehand. The IT project closing phase includes the following tasks:

   i) *Project administrative closure:* It involves the preparation of the administrative documentation, collection of project documentation, disposition of project documents, and logistics activities that ensure that the project resources are redistributed.

   ii) *Project financial account closure:* It involves the termination of the financial aspects and budget of the project. Financial closure includes contract closure and project account closure. Project expenditures are accounted and reconciled with the project account.

   iii) *Contract closure:* The contracts involved during the IT project management are terminated. The supporting documents, such as original contracts, contract addenda and performance reports of the contracts, are used during the contract closure process.

   iv) *Collect and archive project records*: Historic project data helps to improve future projects. Project archive data include the project business case, project feasibility study report, project charter, project management plans, project oversight review records (i.e. meeting minutes), project status report, project contract and other relevant project records.

v) *Document lessons learned:* Lessons learnt throughout the project life cycle are documented and used in future projects.

vi) *Plan for the project post-implementation review:* The plan for the project post-implementation review needs to be prepared. The post-implementation review is conducted in the project operation and maintenance phases of the IT project life cycle. The review enables realising benefits from the project to the organisation.

vii) *Review the user acceptance report:* User acceptance testing is conducted to ensure that the customer or end-user, top management, project sponsor and other project stakeholders are satisfied with the project product. The acceptance certificate is issued to the organisation, and the user acceptance report is prepared.

viii) *Prepare project closing report:* A project closing report is prepared after completing the project activities in the closing phase. The project closing phase report is used by project auditors to conduct an IT project closing phase audit.

e) **Monitoring and controlling phase: Project monitoring and controlling are performed** throughout the project life cycle (PMI, 2017). The continuous monitoring of the project sets out the current status of the IT project. Project monitoring and controlling also include controlling changes, recommending preventative and corrective actions, and monitoring the ongoing project activities against the project management plans. The monitoring and controlling phase provides the deliverables (as shown in Appendix A) which are used during the IT project auditing phase.

f) **Operations and maintenance phase:** This phase includes the ongoing support and maintenance of the project deliverables (Kay, 2014). The purpose of the project operation phase is to ensure that the project product is fully operational and functional. A post-implementation review is conducted during the project operations phase in order to determine if the project product is operating as expected and its benefits are realised. According to Khan and Zheng (2005), the maintenance phase involves:

i) Corrective maintenance which diagnoses and fixes project product defects found by users.

ii) Perfective maintenance which aims at improving the project product performance.

iii) Adaptive maintenance which updates the project product according to changes in the user requirements, changes in the platforms and the external environment.

iv) Preventative maintenance which increases the reliability of the project product and prevents failures.

4.2.3 Level 2: IT Project Deliverables

Project deliverables are measurable and tangible outcomes of a project which meet defined project objectives and goals (PMI, 2017). In each phase of the IT project life cycle, there are basic project deliverables as shown in table 4-3. These project deliverables are examined during the IT project auditing phase.

Table 4-3: Basic IT project deliverables

Initiation Phase	Planning Phase	Execution Phase	Monitoring and Controlling Phase	Closing Phase	Operations and Maintenance Phase
• Business case • Feasibility study report • Project charter • Project governance structure • Project team • Stakeholders register • Project Management Office • Project kick-off Meeting minutes	• Project management plans: i) Project integration management plan ii) Project scope management plan iii) Project cost management plan iv) Project time management plan v) Project resource management plan vi) Project risk management plan vii) Project procurement management plan viii) Project stakeholders management plan ix) Project quality management plan x) Project communication management plan xi) User acceptance test plan xii) Vendor and Contractor management plan xiii) Project fraud and corruption prevention plan xiv) Project benefits management plan xv) Project social responsibility plan xvi) Project conflict management plan • Project management methodology	• Performance of project management plans • Project product deliverables • Project contract performance • Project management plans updates • Change requests • Acceptance test report • Project team performance assessment report • Organisational process assets updates • Project documents updates	• Project progress reports • Project risk register updates • Change requests • Project product quality control • Validated project product deliverables • Organisational process assets updates	• Final project product acceptance report • Project financial accounts closeout • Procurement closeout • Project team closeout • Contracts closeout • Project lessons learned • Training and transfer of knowledge report • Complete project records • Project closeout report • Post-implementation review plan	• Project product accuracy and reliable outputs • Benefits realisation • Service Level Agreements • Operations and maintenance Manual • Incidents response team • Disaster recovery plan • Help desk • Project product sustainability

Source: Author

4.2.4 Level 3: IT Project Auditing

The continuous auditing throughout the IT project life cycle contributes to achieving project success (as discussed in section 3.4 of chapter 3). There are three IT project auditing phases (as discussed in section 2.7.2 of chapter 2), namely the pre-audit phase, the mid-audit phase and the post-audit phase as shown in figure 4-3. These audit phases examine the IT project deliverables from each phase of the IT project life cycle.

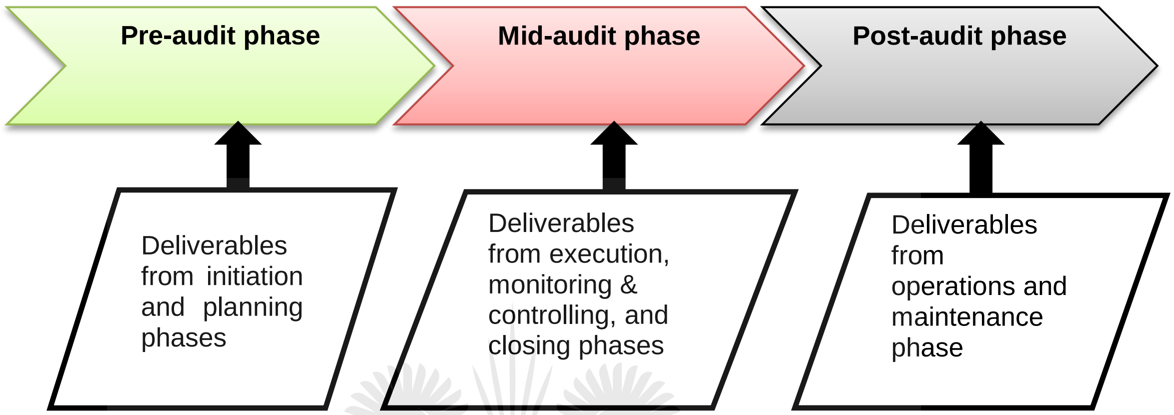

Figure 4-3: IT projects auditing phases

a) **Pre-audit phase:** The pre-audit phase examines the project deliverables from the initiation and planning phases of the IT project life cycle. The basic project deliverables are as shown in table 4-3. The pre-audit phase ensures there is enough evidence to determine whether it is worth the required investment and to ensure the project plans are developed. The pre-audit report is assessed during the project assurance review Gate 1 and Gate 2 as discussed in section 4.2.5.

b) **Mid-audit phase:** The mid-audit phase examines IT project deliverables from the execution, monitoring, controlling and closing phases of the IT project life cycle. The mid-audit phase comprises a Pre-go-live audit, Go-live audit and a closing audit as shown in figure 4-4.

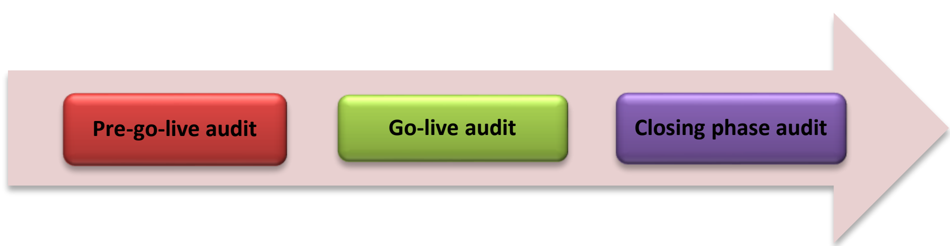

Figure 4-4: Mid-audit phase

The following audits are conducted during the mid-audit phase:

- **Pre-go-live audit:** This audit is conducted in the execution phase before the project product goes live. It aims to review whether the organisation is ready for the deployment of a project product. The audit also establishes baseline performance levels to compare them to the performance levels after going live. Some of the areas examined during the pre-go-live audit are the installation of a project product into production environment, user-acceptance testing, stress testing, end-end testing, functional testing, integration testing, entire-project product testing, training of end-users, operation manuals and training materials, data cleaning and conversion, project product security policy and implementation strategy. The pre-go-live audit report is assessed during the project assurance review Gate 3 (as discussed in section 4.2.5).

- **Go-live audit:** This audit is also conducted in the execution phase of the project life cycle after the project product goes live. The audit aims at assessing the operational use of the project product and identifying areas of improvement. Some of the areas examined during the go-live audit are stress and volume testing, parallel testing, user-acceptance testing and sign-off, end-user training, data migration, help desk support, pre-go-live audit report, completion of the IT project objectives and assess the project management activities. The go-live audit report is assessed during the project assurance review Gate 3 (as discussed in section 4.2.5).

- **Closing phase audit:** The project deliverables from the closing phase are audited. The closing audit report is assessed during the project assurance review Gate 4 (as discussed in section 4.2.5).

c) Post-audit phase: Post-audit examines the project deliverables from the operations and maintenance phase of the IT project life cycle. The operations and maintenance audit report is assessed during the project assurance review Gate 5 (as discussed in section 4.2.5).

4.2.5 Level 4: IT Project Assurance

Project assurance is "about checking that the project remains viable in terms of costs and benefits (business assurance), checking that the users' requirements are being met (user assurance), and that the project is delivering a suitable solution (specialist or technical assurance)" (PRINCE2, 2009: 309). According to PWC (2015), failed IT projects cost the world's largest 500 companies more than $14 billion a year. The utilisation of project assurance in the IT projects can increase the rate of IT project success (Tilk, 2002; Berg, 2013; PWC, 2015). Therefore, the study proposed IT project assurance as one of the components of the developed conceptual framework. The IT "project assurance focuses on whether the IT project is likely to succeed, and what can be done to make it succeed. The main question asked during the IT project assurance review is: Will the IT project be delivered successful with the current information" (Oakes, 2008:45). Hence, IT the project assurance process has a broader view than project auditing as illustrated in figure 4-5.

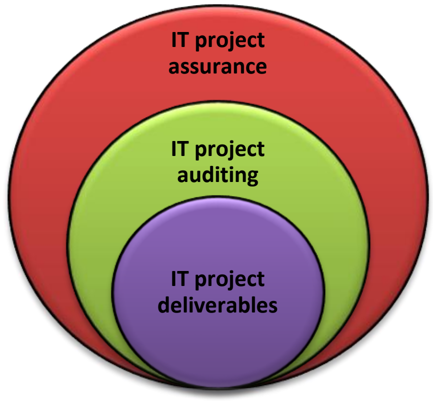

Figure 4-5: Broader view of IT project assurance

Project assurance is conducted by an independent team and this team reports to the project governance board. Therefore, project assurance has a relationship with project governance structures as shown in figure 4-6.

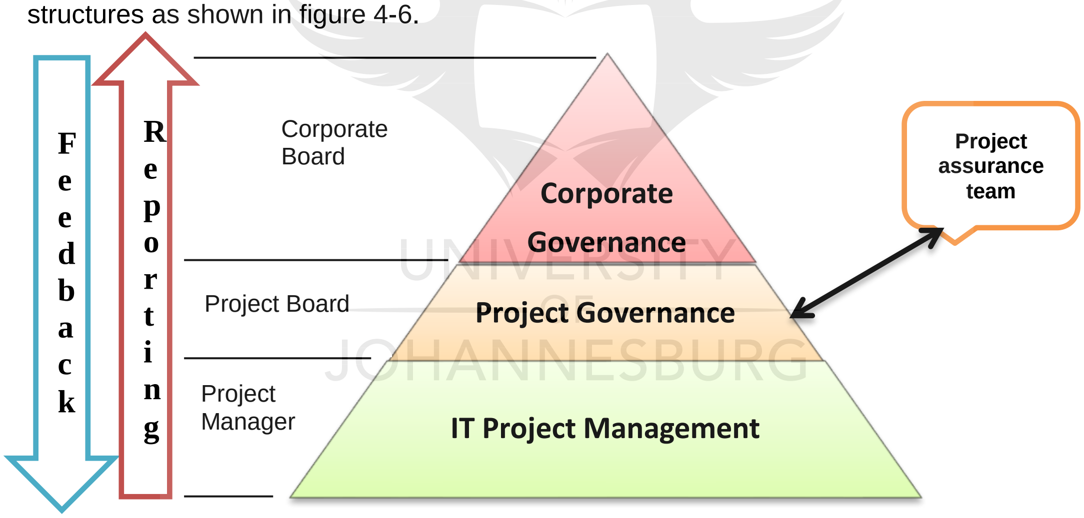

Figure 4-6: Relationship between Project Assurance and Project Governance

The relationship between project assurance and project structures are discussed below.

- **Corporate governance:** Corporate governance comprises a corporate board which makes decisions about which project is worth investing.
- **Project governance:** Project governance comprises a project board which is responsible for making decisions on the direction of the project, resource utilisation to achieve project objectives and goals as well as to ensure project success. Project governance should comply

with the corporate governance requirements. The project board is responsible to the corporate board for the overall direction and management of the project, and has the responsibility and authority for the project within the project mandate set by the corporate board.

- **IT project management:** During the project management phase the project manager is responsible for coordinating all the project activities. The project manager also monitors the progress of the project and reports to the project board.

- **Project assurance:** The project assurance team assesses the IT project delivery performance on behalf of the project board and reports results to project governance and corporate governance boards (Oakes, 2008). IT project assurance comprises a gates review process, which aims at enhancing the prospect of delivering a successful IT project. In each assurance gate review, the project governance makes the decision as to whether or not the IT project is to continue to the next phase of the IT project life cycle.

In the developed conceptual framework, gate reviews are used as a project assurance methodology to ensure the successful delivery of an IT project in the organisation. The areas of IT project assurance review are developed from the following process:

- To derive areas of the IT project assurance review by using a deductive content analysis from the literature review. The following project assurance review areas were identified:

  (i) Strategic alignment

  (ii) Business justification

  (iii) Project approval

  (iv) Project management plans

  (v) Project implementation

  (vi) Project close-out

  (vii) Benefits realisation

- To do mapping of the COBIT 5 processes, project success factors and IT project life cycle with the identified project assurance review areas

From the content analysis of the COBIT 5 processes, project success factors and IT project life cycle requirements that are relevant to project assurance review areas were identified. These relevant requirements of the COBIT 5 processes, project success factors and IT project life cycle were mapped with IT project assurance review areas as shown in table 4-4.

Table 4-4: Mapping COBIT 5 processes, project success factors and project life cycle with IT project assurance review areas

IT Project assurance review areas	COBIT 5 processes	Project success factors	IT Project life cycle
Strategic alignment	X	X	X
Business justification	X	X	X
Project approval	X	X	X
Project management plans	X	X	X
Project implementation	X	X	X
Project closeout	X	X	X
Benefits realisation	X	X	X

Source: Author

- To rename the project assurance review areas

The identified project assurance review areas were given new names as shown in table 4-5 for easy understanding of the terms used. The renamed IT project assurance review areas were mapped with the developed conceptual framework (refer figure 4-7).

Table 4-5: IT project assurance review areas

IT Project assurance review areas	New names of IT project assurance review areas	Identifier (Code)	Gate #
Strategic alignment	Project Strategic Alignment Review	PSAR	Gate 1
Business justification	Project Business Justification Review	PBJR	Gate 1
Project approval	Project Approval Review	PAR	Gate 1
Project management plans	Project Management Plans Review	PMPR	Gate 2
Project implementation	Project Implementation Review	PIR	Gate 3
Project closure	Project Closure Review	PCR	Gate 4
Benefits realisation	Project Benefits Realisation Review	PBRR	Gate 5

Source: Author

4.2.6 IT Project Success

IT project success interacts with all the components of the conceptual framework as shown in figure 4-7. The interaction of IT project success in each level is described as follows:

a) IT project success interacts with Level 1: IT project life cycle to ensure:

   i) Process success where the IT project processes are aligned with the project best practices and/or standards as well as project purpose throughout the IT project life cycle

   ii) Project management success where the success criteria measures assure project success throughout the entire project life cycle

b) IT project success interacts with level 2: IT project deliverables to ensure:

   i) Deliverable success where the project deliverables meet the aspects of specifications, requirements, expectations from stakeholders, customer/user acceptance, quality and effective use of the product

   ii) Business success where there is a positive organisational impact from the IT project success

c) IT project success interacts with Level 3: IT project auditing to ensure that the audit report from each phase of the IT project life cycle assures project success.

d) IT project success interacts with Level 4: IT project assurance where five IT project assurance review gates (as discussed in section 4.2.6) are tailored to ensure IT project success in each phase of the IT project life cycle.

   The developed conceptual framework, as shown in figure 4-7, presents the interrelationship among the components.

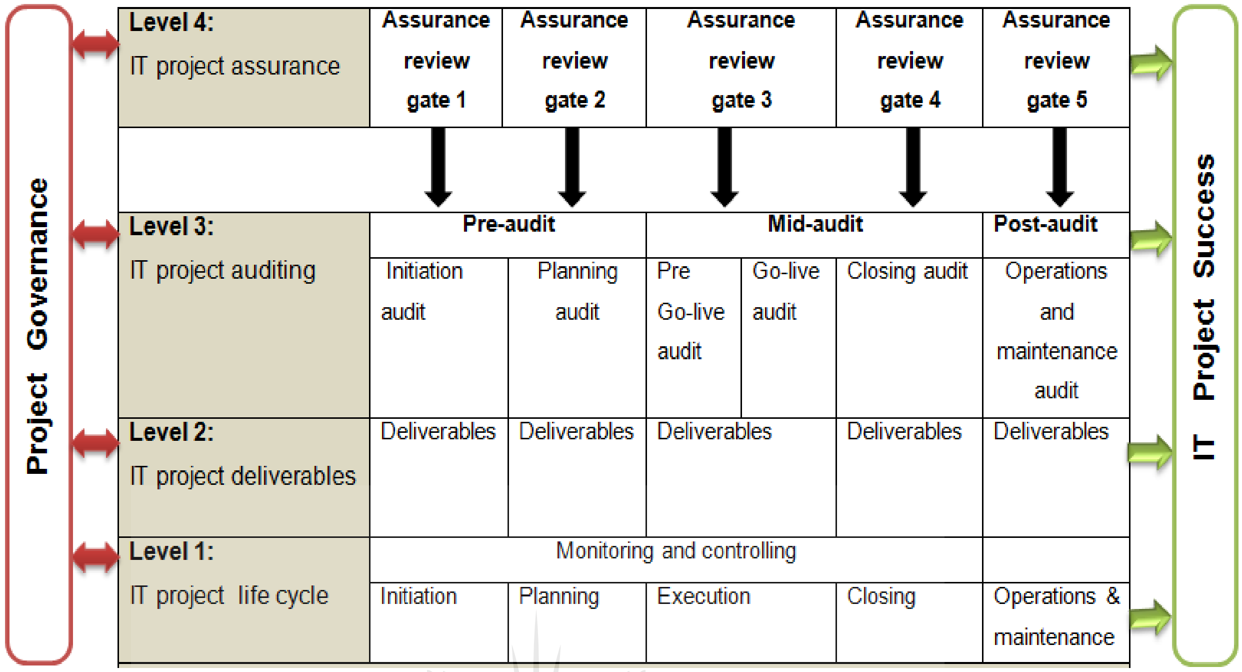

Figure 4-7: Conceptual Information Technology project management assurance framework

4.3 PROCESS TO DEVELOP HIGH-LEVEL IT PROJECT ASSURANCE PROCESSES

The following steps were used to develop the high-level IT project assurance processes:

1. The literature review was conducted to gain an understanding of IT assurance initiatives and fundamental principles for understanding assurance (as illustrated in table 4-6). The literature review identified the IT assurance initiative road map which was used for developing detailed IT project assurance processes.

Table 4-6: Summary of the reviewed literature in IT assurance initiatives

Guide/Framework name	Purpose	References
IT Assurance Guide: Using COBIT®	It provides guidance on how to use COBIT to support IT assurance activities. It also enables efficient and effective development of IT assurance initiatives, providing guidance on planning, scoping and executing assurance reviews using a road map based on well-accepted assurance approaches.	ITGI (2007)
ITAF™: A Professional practices Framework for IT Assurance	It provides guidance on the design, conduct and reporting of IT audit and assurance assignments.	ISACA (2014)

Guide/Framework name	Purpose	References
COBIT® 5: The complete business framework for the Governance of Enterprise IT	It provides processes for governance and management of enterprise IT.	ISACA (2012)
COBIT5® for Assurance	It is built on the COBIT 5 framework for governing and managing assurance activities.	ISACA (2013)

As illustrated in table 4-6, IT the assurance road map from the IT Assurance Guide: Using COBIT® (ITGI, 2007) is adapted in the development of the high-level IT project assurance processes.

2. The adapted road map was applied to develop the high-level IT project assurance processes as follows:

Step 1: Assurance planning

The first process in assurance planning is to establish the IT assurance universe which defines the areas under which assurance can be conducted. The IT project assurance process review areas (as described in section 4.2.5) are the established IT project assurance universe.

The second process in assurance planning is to identify an appropriate IT control framework which enables assurance planning work according to a standardised and structured approach. The COBIT 5 framework is identified as an IT control framework for the IT project assurance initiative. The structure of COBIT 5 processes is adapted in structuring the high-level IT project assurance processes.

Step 2: Scoping high-level IT project assurance processes

The first process in scoping is to identify the COBIT 5 processes which are relevant to IT project assurance areas. The identified COBIT 5 processes are then mapped to IT project assurance areas (as shown in table 4-7) in order to identify focus areas for developing high-level IT project assurance processes.

Table 4-7: Mapping of COBIT 5 processes to IT project assurance review areas

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
Project Strategic Alignment Review	• APO02.05:Define strategic plan and road map • APO03.01:Develop enterprise architecture vision • BAI01.07:Start up and initiate projects within a programme.	• Align IT project objectives with organisational strategy and business objectives
	• APO02.06:Communicate the IT strategy and direction • BAI05.03:Communicate desired vision	• Involvement of top management and project stakeholders throughout the project life cycle
	• BAI05.07:Sustain changes	• Sustainability of the IT project. • Project sustainability factors: economic, social and environmental are referenced from Silvius, Schipper, Planko, Brink & Köhler (2012)
	• MEA02.01:Monitor internal controls • MEA02.03:Perform control self-assessments • MEA02.05:Ensure that assurance providers are independent and qualified.	• Evaluate initiation phase audit report. • Assess competence of the auditors • Confirm that meeting between auditors and top management is conducted.
	• APO01.08:Maintain compliance with policies and procedures • APO02.01 Understand enterprise direction • DSS01.04:Manage environment	• Assess the external environment on political, economic, social and cultural, technological and legal.

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
	• APO04.01:Create an environment conducive to innovation • APO04.02:Maintain an understanding of the enterprise environment • APO04.03:Monitor and scan the technology environment • APO04.04:Assess the potential of emerging technologies and innovation ideas	
Project Business Justification Review	• APO05.03:Evaluate and select programmes to fund • APO06.02:Prioritise resource allocation • APO06.03:Create and maintain budgets • APO08.02:Identify opportunities, risk and constraints for IT to enhance the business • APO12.03: Maintain a risk profile.	• Assess business case to ensure it addresses requirements of the business, project benefits, risks, budget allocation and other resources required to implement project activities.
Project Approval Review	• APO01.01: Define the organisational structure • APO08.01: Understand business expectations • BAI01.07 Start up and initiate projects within a programme • BAI02.04:Obtain approval of requirements and solutions	• Establish project governance structure • Authorise to start IT project. These focus areas are also referenced from PMI (2017).
Project Management Plans Review	• APO05.06:Manage benefits achievement	• Benefits realisation plan

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
	• BAI01.08:Plan projects • BAI01.01:Maintain a standard approach for programme and project management	• Ensure that project plans are developed • Align IT project management with project management methodology and standard.
	• BAI01.03:Manage stakeholder engagement	• Project stakeholders management plan
	• BAI01.09:Manage programme and project quality	• Project quality management plan
	• BAI01.10:Manage programme and project risk	• Project risk management plan
	• BAI01.12: Manage project resources and work packages	• Project resources management plan
	• BAI02.01:Define and maintain business functional and technical requirements	• Project documents
	• BAI03.09:Manage changes to requirements	• Update project management plans
		Other areas relevant to project management plans are knowledge areas from PMBOK (PMI,2013), P2M (Ohara, 2005), and APMBOK (APMBOK, 2012) as: • Project time management plan • Project scope management plan • Project cost management plan • Project communication management plan • Project procurement plan • Project human resources plan • Acceptance test plan

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
		• Project anti-corruption plan(Transparency International, 2008)
	• MEA02.01:Monitor internal controls • MEA02.03:Perform control self-assessments	• Evaluate planning phase audit report
Project Implementation Review	• APO06.05: Manage costs	• Control, manage and update baseline costs
	• BAI01.06:Monitor, control and report on the programme outcomes • BAI01.10:Manage programme and project risk • BAI01.11:Monitor and control projects	• Monitor and control implementation of IT project activities • Progress report • Ensure adequate project funds • Involvement of top management and project stakeholders
	• BAI03.11:Define IT services and maintain the service portfolio • BAI05.01:Establish the desire to change • BAI07.06:Promote to production and manage releases	• Organisation's readiness for change
	• BAI06.01:Evaluate, prioritise and authorise change requests	• Control and manage changes of the project management plans
	• BAI07.04:Establish a test environment • BAI07.05:Perform acceptance tests	• Conduct acceptance test
	• DSS03.01:Identify and classify problems • DSS03.02:Investigate and diagnose problems	• Conflicts management. • Prevent project fraud and corruption.

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
	• DSS03.04:Resolve and close problems • DSS03.05 Perform proactive problem management	
	• EDM03.01:Evaluate risk management • EDM03.02:Direct risk management • EDM03.03:Monitor risk Management.	• Monitor and control risks • Update risks register
	• APO02.01:Understand enterprise direction • APO04.01:Create an environment conducive to innovation • APO04.02:Maintain an understanding of the enterprise environment • APO04.03:Monitor and scan the technology environment • APO04.04:Assess the potential of emerging technologies and innovation ideas. • APO04.01:Create an environment conducive to innovation.	• Assess external environment to determine whether is still conducive to implement project activities.
	• APO07.03:Maintain the skills and competencies of personnel. • APO07.04:Evaluate employee job performance • BAI05.04:Empower role players and identify short-term wins • BAI08.01:Nurture and facilitate a knowledge-sharing culture	• Motivation scheme for the project team members.

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
	• APO13.01:Establish and maintain an information security management system (ISMS) • APO13.02:Define and manage an information security risk treatment plan	• Assess IT security management to the IT project deliverables.
	• APO05.06:Manage benefits achievement • BAI01.04:Develop and maintain the programme plan	• Validate business case.
	• BAI01.01:Maintain a standard approach for programme and project management	• Adherence to project methodology and / or standard.
	• MEA02.01:Monitor internal controls • MEA02.03:Perform control self-assessments	• Evaluate execution phase audit report
Project Closure Review	• BAI01.13:Close a project or iteration • BAI07.08:Perform a post-implementation review	• Project is ready for closure • Capability to support and maintain the final project product
	• APO04.02:Maintain an understanding of the enterprise environment	• Assess external environment to provide IT services
	• MEA02.01:Monitor internal controls • MEA02.03:Perform control self-assessments	• Evaluate closing phase audit report
Project Benefits Realisation Review	• EDM02.01: Evaluate value optimisation	• Benefit identification • Benefit planning • Benefit delivery • Benefit review • Benefit sustainment These focus areas are also referenced from (Ashurst, 2012;

IT project assurance review areas	COBIT 5 processes	Focus areas for high-level IT project assurance processes
		Bradley, 2010; Ward & Daniel, 2012).
	• MEA02.01:Monitor internal controls • MEA02.03:Perform control self-assessments	• Evaluate operations and maintenance phase audit report.

Source: Author

The second process in scoping is to customise the identified IT project assurance focus areas, and come up with the high-level IT project assurance processes. These high-level project assurance processes are discussed in the next section.

Step 3: Assurance initiative execution

According to ITIGI (2007), the assurance initiative execution describes how to execute the assurance initiative. A flow chart of all the IT project assurance processes is developed to explain how the IT project assurance processes are executed. The entire flow chart interacts with the conceptual framework as discussed in chapter 5.

The next section discusses the high-level IT project assurance processes.

4.4 HIGH-LEVEL IT PROJECT ASSURANCE PROCESSES

The high-level IT project assurance processes are discussed in each assurance gate review.

4.4.1 Assurance Review Gate 1

The IT project assurance review Gate 1 is conducted at the end of the initiation phase of the IT project life cycle. Table 4-8 illustrates the high-level project assurance processes which are used in assurance review Gate 1.

Table 4-8: IT project assurance processes for initiation phase (assurance review Gate1)

Code	High-level IT project assurance processes	Purpose
PSAR1	Assess strategic alignment of IT project with organisational strategy and business objectives.	To ensure that IT project is aligned with organisational strategy and business objectives. Project strategic alignment review ensures the top management and project

		stakeholders' are involvement throughout the IT project life cycle.
PSAR2	Assess business justification to invest in the IT project	To ensure that the developed business case justifies whether it is worth investing in the IT project. The business case includes cost and benefits of the project as well as identified risks. The business justification helps the project governance in investment decision making.
PSAR3	Assess approval to start IT project	To confirm that authorization is obtained to start IT project.
PSAR4	Assess audit report from the initiation phase	To confirm that action is taken on the audit recommendations to deliver a successful IT project. To confirm that meetings was conducted between auditors and top management.

The Gate 1 assurance review report helps project governance to decide whether or not to proceed to the next phase of the IT project life cycle.

4.4.2 Assurance Review Gate 2

The IT project assurance review Gate 2 is conducted at the end of the planning phase of IT project life cycle. Table 4-9 illustrates the high-level project assurance processes which are used in assurance review Gate 2.

Table 4-9: IT project assurance processes for planning phase (assurance review Gate2)

Code	High-level IT project assurance processes	Purpose
PMPR1	Involvement of top management and project stakeholders	To confirm that top management and project stakeholders are involved in the development and approval of the project management plans.
PMPR2	Ensured that project plans are developed, updated and realistic in achieving the IT projects outcomes	To confirm that project plans are developed and are realistic in achieving the Project outcomes.

PMPR3	Aligned IT project management with project management methodology and standard	To confirm that project management plans are aligned with the project management methodology and standards.
PMPR4	Validate business case	To confirm that business case is validated
PMPR5	Assess organisational readiness to start executing IT project	To confirm that organisation was ready to start execution IT project
PMPR6	Assess audit report from the planning phase	To confirm that action is taken on the audit recommendations to deliver a successful IT project. To confirm that meetings was conducted between auditors and top management.

The Gate 2 assurance review report helps project governance to decide whether or not to proceed to the next phase of the IT project life cycle.

4.4.3 Assurance Review Gate 3

The IT project assurance review Gate 3 is conducted at the end of the execution phase of the IT project life cycle. Table 4-10 illustrates the high-level project assurance processes which are used in assurance review Gate 3.

Table 4-10: IT project assurance processes for execution phase (assurance review Gate3)

Code	High-level IT project assurance processes	Purpose
PIR1	Assess performance of the implemented IT project activities against the planned activities in the project management plans	To confirm the performance of the implemented IT project activities against the planned activities in the project management plans.
PIR2	Ensure adequate project funding	To confirm that there are sufficient funds to implement IT project activities.
PIR3	Involvement of top management and project stakeholders	To confirms that top management and project stakeholders are involved during the implementation of IT project activities.
PIR4	Adherence to project management methodology	To confirm that IT project is adhering to project management methodology and standard during the implementation of the IT project activities.
PIR5	Assess IT project fraud and corruption management	To confirm that IT project management is adhering to project anti-corruption policy, and

Code	High-level IT project assurance processes	Purpose
		preventing fraud and corruption during the implementation of IT project activities.
PIR6	Assess IT project conflict management	To confirm that there is mechanism to solve conflicts during the implementation of the IT project activities.
PIR7	Assess IT security management to the IT project deliverables	To confirm that information security is addressed and managed in the IT project deliverables.
PIR8	Assess existence of motivation scheme to the project team members	To confirm that project team members are motivated and rewarded according to their performance.
PIR9	Validate business case	To confirm that business case is validated
PIR10	Assess environment	To ensure that external environment is assessed to implement IT project activities.
PIR11	Assess organisational readiness for change	To confirm organisational readiness for change
PIR12	Assess audit report from the execution phase	To confirm that action is taken on the audit recommendations to deliver a successful IT project. To confirm that meetings was conducted between auditors and top management.

The Gate 3 assurance review report helps project governance to decide whether or not to proceed to the next phase of the IT project life cycle.

4.4.4 Assurance Review Gate 4

The IT project assurance review Gate 4 is conducted at the end of the closing phase of the IT project life cycle. Table 4-11 illustrates the high-level project assurance processes which are used in assurance review Gate 4.

Table 4-11: IT project assurance processes for closing phase (assurance review Gate4)

Code	High-level IT project assurance processes	Purpose
PCR1	IT project readiness for closure	To confirm that readiness was conducted for closure of the IT project.
PCR2	Audit report from the closing phase	To confirm that action is taken on the audit recommendations to deliver a successful IT project. To confirm that meetings was conducted between auditors and top management.

The Gate 4 assurance review report helps project governance to decide whether or not to proceed to the next phase of the IT project life cycle.

4.4.5 Assurance Review Gate 5

The IT project assurance review Gate 5 is conducted within the operations and maintenance phase of IT project life cycle. Table 4-11 illustrates the high-level project assurance processes which are used in assurance review Gate 5.

Table 4-12: IT project assurance processes for operations and maintenance phase (assurance review Gate 5)

Code	High-level IT project assurance processes	Purpose
PBRR1	Benefits realisation	To confirm that the planned benefits are delivered, realised and sustained.
PBRR2	Audit report from the operations and maintenance phase	To confirm that action is taken on the audit recommendations to deliver a successful IT project. To confirm that meetings was conducted between auditors and top management.

The Gate 5 assurance review report helps project governance to determine benefits realisation and sustainment from the IT project product.

The research study also developed the detailed IT project assurance processes in each high-level IT project assurance process. The detailed IT project assurance processes are attached as Appendix B. This research focuses on high-level IT project assurance processes.

4.5 CONCLUSION

The overall goal of the chapter was to develop a conceptual information technology project management assurance framework that can be used in public and private sector organisations. The chapter identified and discussed components of the conceptual framework. The identified components were project governance, IT project life cycle, IT project deliverables, IT project auditing, IT project assurance and IT project success.

The chapter pointed out that project governance makes decisions and ensures project success throughout the IT project life cycle. The phases of the IT project, which form part of the conceptual framework, included the (i) initiation phase, (ii) planning phase, (iii) execution phase, (iv) monitoring and controlling phase, (v) closing phase and (vi) operations and maintenance phase.

The basic IT project deliverables were identified which form the bases of the IT project auditing. The chapter discussed three phases of the IT project auditing as pre-audit, mid-audit and post-audit. The conceptual framework proposed IT project assurance and revealed the relationship between auditing and project assurance. IT project assurance is more forward looking in the IT project management than auditing.

The chapter developed IT project assurance areas which were mapped with the conceptual framework gate reviews that are Gate 1, Gate 2, Gate 3, Gate 4 and Gate 5. In each assurance gate review, there are high-level IT project assurance processes which can be tailored to deliver a successful IT project in the organisation. Project governance uses assurance gate review reports to decide whether or not to proceed to the next phase of the IT project life cycle.

The next chapter explains how to execute the IT project assurance review.

CHAPTER 5: EXECUTION OF THE IT PROJECT ASSURANCE REVIEW

5.1 INTRODUCTION

The previous chapter developed high-level IT project assurance processes that are used in IT project assurance reviews. The overall goal of this chapter is to explain how the IT project assurance review is executed by using the high-level IT project assurance processes.

The first objective is to introduce the decision-making guide. This guide is used by the project governance to determine whether or not to proceed to the next phase within the IT project life cycle. The second objective is to discuss the interaction between the high-level IT project assurance processes and the conceptual framework. The flow chart on how to conduct the IT project assurance review in each phase of the IT project is also described.

The following section introduces a decision-making guide which is used by the project governance to determine whether or not to proceed to the next phase within the IT project life cycle.

5.2 DECISION-MAKING GUIDE

This research study used a content analysis method to establish a decision making guide. Decision making is a process of making a choice between a number of alternatives to achieve a desired result (Eisenfuhr, 2011). The traffic light colour coding is adapted from Koenigstorfer, Groeppel-Klein and Kamm (2014). The traffic light colour coding is used in the decision making for reporting on any of the IT project assurance gate reviews. The decision-making guide uses the following steps:

(i) It defines the decision criteria.

(ii) It assigns a colour to each decision criterion (i.e. the decision-making guide uses three colour codes, namely red, green and yellow) as shown in table 5-1. These colours are used because they are easy to understand and interpret.

Table 5-1: Decision making criteria

Colour code	Decision criteria
Red (R)	• Major issues identified during the project assurance review have positive effect on the performance of the IT project. • IT project cannot proceed to the next phase.
Green (G)	• No issues identified during the project assurance review, IT project performance is as planned. • IT project can proceed to the next phase.
Yellow (Y)	• Minor issues identified during the project assurance have a negative effect on the performance of the IT project. • Corrective actions need to be taken to resolve the minor issues identified. The resolved issues will be reviewed before the next gate review. • The project can proceed to the next phase.

Source: Author

The following section discusses the tolerance levels which can be used by project governance to make decisions for unresolved issues during the IT project assurance review gates.

5.2.1 Tolerance Levels

Tolerance levels can be set for the project, for a stage, at work-package level and also for a product level. The overall project tolerances are agreed with the organisation's management, project governance board, project manager and team manager at the start of the project. Tolerance levels act as the next management layer for decision making on how to proceed to the next phase within the IT project life cycle. According to PRINCE2 (2009), the following are types of project tolerance levels:

a) **Project-level tolerance:** Project-level tolerance is first set in the starting up of a project process, and influences both the project approach and the content of the project brief. The organisation's management sets up and agrees upon project-level tolerance, and is held to account for such tolerance. The organisation's management then assigns project-level tolerance to the project governance board.

b) **Stage-level tolerance:** Stage-level tolerance is set at each stage level by the project governance board. The project governance board then assigns stage-level tolerance to the project manager.

c) **Work package-level tolerance:** Work package-level tolerance is set at each work package level by the project manager. The project manager then assigns work package-level tolerance to the team manager.

d) **Product-level tolerance:** Product-level tolerance is set at each project product description by the business management. The business management then assigns product-level tolerance to the project manager.

The next section discusses the tolerance areas used in the tolerance levels.

5.2.2 Tolerance Areas

a) **Time:** A time tolerance is the amount to which the project can be over or under against the project completion dates (Stationery Office, 2009).

b) **Cost:** Cost tolerance is plus or minus the amount set against the planned budget (Stationery Office, 2009; Hinde, 2012).

c) **Quality:** Quality tolerances are allowable flexibilities concerning the specifications of products. These tolerances can be set at a high level in the project product description and at a lower level in the product description (Hinde, 2012).

d) **Scope:** Scope tolerance is measured as an agreed upon variation from the product description, and any potential variations are documented in the product breakdown structure (Stationery Office, 2009).

e) **Benefits:** Benefits tolerances are set at project level and described in the business case. These tolerances are authorised by the project governance board (PRINCE2, 2009; Hinde, 2012).

f) **Risk:** Risk tolerance can be set at project, stage and work package level, and are written into the risk management strategy, stage plan and work package respectively (Hinde, 2012).

The mapping of tolerance levels and tolerance areas are illustrated in table 5-2.

Table 5-2: Mapping of tolerance areas with tolerance levels

Tolerance areas	Project-level tolerance	Stage-level tolerance	Work package-level tolerance	Product-level tolerance
Time → set in	Project plan	Stage plan	Work package	Not applicable
Cost → set in	Project plan	Stage plan	Work package	Not applicable
Scope → set in	Project plan	Stage plan	Work package	Not applicable
Risk → set in	Risk management strategy	Stage plan	Work package	Not applicable
Quality → set in	Project product description	Not applicable	Not applicable	Product description
Benefits → set in	Business case	Not applicable	Not applicable	Not applicable

Source: Stationery Office (2009)

The following section explains the interaction between IT project assurance processes and the conceptual framework.

5.3 INTERACTION BETWEEN IT PROJECT ASSURANCE PROCESSES AND THE CONCEPTUAL FRAMEWORK

The interaction between the IT project assurance processes and the conceptual framework is represented by using the Business Process Modelling Notation (BPMN). BPMN is one of the most widely spread business process modelling notations for implementing business processes (Weske, 2007; Weske, Mendling & Weidlich, 2010). As shown in the conceptual framework in chapter 4, there are five IT project assurance review gates in the IT project life cycle. In each assurance review gate, there are project assurance review areas. Each project review area has IT project assurance processes which aim at enhancing the prospect of the successful delivery of the IT project. The following sections discuss IT project assurance review gates in order to describe the interaction between IT project assurance processes and the conceptual framework.

5.2.3 Assurance Review Gate 1

The assurance review Gate 1 is conducted at the end of the initiation phase of the IT project life cycle. The inputs for the assurance review Gate 1 are the IT project assurance processes as shown in figure 5-1. These assurance processes are derived from the IT project assurance areas as discussed in chapter 4. The IT project assurance processes for assurance review Gate 1 assess the:

a) Strategic alignment of an IT project with organisational strategic and business objectives

b) Business justification to invest in the IT project

c) Approval to start the IT project

d) Audit report from the initiation phase

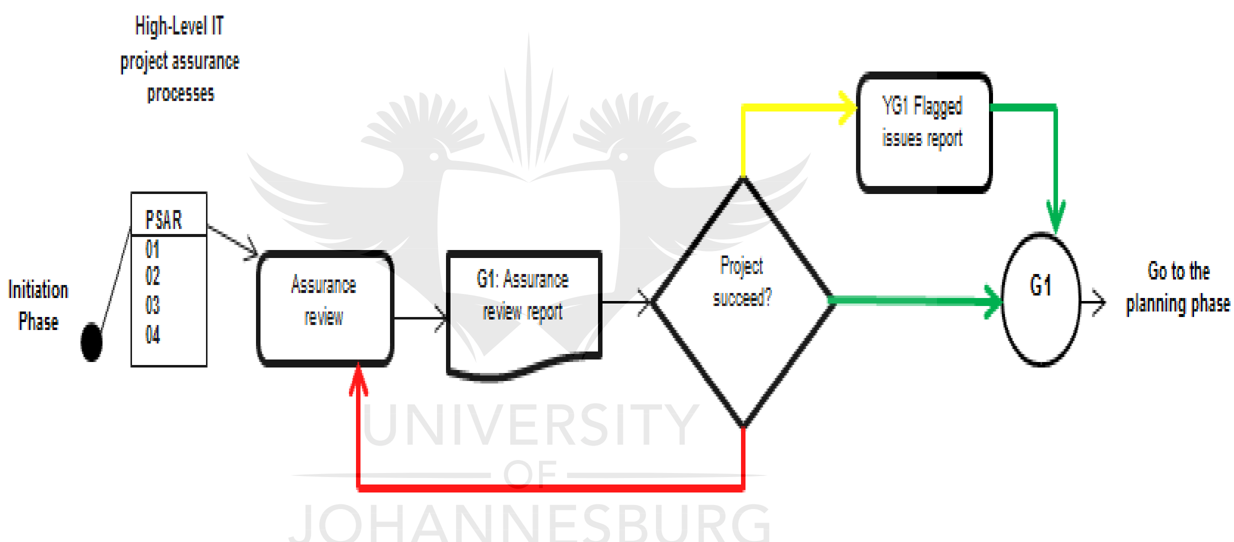

Figure 5-1: Flow chart for IT project assurance review in initiation phase

The output of the project assurance review in the initiation phase is a report of the IT project assurance review Gate 1 (denoted as G1: Assurance review report) as illustrated in figure 5-1. The report uses the decision-making guide to guide the project governance as follows:

(i) A red line indicates that the IT project cannot proceed to the next phase because major issues, which have been identified, need to be resolved first.

(ii) A green line indicates that no issues are identified and the IT project can proceed to the next phase.

(iii) A yellow line indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as YG1 Flagged Issues Report) which need to be resolved, and will be reviewed before or at the assurance review Gate 2.

5.2.4 Assurance Review Gate 2

The assurance review Gate 2 is conducted at the end of the planning phase of the IT project life cycle. The inputs for the assurance review Gate 2 are the IT project assurance processes as shown in figure 5-2. These assurance processes are derived from the IT project assurance areas as discussed in chapter 4. The IT project assurance processes for assurance review Gate 2 are the following:

a) Involvement of top management and project stakeholders

b) Ensuring that IT project management plans are developed and updated, and are realistic in achieving the IT project outcomes

c) Alignment of IT project management with the project management methodology and standard

d) Validation of the business case

e) Assessment of organisational readiness to execute the IT project

f) Assessment of the audit report from the planning phase

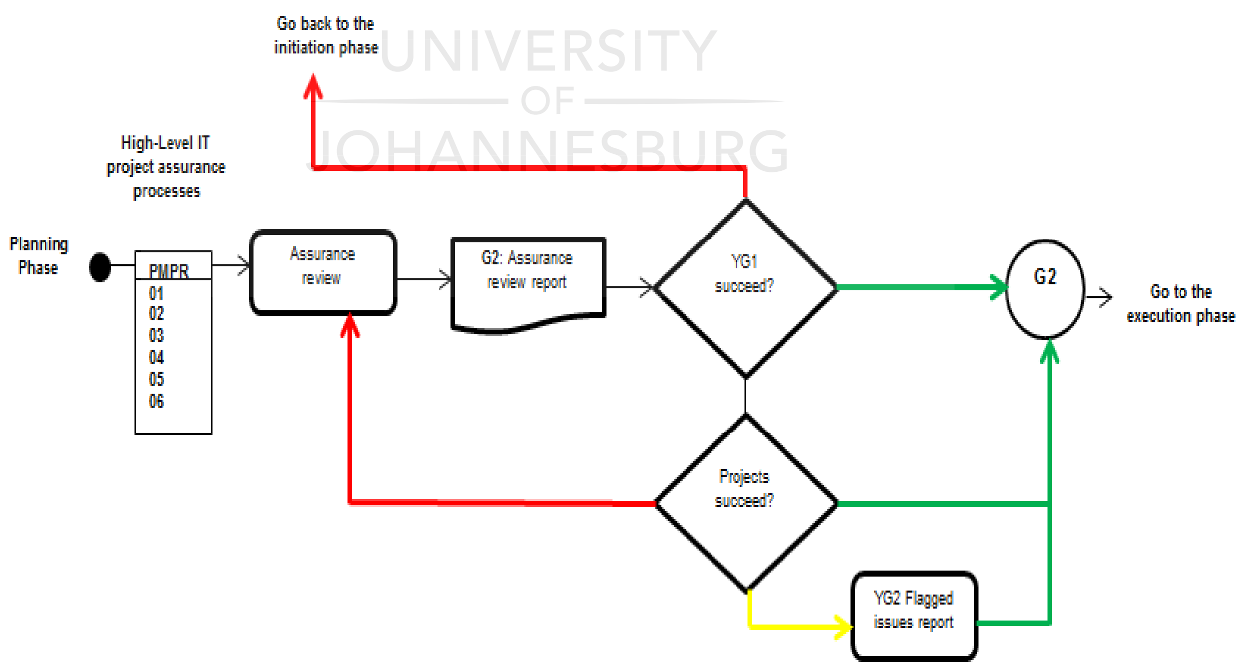

Figure 5-2: Flow chart for IT project assurance review in planning phase

In the planning phase, as illustrated in figure 5-2, project governance has two levels of decision making:

- First, project governance reviews and decides on the minor issues denoted as YG1 flagged issues reported during the project assurance review Gate 1 in the initiation phase auditing. If the minor issues are resolved, then the status of the YG1 flagged issues changes to a green line. Otherwise they go back to the initiation phase auditing in the project assurance review Gate 1 to be resolved. For unresolved issues, the project governance makes decisions by considering the tolerance levels. These tolerance levels are discussed in sections 5.2.1 and 5.2.2.

- Second, project governance reviews and decides on the reporting of project assurance review Gate 2 denoted as the G2: Assurance Review Report. The report uses the decision-making guide as follows:

  (i) A red line indicates that the IT project cannot proceed to the next phase because major issues, which have been identified, need to be fixed first.

  (ii) A green line indicates that no issues are identified and the IT project can proceed to the next phase.

  (iii) A yellow line indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as the YG2 Flagged Issues Report) which need to be resolved, and will be reviewed before or at the assurance review Gate 3.

5.2.5 Assurance Review Gate 3

The assurance review Gate 3 is conducted at the end of the execution phase of the IT project life cycle. The inputs for the assurance review Gate 3 are the IT project assurance processes as shown in figure 5-3. These assurance processes are derived from the IT project assurance areas as discussed in chapter 4. The IT project assurance processes for assurance review Gate 3 are the following:

a) Assess performance of the implemented IT project activities against the planned activities in the project management plans

b) Ensure adequate project funding

c) Involve top management and other project stakeholders

d) Adhere to the project management methodology

e) Assess IT project fraud and corruption management

f) Assess IT project conflict management

g) Assess IT security management to the IT project deliverables

h) Assess the existence of a motivation scheme to the project team members

i) Validate the business case

j) Evaluate the environment

k) Assess the organisational readiness for change

l) Assess the audit report from the execution phase

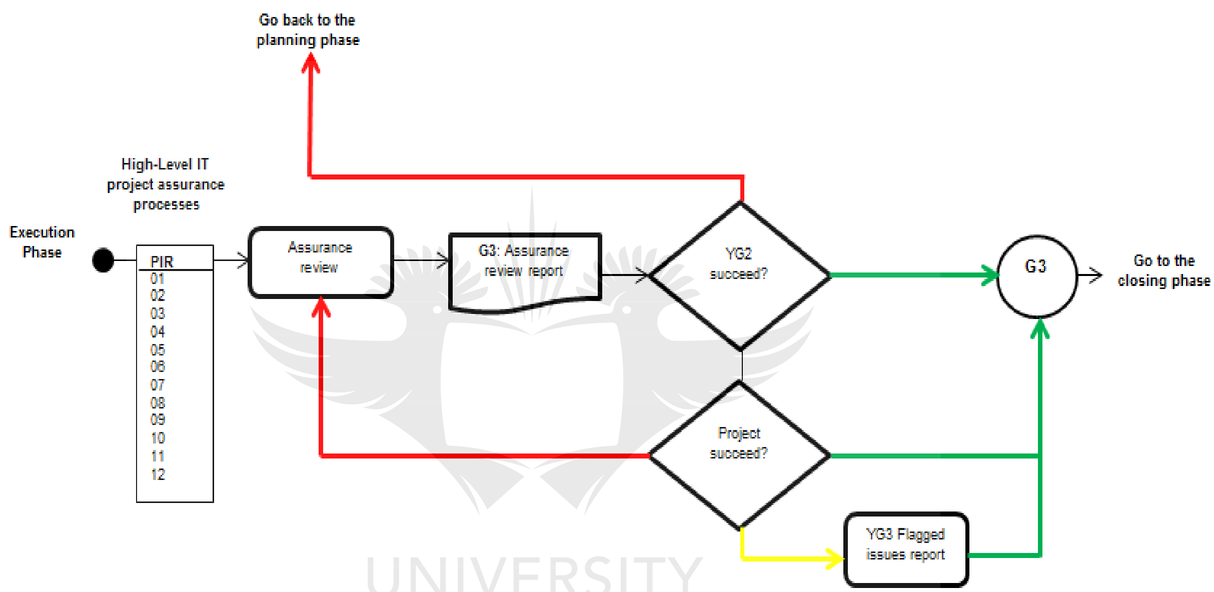

Figure 5-3: Flow chart for IT project assurance review in execution phase

In the execution phase, as illustrated in figure 5-3, project governance has two levels of decision making:

- First, project governance reviews and decides on the minor issues denoted as YG2 flagged issues reported during the project assurance review Gate 2 in the planning phase auditing. If the minor issues are resolved, then the status YG2 flagged issues changes to a green line. Otherwise they go back to the planning phase auditing in the project assurance review Gate 2 to be resolved. For unresolved issues, the project governance makes decisions by considering the tolerance levels. These tolerance levels are discussed in sections 5.2.1 and 5.2.2.

- Second, project governance reviews and decides on the reporting of project assurance review Gate 3 (denoted as the G3: Assurance Review Report). The report uses the decision-making guide as follows:

(i) A red line indicates that the IT project cannot proceed to the next phase because major issues, which have been identified, need to be fixed first.

(ii) A green line indicates that no issues are identified and the IT project can proceed to the next phase.

(iii) A yellow line indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as the YG3 Flagged Issues Report) which need to be resolved, and will be reviewed before or at the assurance review Gate 4.

5.2.6 Assurance Review Gate 4

The assurance review Gate 4 is conducted at the end of the closing phase of the IT project life cycle. The inputs for the assurance review Gate 4 are the IT project assurance processes as shown in figure 5-4. These assurance processes are derived from the IT project assurance areas as discussed in chapter 4. The IT project assurance processes for the assurance review Gate 4 are the following:

a) Assess the project's readiness for closure

b) Assess the audit report from the closing phase

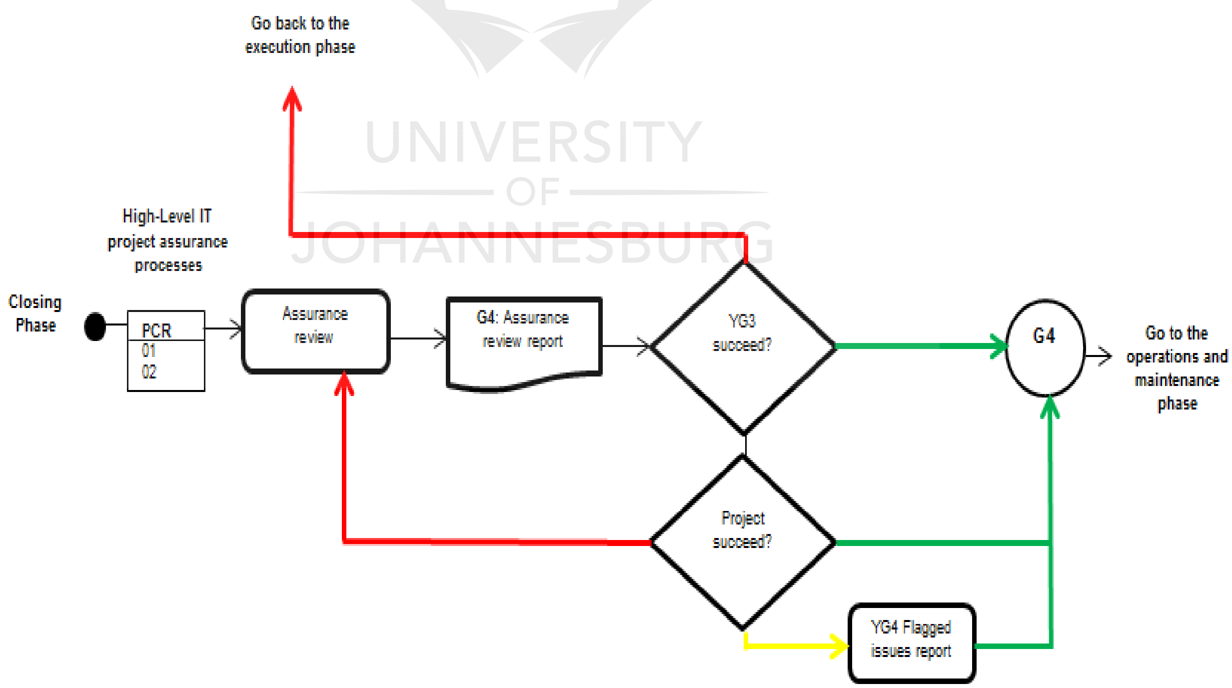

Figure 5-4: Flow chart of IT project assurance review in closing phase

In the closing phase, as illustrated in figure 5-4, project governance has two levels of decision making:

- First, project governance reviews and decides on the minor issues denoted as YG3 flagged issues reported during the project assurance review Gate 3 in the execution phase auditing. If the minor issues are resolved, then the status YG3 flagged issues changes to a green line. Otherwise they go back to the execution phase auditing in the project assurance review Gate 3 to be resolved. For unresolved issues, the project governance makes decisions by considering the tolerance levels. These tolerance levels are discussed in sections 5.2.1 and 5.2.2.

- Second, project governance reviews and decides on the report of the project assurance review Gate 4 (denoted as the G4: Assurance Review Report). The report uses the decision-making guide as follows:

    (i) A red line indicates that the IT project cannot proceed to the next phase because major issues, which have been identified, need to be fixed first.

    (ii) A green line indicates that no issues are identified and the IT project can proceed to the next phase.

    (iii) A yellow line indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as the YG4 Flagged Issues Report) which need to be resolved, and will be reviewed before or at the assurance review Gate 5.

5.2.7 Assurance Review Gate 5

The assurance review Gate 5 is conducted within the operations and maintenance phase of the IT project life cycle. The inputs for the assurance review Gate 5 are the IT project assurance processes as shown in figure 5-5. These assurance processes are derived from the IT project assurance areas as discussed in chapter 4. The IT project assurance processes for assurance review Gate 5 are the following:

a) Assess benefits realisation from the IT project.

b) Assess the audit report from the operations and maintenance phase

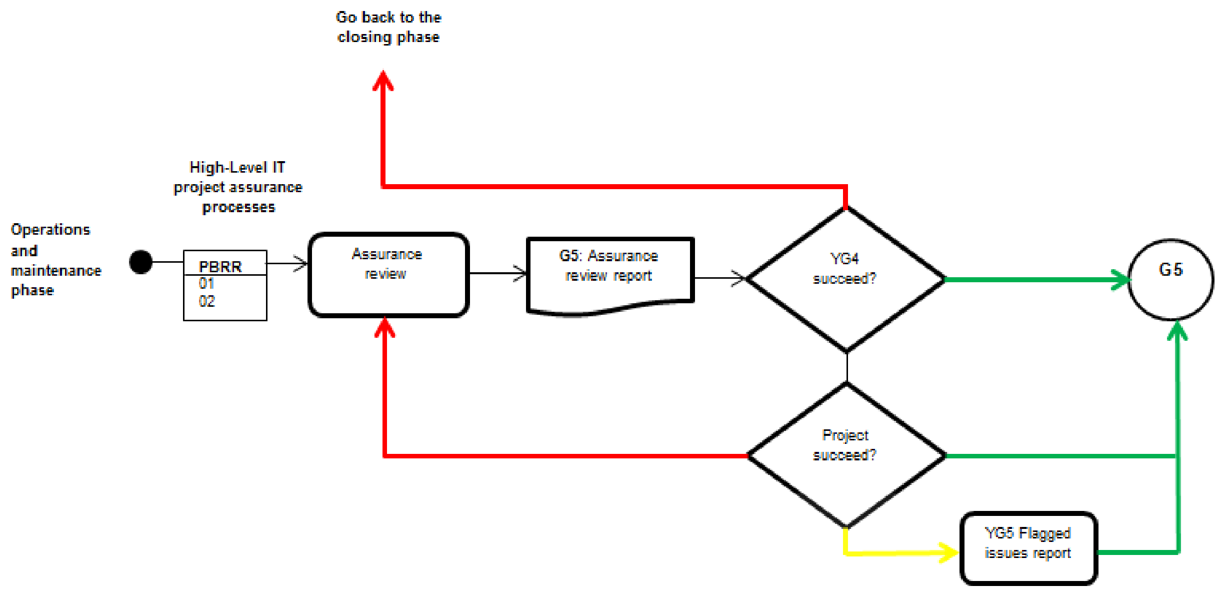

Figure 5-5: Flow chart IT project assurance review in operations and maintenance phase

In the operations and maintenance phase, as illustrated in figure 5-5, project governance has two levels of decision making:

- First, project governance reviews and decides on the minor issues denoted as YG4 flagged issues reported during the project assurance review Gate 4 in the execution phase auditing. If the minor issues are resolved, then the status of the YG4 flagged issues changes to a green line. Otherwise they go back to the closing phase auditing in the project assurance review Gate 4 to be resolved. For unresolved issues, the project governance makes decisions by considering the tolerance levels. These tolerance levels are discussed in sections 5.2.1 and 5.2.2.

- Second, project governance reviews and decides on the report of the project assurance review Gate 5 (denoted as the G5: Assurance Review Report). The report uses the decision-making guide as follows:

  (i) A red line indicates that the IT project cannot proceed to the next phase because major issues, which have been identified, need to be fixed first.

  (ii) A green line indicates that no issues are identified and the IT project can continue operating with support and maintenance of the product.

  (iii) A yellow line indicates that the IT project can proceed to the next phase. Minor issues are identified (denoted as the YG5 Flagged Issues Report). Thus, the operations and maintenance phase is the last phase in the IT project life cycle. The issues found in the YG5 Flagged Issues Report will be decided upon by the project governance in the overall maintenance of the IT project product.

The entire flow chart for the IT project assurance review is illustrated in figure 5-6 below. This flow chart interacts with the conceptual framework, as discussed in chapter 4, to come up with a conceptual information technology project management assurance framework as shown in figure 5-7. The conceptual framework can be used as a dashboard during the IT project assurance review gates within the IT project life cycle.

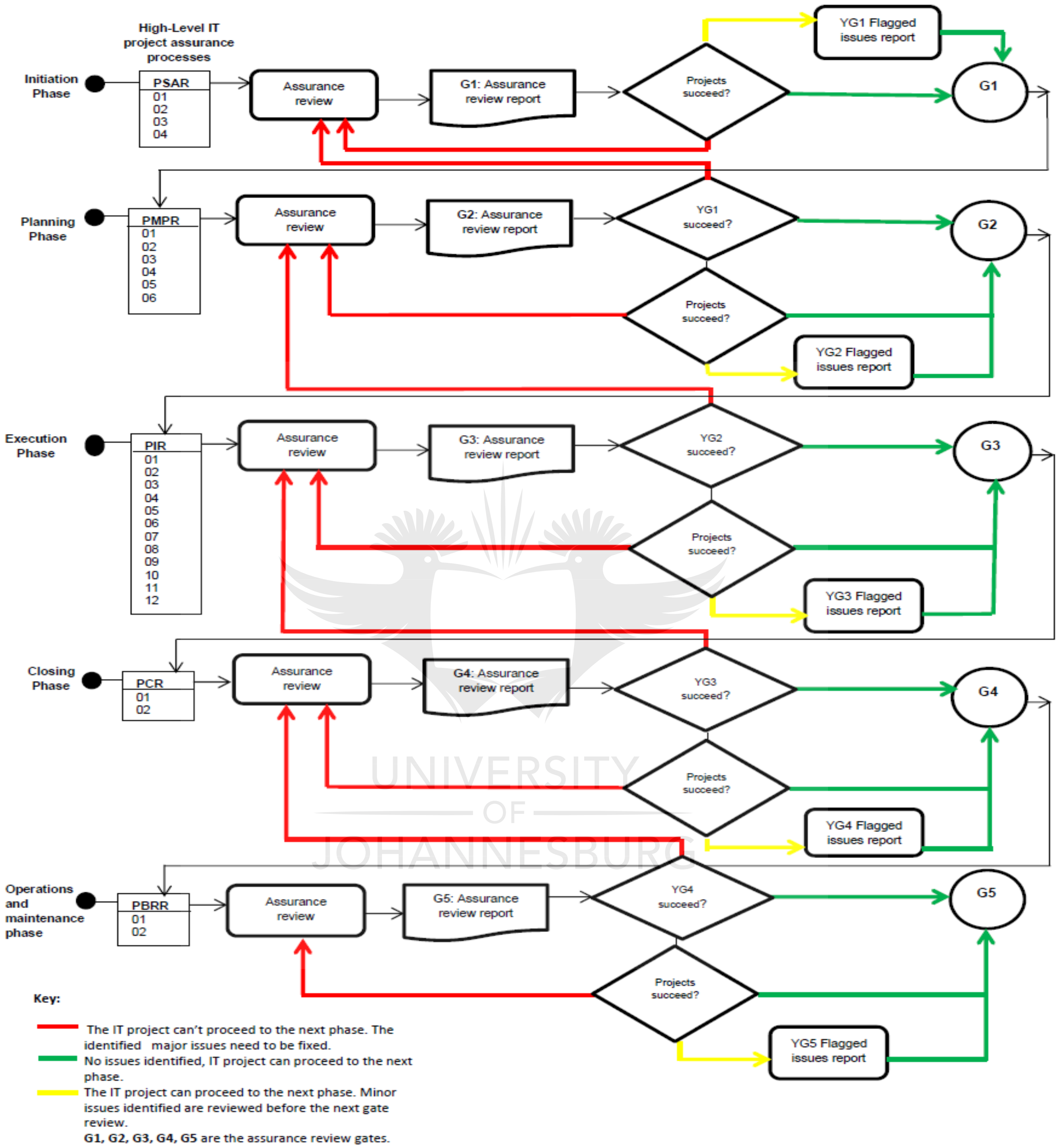

Figure 5-6: Entire flow chart for the IT project assurance review

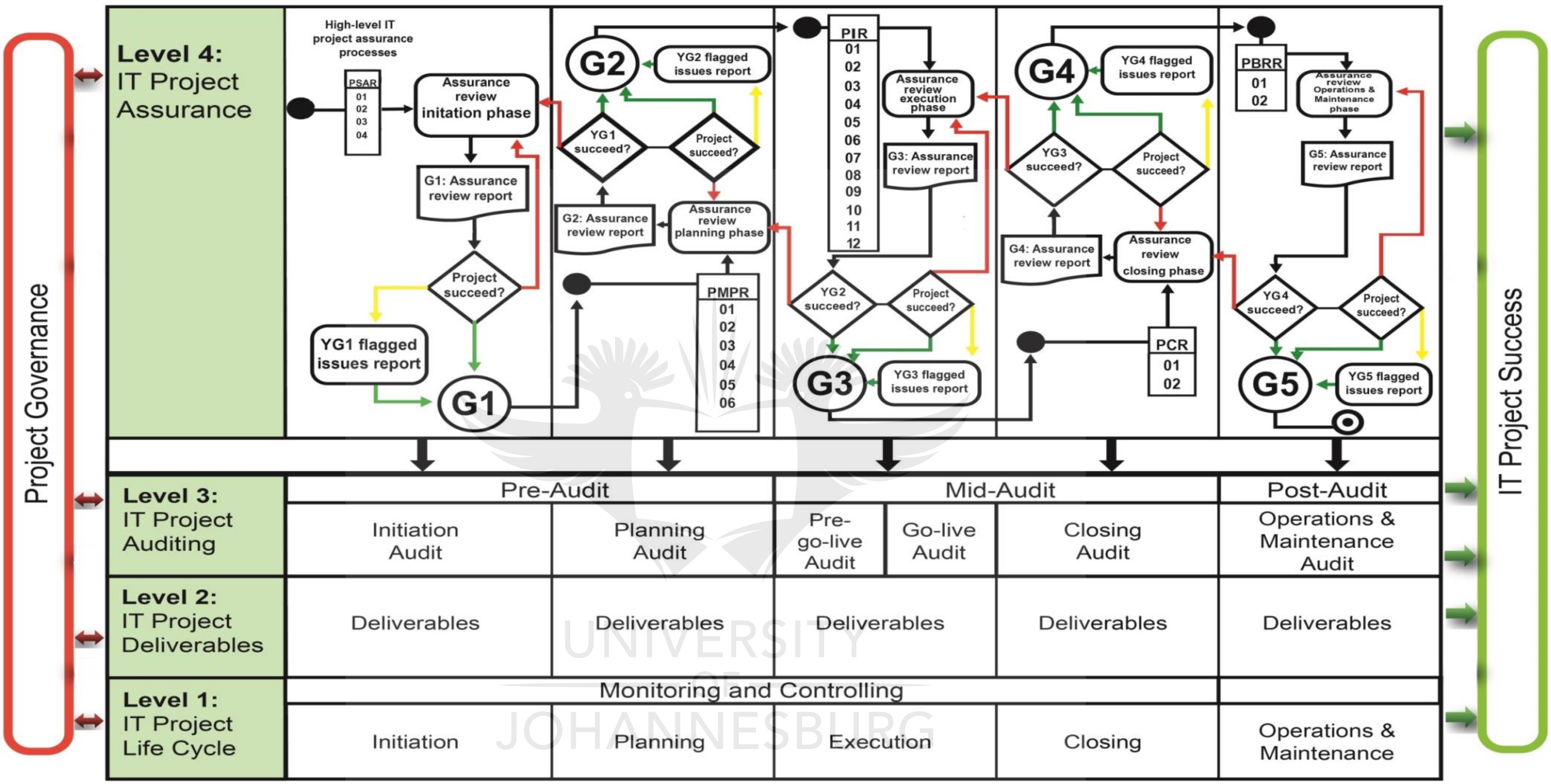

Figure 5-7: Conceptual Information Technology Project Management Assurance Framework (Mkoba & Marnewick, 2016)

5.3 CONCLUSION

The chapter explained how the IT project assurance review is executed by using the high-level IT project assurance processes.

The decision-making guide, which can be used by the project governance to determine whether or not to proceed to the next phase within the IT project life cycle, is introduced. Tolerance levels, which act as the next management layer on decision making, are explained. Project governance uses tolerance levels to make decisions on unresolved issues during the assurance review gates.

The chapter also discussed the interaction between the high-level IT project assurance processes and the conceptual framework. The flow chart on how to conduct the IT project assurance review in each phase of the IT project was also described.

The next chapter focuses on validating the conceptual framework.

CHAPTER 6: VALIDATING THE CONCEPTUAL FRAMEWORK

6.1 INTRODUCTION

The overall goal of this chapter is to choose an appropriate research methodology to validate the conceptual framework. In order to achieve this goal, the first objective is to gain an understanding of the underlying research philosophical assumptions, and adopt a philosophical assumption suitable to this research. The second objective is to select a research approach and strategy for this research. The third objective is to design a research process to be used to validate the conceptual framework.

The next section discusses the underlying philosophical assumptions in research.

6.2 RESEARCH PHILOSOPHY

Research philosophy provides a researcher with a guide in selecting an appropriate research approach (Burrell & Morgan, 1979). In the social sciences, research philosophical assumptions are based on ontology, epistemology and human nature (Burrell & Morgan, 1979). These assumptions are categorised into subjective and objective dimensions as shown in figure 6-1 which aligned the philosophical positions.

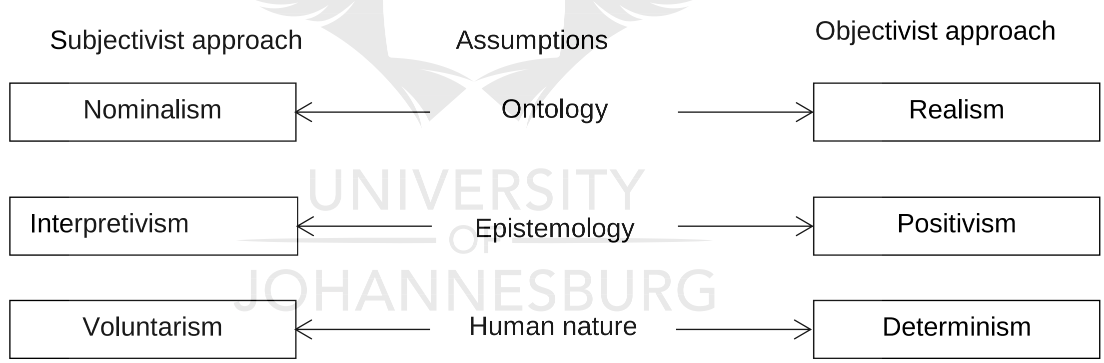

Figure 6-1: Research philosophical assumptions (adapted from Burrell & Morgan, 1979)

The discussion below gives a general overview of research philosophical assumptions in social sciences. The research philosophical assumptions are described as:

- **Ontology:** An ontological assumption is based on the nature of reality, and the underlying research philosophical assumptions are nominalism and realism (Burrell & Morgan, 1979). The nominalists believe that the social world is made up of nothing other than concepts, names and labels which are used to structure reality (Burrell & Morgan, 1979). Realists believe that the real world has its own reality, and is made up of hard, tangible and relatively immutable structures (Burrell & Morgan, 1979; Fitzgerald & Howcroft, 1998).

- **Epistemology:** These are assumptions about knowledge, and how it can be obtained and communicated to other human beings (Burrell & Morgan, 1979; Hirschheim, 1992; Neuman, 2011). According to the epistemological stance, the underlying philosophical assumptions that guide the research are interpretivism and positivism (Burrell & Morgan, 1979; Garry, 1999; Myers, 2008). Positivists believe that the social world exists externally and is viewed objectively, research is value-free and a researcher is independent, taking on the role of an objective analyst (Blumberg, Cooper & Schindler, 2011:17). Positivist research involves formal propositions, quantifiable measures of variables, hypothesis testing and discovering causal relationships between variables through empirical observation and value-free research (Neuman, 2011; Orlikowski & Baroudi, 1991). Interpretivists believe that the world is socially constructed and subjective, the researcher is a part of what is observed and even actively collaborates, while research is driven by human interests and takes a broad view of a phenomenon to detect explanations beyond the current knowledge (Blumberg et al., 2011:17). Interpretive research does not predefine dependent and independent variables (Kaplan & Maxwell, 1994; Myers, 2008, 2011).

- **Human nature:** These are research assumptions concerned with the relationship between human beings and their environment (Burrell & Morgan, 1979). The underlying philosophical assumptions that guide the research are determinism and voluntarism. Determinists believe that human actions are largely caused by external forces, pressures and structures that operate on individual, group, organisational or societal produced outcomes (Neuman, 2011). Voluntarism is a subjective approach which views man to be completely autonomous and free-willed (Burrell & Morgan, 1979).

The following section describes the research philosophies applied in the information systems (IS) research.

6.2.1 Research Philosophies in Information Systems Research

Information systems (IS) research is an applied field that is oriented towards the application of information systems in business (Baskerville & Myers, 2009; Garcia & Quek, 1997). In recent years, the philosophical assumptions applied in IS research are positivism, interpretivism and critical realism (Hirschheim, Klein & Lyytinen, 1995; Mumford, Hirschheim, Fitzgerald & Wood-Harper, 1985; Mingers & Stowell, 1997; Myers & Klein, 2011; Orlikowski & Baroudi, 1991; Walsham, 1993, 1995a, 2006; Winder, Probert & Beeson, 1997).

The research philosophies in IS research are discussed in more detail below.

- **Positivism:** The positivism research philosophy has been applied in IS research over the last couple of decades (Orlikowski & Baroudi, 1991; Myers & Newman, 2007). Positivist IS researchers believe that objective physical and social worlds exist independent of humans whose nature can be characterised and measured (Myers & Avison, 2002). Most of the positivist research uses a quantitative research approach (Alvesson & Skoldberg, 2009; Orlikowski & Baroudi, 1991; Popper, 1959; Straub, Gefen & Boudreau, 2005).

- **Interpretivism:** The interpretivist research philosophy has been applied in the information systems (IS) research as far back as the 1980s when Boland (1989) first drew attention to the relevance of hermeneutics and phenomenology to IS research. Interpretivists believe that IS research is based on subjective assumptions about the social world on how the knowledge can be obtained and shared (Orlikowski & Baroudi, 1991; Walsham, 1995a, 2006). Interpretive research does not predefine dependent and independent variables as discussed in section 6.2. Most of the interpretivist research uses a qualitative research approach (Boland, 1991; Denzin & Lincoln, 2005; Klein & Myers, 1999; Remenyi, Williams, Money & Swartz, 1998; Walsham, 1993).

- **Critical realism:** Critical realism has been developed after the disagreement between positivists and interpretivists. Bhaskar (1978) combines a general philosophy of natural science with a philosophy of social science to describe an interface between the natural and social worlds. Critical realists believe that all humans are biased and all studies conducted by human beings are inherently biased (Pather & Remenyi, 2004). According to Mingers (2000), critical realism can be useful as the underpinning philosophy for operations research, management science and systems. In recent years, there is a growing interest in the critical realism philosophy in IS research (Carlsson, 2003, 2004, 2010; Dobson et al., 2007; Mingers, 2004). Volkoff and Strong (2013) provide theory development in developing and operationalising critical realism's concept for an IS context. Critical realist research strives to resolve conflicts and contradictions in contemporary society. Critical realist research also uses a qualitative research approach (Hirschheim & Klein, 1994; Myers & Klein, 2011; Ngwenyama & Lee, 1997). Figure 6-2 illustrates the research approaches with the underlying research philosophical assumptions in IS research.

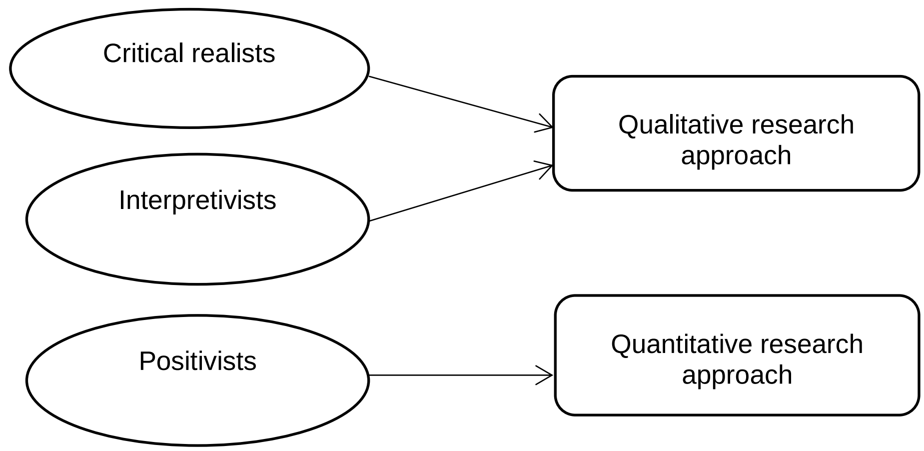

Figure 6-2: Research philosophical assumptions in IS research with research approaches

According to Galliers (1992), a researcher can choose the research philosophy by considering purpose of the research and goal of the research such as theory building, theory extension or theory testing. Therefore, based on the research purpose and discussion of the research philosophical assumptions applied in IS research, the interpretivist and positivist research philosophies are adopted in this research. The interpretivist philosophy is adopted because this research aims at validating the conceptual framework through focus group interviews and collecting qualitative data. The positivist philosophy is adopted because this research intends to validate the conceptual framework into a larger sample and collect quantitative data. The adopted research philosophies have guided the researcher in selecting an appropriate research approach.

The next section discusses the research approaches and then selects an appropriate research approach to apply in this research.

6.3 RESEARCH APPROACHES

There are three main approaches to research, namely qualitative, quantitative and mixed methods (Kothari, 2004; Mingers, 2001; Zikmund, Babin, Carr & Griffin, 2010:134). Qualitative research is an inductive approach and exploratory in nature which aims at gaining an in-depth understanding of a phenomenon under enquiry. The qualitative research approach was developed in the social sciences to enable researchers to study social and cultural phenomena (Myers, 1997). Qualitative research can be interpretive or critical realist as discussed in section 6.2.1. When the focus of information systems research continues to move from technological to managerial and organisational issues, the qualitative research approach becomes increasingly useful (Myers, 1997; Myers & Avison, 2002).

The quantitative research approach involves measuring concepts which provide numeric values for statistical computation and hypothesis testing (Zikmund et al., 2010:135). The quantitative research approach has been used by positivists in IS research as discussed in section 6.2.1. According to Creswell (2003, 2014), mixed methods combine both qualitative and quantitative research approaches in a single research project. Therefore, this research adopts the mixed methods research approach for an in-depth investigation into how IT projects can be continuously audited to increase the number of successful IT projects in both public and private sector organisations.

The following section discusses various designs of mixed methods research and adopts a mixed methods design suitable for this research.

6.4 MIXED METHODS RESEARCH DESIGN

Mixed methods use both the quantitative and qualitative approaches in combination to provide a better understanding of research problems than either approach alone (Creswell, 2003). According to Creswell (2014), there are three basic mixed methods designs.

- **Convergence parallel mixed methods design:** This is a form of mixed methods design in which both quantitative and qualitative data are collected concurrently and analysed separately, as shown in figure 6-3. A researcher then compares and merges the quantitative and qualitative sets of results. The merged results are then interpreted to find out if the two data sets converge, diverge or are related to each other.

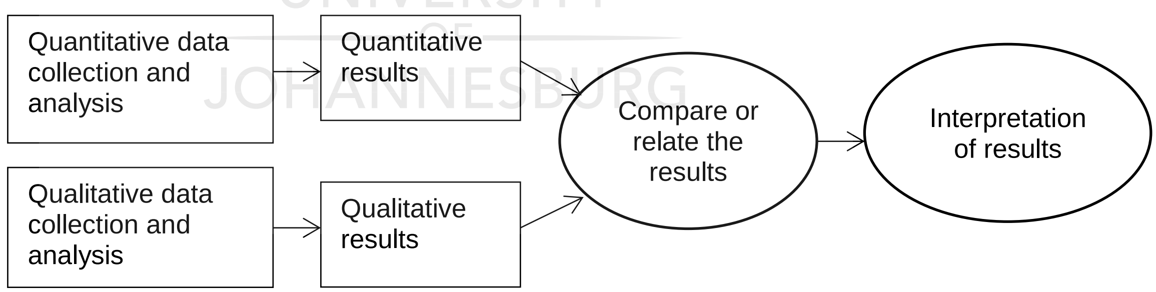

Figure 6-3 : Convergence parallel mixed methods design

- **Explanatory sequential mixed methods design:** This is a mixed methods design which starts with the collection and analysis of quantitative data. It is then followed by designing a qualitative study based on the quantitative results. The qualitative data are then collected and analysed. The qualitative results are then interpreted. Figure 6-4 illustrates the explanatory sequential mixed methods design.

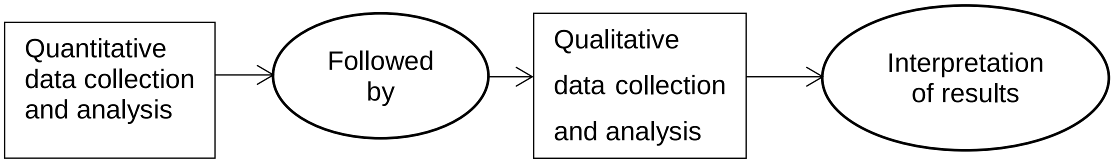

Figure 6-4 : Explanatory sequential mixed methods design

- **Exploratory sequential mixed methods design:** This is the reverse sequence from the explanatory sequential design. In the exploratory sequential approach, the researcher starts with collecting and analysing qualitative data. Then the qualitative results are used (i) to build an instrument that best fits the sample under study, (ii) to identify appropriate instruments to use in the follow-up quantitative phase and (iii) to specify variables that need to go into a follow-up quantitative study. The quantitative data are collected and analysed, and followed by an interpretation of results, as shown in figure 6-5.

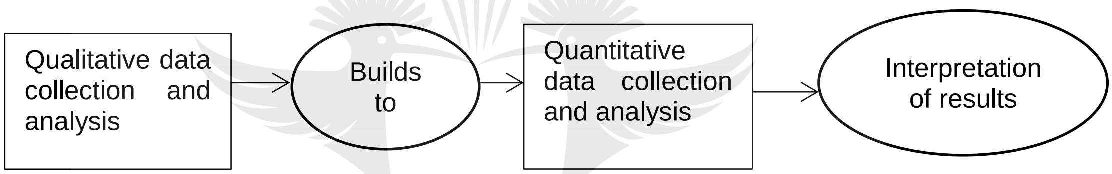

Figure 6-5 : Exploratory sequential mixed methods design

Based on the discussed mixed methods research designs, the exploratory sequential mixed methods design is adopted to validate the conceptual framework. This method has been adopted because of very little existing research on how IT projects can be audited continuously to increase the number of successful IT projects in both public and private sector organisations. The exploratory sequential mixed methods design will provide a better understanding of the research problem than either approach alone. Qualitative and quantitative research used together produce more complete knowledge necessary to inform theory and practice. The use of the mixed methods approach in this research overcomes the weaknesses in both these methods. Using the exploratory sequential mixed method in the same research study will provide multiple sources of data (i.e. triangulation) which increase the validity of the research findings.

6.4.1 Qualitative Research Method

There are numerous research strategies applied in the qualitative research method such as case studies, ethnography, ground theory and action research (Charmaz, 2000, 2006; Glaser & Strauss, 1967; Jackson & Verberg, 2006; Myers, 2009; Strauss & Corbin, 1990, 1998; Yin, 2003; Olivier, 2009; Zikmund et al., 2010:142). According to Olivier (2009:144), qualitative research strategies are “applied in Information Technology in a similar manner to the way they are applied in various branches of social sciences”. However, over the past decade, focus groups and group interviews have emerged as the popular techniques for gathering qualitative data, both among sociologists and across a wide range of academic and applied research areas (Morgan, 1988).

In recent years, the focus group has gained popularity as a qualitative research method in IS research (Burgess, 2010; Belanger, 2012; Myers, 2008; Sobreperez, 2008). Focus groups represent a qualitative research method where participants are selected and brought together to explore and discuss a specific topic in detail (Morgan, 1988; Krueger, 1994; Krueger & Casey, 2009; Stewart, Shamdasani & Rook, 2007). The selected participants are able to interact with and react to other participants in responding to the questions and prompts of the moderator (Krueger & Casey, 2000). According to Krueger (1994) and Morgan (1988), advantages of a focus group are:

a) It is relatively low cost and provides quick results. The actual time and cost for planning, conducting and analysing data may be relatively small when compared to survey projects and individual interviews.

b) It generates an opportunity to collect data from the group interaction which concentrates on the topic of the researcher’s interest.

c) The natural setting allows participants to interact with one another and to generate new ideas that they might not think of on their own.

d) It provides a room to record the group discussion responses and interpret them.

The objective of this chapter is to validate the conceptual framework on how IT projects can be audited continuously to increase the number of successful IT projects in both public and private sector organisations. An appropriate data collection instrument which provides rich information and quick results at low cost is required to validate the framework. Therefore, the focus group is adopted in this research because it provides data from a group of people much more quickly at less cost, it allows the researcher to interact directly with the respondents which gives contingent answers to questions, and provides an opportunity to obtain a rich amount of data and new ideas from the respondents.

The focus group design comprises the following stages: (i) Focus group planning, (ii) Data collection, (iii) Data analysis, (iv) Validity and (v) Refinement of the conceptual framework.

6.4.1.1 Focus group planning

The planning phase of a focus group involves the following:

a) **Defining the purpose and expectations of the focus group:** The purpose of the focus group is to validate the conceptual framework on how IT projects can be audited continuously to increase the number of successful projects in both public and private sector organisations. Expectations from the focus group include to discuss the developed conceptual framework and to come up with new ideas which can be used to refine the conceptual framework. The purpose and expectations from the focus group help to determine who should be invited to participate in a focus group.

b) **Selection of the participants:** Focus groups bring together several participants to generate new ideas from the topic of the researcher's interest. According to Krueger (1994) and Krueger and Casey (2015), five to ten persons can be included in the focus group. Participants are normally chosen by using non-probability sampling with 'information rich' participants (Krueger & Casey, 2000). Therefore, focus group participants are selected through purposive sampling (Glaser & Strauss, 1967; Patton, 1990). The aim of the purposive sampling is to select information-rich participants strategically related to the purpose of the research (Patton, 2002). The five participants of the focus group will be selected based on their common characteristics relevant to the research's purpose as well as their in-depth knowledge of and experience in managing IT projects in their organisations. Objects of a study, referred to as 'units of analysis', are the selected participants in a focus group.

c) **Identification of a moderator:** A moderator leads a focus group by ensuring that (i) the group keeps within the boundaries of the topic being discussed, (ii) the group generates interest in the topic and (iii) the moderator manages the group discussion to generate new ideas (Morgan, 1988; Saunders, Lewis & Thornhill, 2009:378; Stewart & Shamdasani, 2015). A researcher will act as a moderator in group discussion sessions, assisted by an assistant moderator. An assistant moderator or recorder can also be used to take notes and tape-record the group discussion (Krueger, 1994; Krueger & Casey, 2000).

d) **Defining the place for the group discussion:** Krueger (1994) recommends identifying conducive and easy reachable places where the focus groups will be conducted. In this research, the place to conduct the focus group discussion will be identified.

e) **Development of an interview guide for the focus group:** Stewart and Shamdasani (2015) point out the critical element in successful focus group discussions, namely the design of the interview guide which establishes the agenda for the group discussion. Thus, the interview guide with open-ended questions will be developed to guide the focus group discussion.

Before the administering of the interview guide in the focus group discussion, the content validity will be pre-tested and given to experts before being used in focus group discussions.

6.4.1.2 Data collection

The focus group is a data collection method on a specific topic where data are collected through a semi-structured group interview process. Morgan (1988) presents four aspects to be observed in a focus group interview: (i) to cover the maximum number of important topics, (ii) to provide as specific as possible data, (iii) to promote interaction that explores the participants' feelings in some depth and (iv) to take into account the personal context in which the participants have generated their responses on the topic.

Therefore, focus group interviews, through group discussions on the researcher's topic, have been adopted. The focus group discussion will be facilitated by a moderator. The interview guide will be developed as an effective way of soliciting new ideas from the focus group. The interview guide will include open-ended questions to gather information from the participants regarding how IT projects can be audited continuously in order to increase the number of successful IT projects in both public and private organisations. The focus group interview will be tape-recorded to ease the data analysis process.

6.4.1.3 Data analysis

Yin (1994) points out that a data analysis consists of examining, categorising and tabulating or otherwise recombining the evidence in order to address the initial goal of a study. Krueger and Casey (2000) suggest that the purpose of the research needs to drive the data analysis. The qualitative data analysis process is illustrated in figure 6-4.

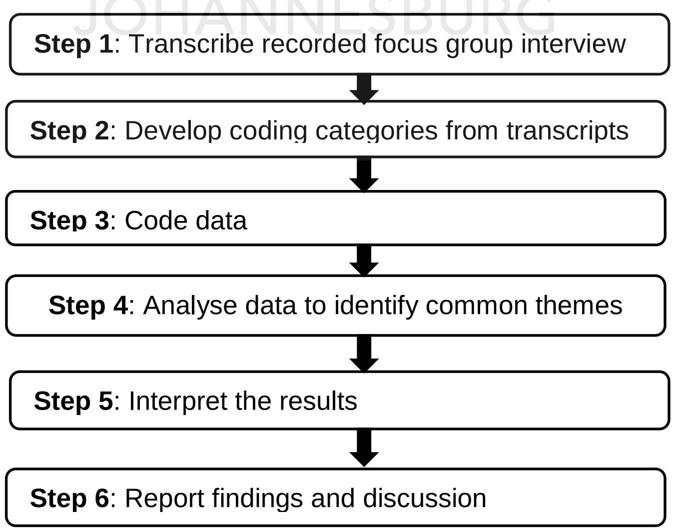

Figure 6-6: Qualitative data analysis process

6.4.1.4 Validity

According to Nunan (1992), validity refers to the extent to which a research study investigates what the researcher claims to investigate. This research uses the following:

- **Internal validity:** The sample used in the research study is representative of the general population to which the research results would apply (Denzin, 1970). In this research, the participants of the focus group discussion will be representative of the entire population. Triangulation is an internal validity procedure where multiple and different sources of information are used to form themes or categories in a research study (Creswell & Miller, 2000). Therefore, to ensure triangulation of information among different sources of data, the participants of the focus group discussion will be recruited from different organisations.

- **External validity:** It is the extent to which the results of a research study can be generalised to other situations and to other people (Denzin, 1970; Nunan, 1992). The findings of qualitative research methods will be used to refine the conceptual framework and plan for the quantitative research method.

6.4.1.5 Refine the conceptual framework

The findings from the qualitative research method will be used to refine the conceptual framework. The qualitative results will then be used to build a quantitative research process to validate the conceptual framework discussed in more detail in the next section.

6.4.2 Quantitative Research Method

The most common research strategies applied in the quantitative method are surveys and experiments (Denscombe, 1998). Surveys provide a numeric description of trends, attitudes or opinions of a population by studying a sample of the population (Creswell, 2003). Surveys use questionnaires or structured interviews for data collection, and they analyse quantitative data by using statistical methods (Fowler, 2009). Survey questionnaires have been a popular method used in IS research for gathering quantitative data (Newsted, Huff & Munro, 1998; Pinsonneault & Kraemer, 1993). The advantages of using survey questionnaires are that large amounts of information can be collected from a large sample at a relatively low cost and within a short timeframe, respondents are able to complete questionnaires at their own time, they provide the same questions to respondents, they maintain standardisation in gathering information and they provide data accuracy when the process of data entry is automated in the online survey (Cavana, Delahaye & Sekaran, 2001; Denscombe, 1998, 2010). Therefore, survey questionnaires have been adopted as a quantitative research method in this research study.

6.4.2.1 Unit of analysis

Objects of a study are referred to as ‘units of analysis’ (Runeson, Höst, Rainer & Regnell, 2012). The proposed units of analysis in this research are IT project managers who are involved in the implementation and managing IT projects in their organisations.

6.4.2.2 Sampling technique, population and sample size

A sampling technique is a process of selecting individuals, groups or organisations from the entire population to be studied (Kothari, 2004). The classification of survey sampling methods includes probability and non-probability sampling techniques. Probability sampling techniques are simple random, systematic, stratified and cluster sampling. Simple random sampling gives each individual, group or organisation an equal chance of being selected as an object of the study (Cochran, 1977; Fowler, 2009; Kothari, 2004). In this research, simple random sampling is adopted because it provides results which are highly generalisable as a representative view of the entire population and they are also relatively unbiased (Fink, 2003; Kumar, 2011).

The ‘population’ is the universe to be sampled in the research (Fink, 2003). This research uses a population of 300 IT project managers who have experience in managing IT projects in both public and private organisations.

Sample size is the number of units that need to be surveyed in order for the findings to be precise and reliable (Fink, 2003). The determination of the sample size differs depending on the research design (Fink, 2003). Krejcie and Morgan (1970) argue that, in order to provide the basis for a sound generalisation, the sample size should not be too small. As the sample size increases, the margin of errors decreases for a particular level of confidence (Krejcie & Morgan, 1970; Antonius, 2003; Fowler, 2014). Krejcie and Morgan (1970) introduced a table to determine the sample size from a finite population. To determine the sample size for this research, a table developed by Krejcie and Morgan (1970) is used. Therefore, the proposed sample size in this research is 169.

6.4.2.3 Instrument for data collection

A structured questionnaire (with closed-ended questions) will be developed to collect the quantitative data. The main advantage of using closed-ended questions is that “the structure imposed on the respondents’ answers provides the researcher with information which is of uniform length and in a form that lends itself nicely to being quantified and compared” (Denscombe, 2010:181). The quality and importance scales will be used to develop the survey questionnaire. Data measurements will be constructed by using the conceptual framework and the high-level IT project assurance processes as discussed in chapter 4.

The common methods, which have gained popularity in administering the survey questionnaire, are online surveys and postal mail surveys (Cavana et al., 2001; Dillman, 2000; Kwak & Radler, 2002). Online surveys are done by means of e-mails, the Web and mobile phones (Sue & Ritter, 2012). Postal mail surveys are questionnaires which have been posted manually to respondents. There are advantages and disadvantages to online and post mail surveys as illustrated in table 6-1.

Table 6-1: Comparison of Online and Post mail surveys

Type of survey	Advantages	Disadvantages
Online survey	• Low cost to administer • Faster response time • Efficient when the sample size is large and distributed geographically • Wide geographic reach • Direct data entry • Convenient to use online software to create questionnaire, write e-mail invitation, send reminders to respondents, upload distribution list.	• Coverage bias • Reliance on software • E-mail surveys can be blacklisted • Too many e-mail surveys, respondents can ignore invitations
Post mail survey	• No interview bias • Wide geographic reach • Anonymity allows for sensitive questions	• Low response rate • Lengthy response time • High cost to administer

Source: Adapted from Sue & Ritter, 2012.

Therefore, to administer a survey questionnaire, an e-mail invitation survey is adopted in this research. A researcher will create a database of IT project managers and questionnaires will be e-mailed to them.

6.4.2.4 Survey questionnaire pre-testing

A survey questionnaire will be pre-tested before the actual data collection begins to ensure the appropriate data are gathered. The pre-testing of questionnaire will involve the following:

- **Content validity:** According to Creswell (2014), content validity refers to the appropriateness of the data collection instrument to measure what it is intended to measure. Before the administering of the questionnaire, experts will be chosen to give their opinion on the validity of the instrument. The purposive sampling will be used to select participants to pre-test the design and content validity of the survey questionnaire. The aim of the purposive sampling is to select information-rich participants strategically related to the purpose of the research (Patton, 2002). The findings from the content validity will be used to update the questionnaire before the actual data collection takes place.

- **Reliability:** Reliability refers to the ability of the instrument to yield the same consistent results in a repeated testing period (Nunan, 1992). In IS research, internal consistency has been used to measure instrument reliability. The Cronbach alpha test is recommended in testing reliability in IS research (Straub et al., 2005). This research will use the Cronbach alpha coefficient (Cronbach, 1951; Cortina, 1993) to test the reliability of the questionnaire.

6.4.2.5 Ethical consideration

Ethical considerations are important in research which involves human subjects. This research will involve respondents from various organisations. Some of the ethical issues that will be considered are:

- **Informed consent:** Voluntary participation of the respondents to fill in the questionnaires. The participants will be informed through the e-mail survey invitation of all the necessary information about the survey such as the timeframe to complete the survey questionnaire, how data will be used etc.

- **Confidentiality and anonymity:** The most requirements in research maintain the confidentiality of participants (Sue & Ritter, 2012:28). The data collected will be kept confidential and will not be disclosed to third parties. The promise of anonymity will be included in the same statement that guarantees confidentiality, namely “All responses will remain strictly confidential and anonymous.”

- **Ethical interpretation and reporting results:** A survey researcher is obligated to produce reports that cannot lead to the identification of respondents.

Therefore, approval from the Ethics Committee of the University of Johannesburg will be obtained before starting the actual data collection from the selected sample.

6.4.2.6 Actual data collection

The actual data collection will start after obtaining approval from the Ethics Committee of the University of Johannesburg. The survey questionnaire will then be distributed to the selected sample. According to Denscombe (2010:158), “the researcher must keep a record of how many questionnaires are sent out, to whom they are sent and when they were sent”. Thus, the researcher will monitor the survey responses and prepare for the data analysis.

6.4.2.7 Data analysis

A quantitative data analysis was conducted by using the Statistical Package for Social Sciences (SPSS) software application package. The quantitative data analysis process is illustrated in figure 6-5.

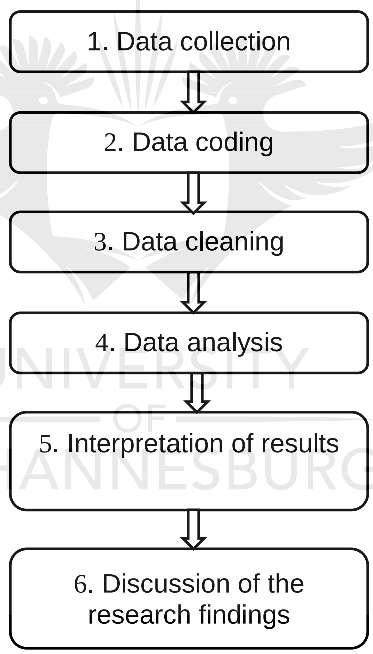

Figure 6-5: Quantitative data analysis process

6.4.2.8 Refine the conceptual framework

The quantitative findings were used to refine the conceptual framework. After refining the conceptual framework, the following section reports on the findings and discussion.

6.5 REPORT FINDINGS AND DISCUSSION

The research findings and discussion are discussed in the next chapter.

Based on the above discussion, the research design was constructed by considering the research question and purpose, the conceptual framework and exploratory sequential mixed methods design. A summary of the research design is shown in figure 6-6 below.

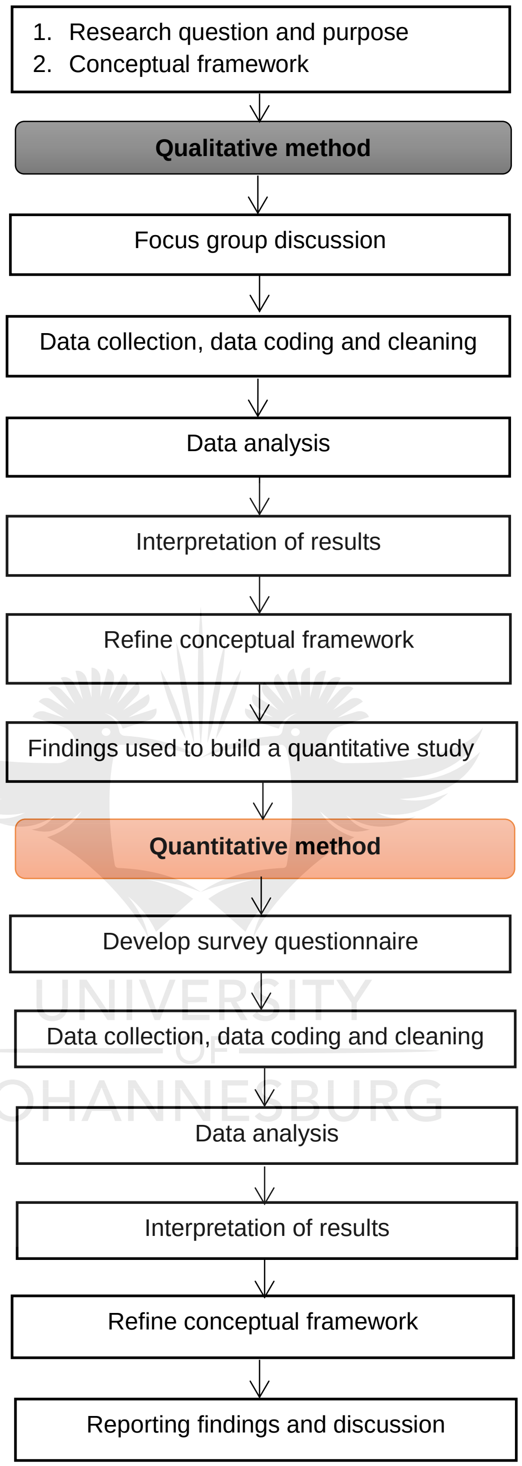

Figure 6-6: Exploratory sequential mixed methods research design

6.6 CONCLUSION

This chapter aimed at selecting an appropriate research methodology to validate the conceptual framework. The underlying research philosophical assumptions were discussed in more detail. Positivist and interpretivist were adopted as research philosophies. There are three research approaches, namely qualitative, quantitative and mixed methods. The mixed methods research approach was adopted which combined both the qualitative and quantitative approaches in a single research project. The basic types of mixed methods design were discussed in detail and the exploratory sequential mixed method design was adopted to design a research process.

In a qualitative research, a focus group is used as a data collection method. The focus group design was discussed in detail. The participants of the focus group were selected according to their ability to share their rich information and experience in implementing and managing IT projects in their organisations. Data analysis and interpretation of the qualitative data were used to refine the conceptual framework. The findings from the qualitative research built the quantitative research study. In quantitative research, a survey questionnaire was used to collect data. The Statistical Package for Social Science was used for quantitative data analysis. The quantitative results were used to refine the conceptual framework. The chapter also provided an exploratory sequential mixed methods research design which was used in this research study.

Ethical considerations are important in conducting research, particularly when human subjects are involved. The researcher will seek approval from the Ethics Committee of the University of Johannesburg before starting to collect data from various individuals and organisations.

The next chapter presents the qualitative research results and findings.

CHAPTER 7: QUALITATIVE DATA ANALYSIS AND RESULTS

7.1 INTRODUCTION

The previous chapter described the research methodology to validate the conceptual information technology project management assurance framework. The goal of this chapter is to apply a focus group discussion to validate the conceptual framework. To achieve this goal, the first objective is to describe how the focus group discussion has been conducted to collect qualitative data. The second objective is to describe how the collected data have been coded. The third objective is to analyse the data using a Computer-Assisted Qualitative Data Analysis (CAQDAS) software package, and then to interpret the results. Based on the qualitative data analysis results, the fourth objective is to provide the updated conceptual framework.

The following section describes how the focus group discussion has been conducted to collect qualitative data.

7.2 FOCUS GROUP DISCUSSION

Participants of the focus group were recruited using a purposive sampling strategy which was used to select information-rich participants related to the purpose of the research. Project managers and Project Management Office managers were considered to possess in-depth knowledge of and experience in managing IT projects in their organisations. They were recruited from various organisations located in South Africa.

A list of fourteen contacts of project managers was established and invitation letters to participate in the focus group discussion were sent to them. The researcher then contacted the fourteen invitees with follow-up telephone calls. Participation in the focus group discussion was voluntary. Five out of the fourteen persons accepted to participate in the focus group discussion. The identified participants were from financial market companies, a utilities company and a financial investment company located in Johannesburg, South Africa, as shown in table 7-1.

Table 7-1: Participants of the focus group discussion

Participant ID	Job description	Company description	Type of industry
Respondent1	Project Management Office (PMO) Manager	Financial market	Private sector
Respondent2	Project Manager	Financial investment	Private sector
Respondent3	Project Manager	Electricity	Public sector
Respondent4	Head of Project Management Office (PMO) and Governance	Financial market	Public sector
Respondent5	IT Governance Officer	Financial market	Public sector

Source: Author

In order to guide the focus group discussion, a focus group interview guide was developed with ten open-ended questions divided into six sections. The focus group interview guide is shown in Appendix C. The first section focused on an opening question which aimed at getting all participants to say something early on in the conversation. The second section focused on an introductory question which aimed at introducing the topic of discussion and get participants to start thinking about their connection with the topic. The third section focused on the transition questions which aimed at moving the conversation into the key questions that drove the research study. The fourth section focused on the key questions which aimed at driving the research study. The fifth section focused on the concluding questions which aimed at concluding the focus group discussion. The sixth section focused on the final question which aimed at ensuring that critical aspects have not been overlooked during the focus group discussion. The focus group questions were used during the focus group discussion which lasted for two hours.

The researcher started by welcoming the participants and presented to them an overview of the research topic. The researcher then explained to the participants the ground rules of the focus group discussion. The focus group questions were posed and the participants responded to them. The responses of the focus group discussion were digitally recorded for qualitative data analysis purposes.

To ensure triangulation of information among different sources of data, the participants of the focus group discussion were recruited from various organisations. In order to ensure the validity of the findings, reliable recordings of the focus group discussion used more than one digital recorder, and the assistant moderator also took notes during the focus group discussion.

The next section describes how the collected qualitative data were coded.

7.3 DATA CODING

According to Saldaña (2013:3), “coding is described as a link between data collection and their explanation of meaning”. Data coding involved transcribing the digitally recorded focus group interviews, developing coding categories, and coding the interviews. The digitally recorded focus group interviews were transcribed verbatim by using Express Scribe Transcription Software Version 5.87 and manually taking notes of the transcripts. The transcriptions were then loaded into a Computer-Assisted Qualitative Data Analysis (CAQDAS) software package. The software package that was used to code the transcriptions for analysis purposes was ATLAS.ti Version 7.

Coding categories can be generated inductively or deductively (Friese, 2012:93; Mangan, Lalwani & Gardner, 2004). Inductive coding refers to an approach that primarily uses detailed readings of raw data to derive at concepts, themes or a model through interpretations made from the raw data (Lewins & Silver, 2014). In the inductive approach, themes are identified and linked to the data and at the end, the themes identified may add value to the questions posed to respondents (Braun & Clarke, 2006; Patton, 1990). This approach is also known as a bottom-up way of identifying themes within data and bears some similarity to the grounded theory (Braun & Clarke, 2006). Deductive coding is an approach that sets out to test whether data are consistent with prior assumptions, theories or hypotheses identified or constructed by a researcher. In the deductive approach, themes are identified based on the theoretical interest of the researcher on the phenomenon of inquiry. This approach is known as a top-down way of identifying themes within data (Braun & Clarke, 2006).

In the process of coding, the text segments were selected and a code generated to the text segment that accurately described the meaning of the text segment. The similar data segments were assigned to the same code. The relationships among the codes were identified, and then themes emerged among the data. The inductive coding approach was therefore adopted in this research.

The next section discusses how the qualitative data has been analysed.

7.4 QUALITATIVE DATA ANALYSIS

Thematic analysis has been used to analyse the qualitative data (Braun & Clarke, 2006). Thematic analysis is "a method for identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006:6). According to Patton (1990), there are two types of thematic analysis techniques, namely the inductive thematic analysis and the deductive thematic analysis. In the inductive thematic analysis, the researcher codes the data without a specific research question and the identified themes are linked to the data. In the deductive thematic analysis, the researcher codes the data for a specific research question and themes are identified based on the theoretical interest of the researcher on the phenomenon of inquiry (Braun & Clarke, 2006).

In this research, the data coding was done by using inductive coding as discussed in section 7.3. Therefore, an inductive thematic analysis was used to analyse the qualitative data. Data were analysed for each phase of the IT project life cycle and this process is discussed in the following sections.

7.4.1 Initiation Phase

Data were collected and transcribed from the focus group interviews on IT project assurance processes in the initiation phase of the IT project life cycle. The IT project assurance processes assessed the (i) strategic alignment of the IT project with the organisational strategy and business objectives, (ii) business justification to invest in the IT project, (iii) approval to start IT project and (iv) audit report from the initiation phase.

The researcher read through the transcripts, selected a segment of text, and then derived codes inductively, using the code manager tool of the ATLAS.ti software package. The next process was to collect similar data segments and link them to the same code. The process of collecting the similar data segments was based on the underlying focus group questions, research aim, research question and the proposed IT project assurance processes in the initiation phase. The coded data were analysed, patterns were discovered, and then themes emerged from the patterns. The themes that emerged in the initiation phase were (i) the strategic alignment of the IT project with the organisational strategy and business objectives, (ii) business justification to invest in the IT project, (iii) approval to start a project, (iv) an audit report from the initiation phase and (v) aligning the IT project with the existing programme.

To illustrate the relations in the data, the Network View Manager tool of the ATLAS.ti software package has been used to generate the initiation phase codes family which shows the relationships among the emerged themes. The relationship between the code nodes is shown by using lines which link code nodes to one another.

The network view of the code families in the initiation phase is shown in figure 7-1.

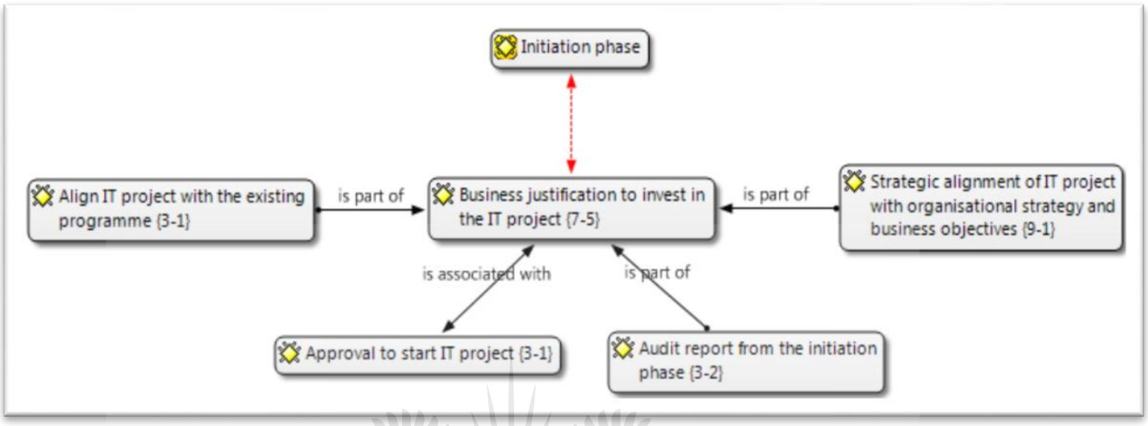

Figure 7-1 : Network view of codes family in the initiation phase

Results of the data analysis

The themes that emerged from the analysed data in the initiation phase of the IT project life cycle are discussed below.

a) Strategic alignment of IT project with organisational strategy and business objectives

According to PMI (2017), projects should be aligned with the organisation's strategic plan. Top management is responsible to ensure that projects are aligned with organisational and business strategy (PRINCE2, 2009). Respondent2 said that "…*we align project with business strategy. You cannot implement project which is nothing to do with your strategic objectives".* Respondent3 commented that *"Portfolio manager must align projects with the business strategy"*. Respondent4 added that *"…we align IT projects with business strategy. We scrutiny the projects to make sure that they are aligned with organisational business strategy"*.

Strategic alignment of the IT project with the organisation's strategy is part of the business justification to invest in the IT project. Therefore, the IT project should be aligned with the organisational business strategy to ensure that the project contributes to achieving the organisational strategic objectives.

b) Business justification to invest in the IT project

Business case provides justification for carrying out the project (PRINCE2, 2009; PMI, 2017). Respondents have indicated that it is important for the organisations to develop a business case in the initiation phase to justify investing in the IT project. Respondent1 said that *"…we have a policy on how the business case is supposed to be. We are adhering to the business case policy to make sure all the requirements of business case are met. The risk analysis is done and continuous monitoring of the costs, if the costs go up and down, we are continuously updating the justification of the project. This is valuable because at the end of the day we have to validate the business case".*

During the development of a business case organisations need to adhere to the requirements of the business case. Organisations should ensure that the business case is reviewed and updated regularly to verify its validity. Respondent4 commented that *"...we develop business case to justify investing in the IT project, and we communicate benefits of the project to stakeholders*". This means that organisations use the business case to link project benefits to the organisational strategies.

Thus, business case is a tool for providing justification to undertake a project. The main purpose of the business case is to obtain senior management's commitment and approval to invest in the IT project.

c) Approval to start the IT project

The project governance approves a project to start by providing resources and authorising funds for the project (PRINCE2, 2009). Respondent2 said that *"…what we do is, during the project management we have various stages where we insist senior management for final approval before we move on to the next stage".* Respondent4 said that "*...our projects are approved by the top management, we make sure the approval is obtained before we start implementing the project"*.

The conclusion that can be drawn from the analysed data is that approval to start a project is required in order to provide the project manager with the authority to apply organisational resources to the IT project activities. The project governance not only approves an IT project to start, but also provides oversight and support to ensure that the project is completed successfully.

d) Audit report from the initiation phase

Respondents commented that auditing projects during the initiation phase had additional costs due to the limited annual budget in their organisations. Respondent1 said that *"…during the initiation phase the audit report is not necessary".* Respondent3 commented that *"…audit at the initiation phase has no value because it adds another layer of costs".*

The conclusion that can be drawn from the analysed data is that the audit report in the initiation phase has no value because it adds costs to organisations.

The following are the reasons for auditing a project in the initiation phase:

i. Auditing a project throughout the IT project life cycle helps to identify project risks earlier and trigger timely corrective actions in order to improve project performance (McDonald, 2002; Simon, 2011). An audit report in the initiation phase verifies whether the project can move on to the next phase.

ii. Auditing of processes throughout the project life cycle influences the IT project success (Meredith & Mantel, 2009; Marnewick, 2013; Marnewick & Erasmus, 2014).

Based on the importance of auditing a project, it is recommended that organisations allocate a budget to audit an IT project during the initiation phase.

e) Aligning an IT project with the existing programme

Aligning an IT project with the existing programme is a theme that has emerged during the data analysis process. Programmes manage groups of related projects in order to achieve organisational strategic goals and objectives (PMI, 2013b). Respondents suggested that new IT projects be aligned with existing programmes within the organisations in order to contribute to achieving the organisational strategic and business objectives.

Respondent1 said that "…*projects must be aligned with the existing programme and programme management standards"*. The Standard for Program Management provides guidelines for managing programme within the organisations (PMI, 2013b). Respondent3 commented that "…*the projects under programme must be aligned with the business strategy and program management standards".* In the organisation where there are existing programmes, the new IT project can be incorporated into the appropriate existing programmes in order to contribute to achieving the programme benefits as well as the organisational strategic objectives.

Based on the analysed data, the updated IT project assurance processes in the initiation phase are shown in table 7-2.

Table 7-2: IT project assurance processes in the initiation phase

#	Original IT project assurance processes	Updated IT project assurance processes
1.	Assess strategic alignment of IT project with organisational strategy and business objectives	Assess strategic alignment of IT project with organisational strategy and business objectives
2.	Assess business justification to invest in the IT project	Assess business justification to invest in the IT project
3.	Assess approval to start IT project	Assess approval to start IT project
4.	Assess audit report from the initiation phase	Assess audit report from the initiation phase
5.	_	Align IT project with the existing programme

Source: Author

The reasons for adding a new IT project assurance process 'Align IT project with the existing programme' to the conceptual framework is that projects are like programmes in that they contribute to achieving organisational strategic and business objectives. Therefore, the organisations which have existing programmes may align IT projects with their existing programmes to deliver benefits to the organisations.

7.4.2 Planning Phase

Data were collected and transcribed from the focus group interviews on IT project assurance processes in the planning phase of the IT project life cycle. The IT project assurance processes assessed (i) the involvement of top management and project stakeholders, (ii) project plans which were developed, updated and realistic in achieving the IT project outcomes, (iii) IT project management aligned with project management methodology and standards, (iv) organisational readiness to start executing the IT project, (v) how to validate the business case and (vi) the audit report from the planning phase.

The researcher read through the transcripts, selected a segment of text and then derived codes inductively by using the Code Manager tool of the ATLAS.ti software package. The next process was to collect similar data segments and link them to the same code name. The process of collecting the similar data segments depended on the underlying focus group questions, research aim, research question and the proposed IT project assurance processes in the planning phase. The coded data were analysed, patterns were discovered, and then themes emerged from the patterns. The themes that emerged in the planning phase were (i) the involvement of top management and project stakeholders, (ii) project plans which were developed, updated and realistic in achieving the IT projects outcomes, (iii) IT project management should be aligned with project management methodology standards and best practice, (iv) organisational readiness to start executing the IT project, (v) to validate the business case and (vi) the audit report from the planning phase.

To illustrate the relations in the data, the Network View Manager tool of ATLAS.ti has been used to generate the planning phase codes family which shows the relationships among the emerged themes. The relationship between the code nodes is shown by using lines which link code nodes to one another. The network view of the code families in the planning phase is shown in figure 7-2.

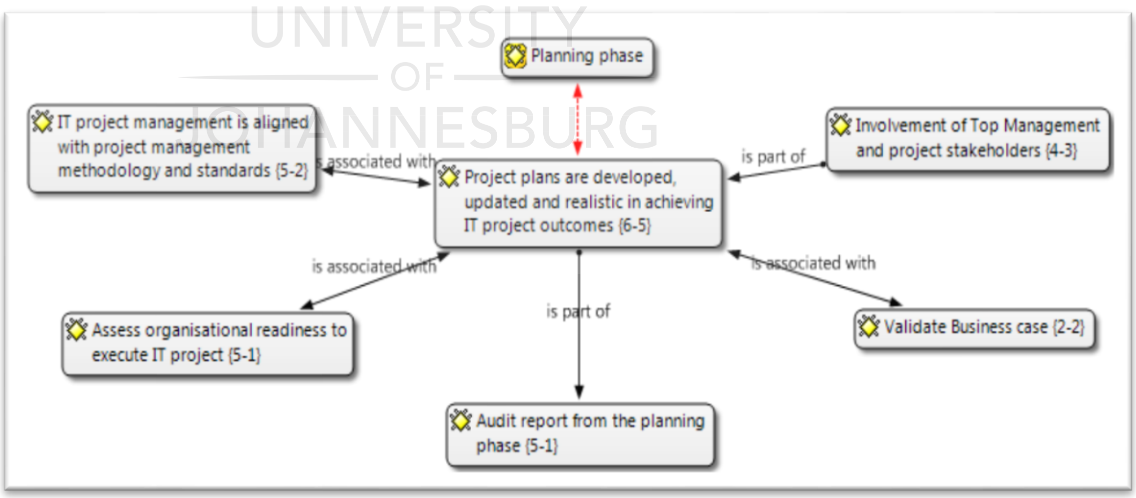

Figure 7-2 : Network view of codes family in the planning phase

Results of the data analysis

The themes that emerged from the analysed data in the planning phase of the IT project life cycle are discussed below:

a) Involvement of top management and project stakeholders

Respondent3 said that, *"…leadership commitment is required time to time"*. Good leadership from the top management provides direction to the project team which leads to project success (Kerzner, 1987; Turner & Müller, 2005; Standish Group, 2016; Almajed & Mayhew, 2013). Respondent1 said that, *"…we satisfied that project involves project stakeholders"*. Respondent2 commented that, *"…assurance from the stakeholders supporting the projects"*. Respondent2 also added that, *"… what is key is the acceptance of processes ownership of basic phase within the project, once you get agreement of ownership it has much more control rather than blaming project manager when project fail"*. Respondent3 said that, *"…the moment we have the processes, project stakeholders are required to be adhered to the processes"***.**

Organisations need to develop appropriate management strategies for effectively engaging project stakeholders in project decisions throughout the project life cycle. The commitment and involvement of top management and project stakeholders ensure close monitoring and controlling of IT project progress until its successful completion.

b) Projects plans are developed, updated and realistic in achieving IT project outcomes

During the planning phase, project plans are developed explaining how to achieve the IT project's goals and objectives. Project plans cover the management of project scope, cost, time, quality, integration, resources, procurements, risks, communication, stakeholders and any other relevant project documents. These projects plans are updated and realistic in achieving the IT project outcomes. Respondent1 commented that", *I agree with the proposed IT project assurance processes on developing and updating project plans in order to achieve project's outcomes"*. Respondent2 said that, *"…adding review of existing projects. During the project planning, the lessons learnt from the existing projects can be incorporated in the project plans*". Respondent4 also added that", *I agree with the assurance process*".

A project plan is a means of achieving the project's objectives (PRINCE2, 2009; Burke, 2011; PMI, 2017). Top management and project stakeholders are involved in the development and approval of the project management plans. Project management plans are then used to implement project activities throughout the IT project life cycle to achieve project goals and objectives.

c) IT project management is aligned with project management methodology and standards

A project management methodology is a structured method for effective project management in order to achieve project objectives. The most used project management methodologies in the project management practice include: PRINCE2 and Agile software development methodology. Project management standard is a collection of knowledge areas that are generally accepted as best practice in the industry. The most popular standards are the PMBOK, APMBOK, and P2M. Respondents agreed that, IT project management needs to be aligned with the project management methodology and/or standards. Respondent1 said that, *"…we use PRINCE2 as a project management methodology, continuous adherence to the project management methodology is vital"*. Respondent4 said that, *"…in our organisation we follow PMBOK*".

The importance of aligning IT project management with project management methodology and /or standards creates a project roadmap, helps to monitor resources allocated to projects, controls project scope, minimize project's risks and leads to achieve project's objectives.

d) Validate business case

Business case captures justification for investing in the IT project and is used to authorise IT project in the initiation phase. Respondents commented that in the planning phase, it is necessary to confirm that business case is still valid before starting to execute the IT project. Respondent1 said that, *"…I agree with the assurance process"*. Respondent4 also added that, *"I agree with the assurance process"*. Respondent5 commented that, *"…I also agree with the proposed assurance process"*.

In the planning phase, the business case needs to be evaluated to check if it is unaffected by internal and external events or changes.

e) Assess organisational readiness to execute IT project

Organisational readiness examines to determine whether the organisation is ready to start executing IT project. Respondent2 said that, "…*before we go on do we have organisational* *readiness"*. Respondent4 also added that, *"I agree with the proposed assurance process"*. Respondent5 commented that, *"….I also agree with the proposed assurance process"*.

Organisational readiness is important because it determines the current state of readiness to start executing IT project. Corrective actions can be taken for the missing gaps identified in the assessment of the organisational readiness.

f) Audit report from the planning phase

Respondents commented that auditing projects during the planning phase adds value. Respondent4 said that, *"…audit in the planning phase adds value. The cost of not performing audits in the planning phase can be much higher than the cost of performing it"*. Respondent5 commented that, *"I also agree with the assurance process"*. Some of the benefits of auditing a project during the planning phase include: to improve project performance, to control project scope to avoid scope creep, and to provide early problem diagnostics before starting to execute the project.

The conclusion that can be drawn from the analysed data is that, it is important for organisations to consider auditing projects during the planning phase to confirm that the IT project can proceed to the execution phase.

Based on the analysed data, nothing changed in the IT project assurance processes in the planning phase. Respondent3 said that *"…leadership commitment is required from time to time"*. Good leadership from the top management provides direction to the project team which leads to project success (Almajed & Mayhew, 2013; Kerzner, 1987; Turner & Müller, 2005; Standish Group, 2016). Respondent1 said that *"…we satisfied that project involves project stakeholders"*. Respondent2 commented that *"…assurance from the stakeholders supporting the projects is important"*. Respondent2 also added that *"…what is key is the acceptance of processes ownership of basic phase within the project, once you get agreement of ownership it has much more control rather than blaming project manager when project fail"*. Respondent3 said that *"…the moment we have the processes; project stakeholders are required to be adhered to the processes".*

Organisations need to develop appropriate management strategies for effectively engaging project stakeholders in project decisions throughout the project life cycle. The commitment and involvement of top management and project stakeholders ensure close monitoring and controlling of IT project progress until its successful completion.

g) Project plans are developed, updated and realistic in achieving IT project outcomes

During the planning phase, project plans are developed explaining how to achieve the IT project goals and objectives. Project plans cover the management of the project scope, cost, time, quality, integration, resources, procurements, risks, communication, stakeholders and any other relevant project documents. These project plans are updated and realistic in achieving the IT project outcomes. Respondent1 commented that "…*I agree with the proposed IT project assurance processes on developing and updating project plans in order to achieve project's outcomes"*. Respondent2 said that *"…adding review of existing projects. During the project planning, the lessons learnt from the existing projects can be incorporated in the project plans*". Respondent4 added that "…*I agree with the assurance process*".

A project plan is a means of achieving the project objectives (Burke, 2011; PMI, 2017; PRINCE2, 2009). Top management and project stakeholders are involved in the development and approval of the project management plans. Project management plans are then used to implement project activities throughout the IT project life cycle to achieve the project goals and objectives.

h) IT project management is aligned with project management methodology and standards

A project management methodology is a structured method for effective project management in order to achieve project objectives. The most used project management methodologies in the project management practice include the PRINCE2 and Agile software development methodologies. Project management standard is a collection of knowledge areas that are generally accepted as best practice in the industry. The most popular standards are the PMBOK, APMBOK and P2M. Respondents agreed that IT project management needs to be aligned with the project management methodology and/or standards. Respondent1 said that *"…we use PRINCE2 as a project management methodology, continuous adherence to the project management methodology is vital"*. Respondent4 said that *"…in our organisation we follow PMBOK*".

The importance of aligning IT project management with a project management methodology and/or standards creates a project roadmap, helps to monitor resources allocated to projects, controls project scope, minimises project risks and leads to achieving the project objectives.

i) Validate the business case

Business case captures justification for investing in the IT project and is used to authorise an IT project in the initiation phase. Respondents commented that, in the planning phase, it is necessary to confirm that business case is still valid before starting to execute the IT project. Respondent1 said that *"…I agree with the assurance process"*. Respondent4 added that *"I agree with the assurance process"*. Respondent5 commented that *"…I also agree with the proposed assurance process"*. In the planning phase, the business case needs to be evaluated to check if it is unaffected by internal and external events or changes.

j) Assess organisational readiness to execute the IT project

Organisational readiness examines whether the organisation is ready to start executing the IT project. Respondent2 said that "…*before we go on we have organisational readiness"*. Respondent4 added that *"I agree with the proposed assurance process"*. Respondent5 commented that *"…I also agree with the proposed assurance process"*. Organisational readiness is important because it determines the current state of readiness to start executing the IT project. Corrective actions can be taken for the missing gaps identified in the assessment of the organisational readiness.

k) Audit report from the planning phase

Respondents commented that auditing projects during the planning phase add value. Respondent4 said that *"…audit in the planning phase adds value*. *The cost of not performing audits in the planning phase can be much higher than the cost of performing it"*. Respondent5 commented that *"I also agree with the assurance process"*. Some of the benefits of auditing a project during the planning phase include improving the project performance, controlling the project scope to avoid scope creep and providing early problem diagnostics before starting to execute the project.

The conclusion that can be drawn from the analysed data is that it is important for organisations to consider auditing projects during the planning phase to confirm that the IT projects can proceed to the execution phase. Based on the analysed data, nothing changed in the IT project assurance processes in the planning phase.

7.4.3 Execution Phase

Data were collected and transcribed from the focus group interviews on the IT project assurance processes in the execution phase of the IT project life cycle. The IT project assurance processes were the following: (i) performance of the implemented IT project activities against the planned activities in the project management plans,(ii) ensure adequate project funding, (iii) involvement of top management and project stakeholders, (iv) adherence to project management methodology, (v) assess IT project fraud and corruption management, (vi) assess IT project conflict management, (vii) assess IT project deliverable security management, (viii) assess existence of motivation scheme to the project team members, (ix) validate business case, (x) environmental assessment, (xi) assess organisational readiness for change, and (xii) audit report from the execution phase.

The researcher read through the transcripts, selected a segment of text and then derived codes inductively by using the code manager tool of the ATLAS.ti software package. The next process was to collect similar data segments and link them to the same code name. The process of collecting the similar data segments was based on the underlying focus group questions, research aim, research question and the proposed IT project assurance processes in the execution phase. The coded data was analysed, patterns were discovered, and then themes emerged from the patterns.

The themes that emerged in the execution phase were: (i) performance of the implemented IT project activities against the planned activities in the project management plans, (ii) ensure adequate project funding, (iii) involvement of top management and project stakeholders, (iv) adherence to project management methodology, (v) assess IT project fraud and corruption management, (vi) assess IT project conflict management, (vii) assess IT security management to the IT project deliverables, (viii) assess existence of motivation scheme to the project team members, (ix) validate business case, (x) environmental assessment, (xi) assess organisational readiness for change, and (xii) audit report from the execution phase.

To illustrate the relations in the data, the Network View Manager tool of the ATLAS.ti software package has been used to generate the execution phase codes family which shows the relationships among the emerged themes. The relationship between the code nodes is shown by using lines which link code nodes to one another.

The network view of the code families in the execution phase is shown in figure 7-3.

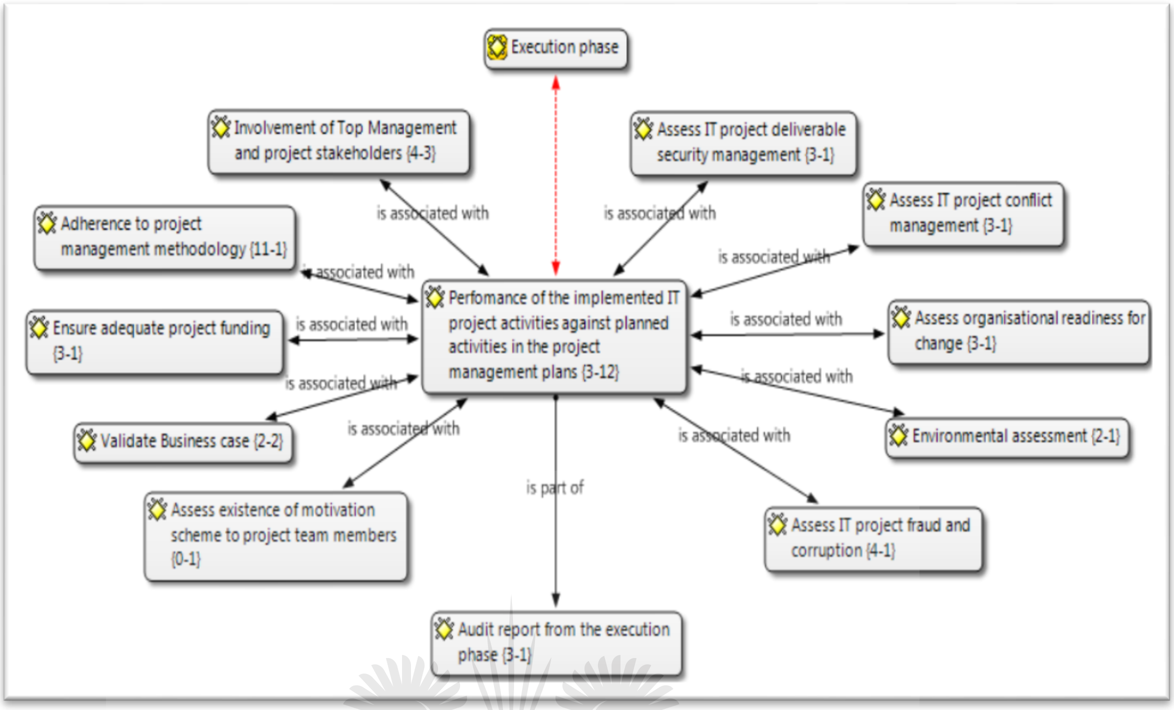

Figure 7-3 : Network view of codes family in the execution phase

Results of the data analysis

The themes that emerged from the analysed data in the execution phase of the IT project life cycle are discussed below.

a) Performance of the implemented IT project activities against the planned activities in the project management plans

Respondents suggested that, in order to determine the performance of an IT project, the implemented project activities be measured against the planned project activities in the project management plans. Respondent1 said that *"…PMBOK has got ten knowledge areas, you may provide assurance process which covers all the ten knowledge areas"*. Respondent3 said that *"...primary factors are built from the PMBOK knowledge areas"*. Respondent4 commented that *"…I agree with the proposed assurance processes".* Respondent5 said that *"… I also agree with the proposed assurance process".* Most of the organisations developed project management plans based on the knowledge areas. Measuring project performance gives a clear picture of the status of the IT project to top management and project stakeholders.

b) Ensuring adequate project funding

Project funds are secured and made available at the appropriate time to implement a project (Ohara, 2005; APMBOK, 2012). Respondents suggest that the project sponsor ensure there are sufficient project funds to implement IT project activities. Respondent4 said that *"…I agree with the process, ensure fund spends in the IT project will benefit the organisation"*. Respondent5 added that "…*I agree with the assurance process*". Adequate project funding throughout the project life cycle influences project success (Baker et al., 1983; Morris & Hough, 1987). It is necessary to ensure that there are sufficient project funds to implement IT project activities.

c) Involvement of top management and project stakeholders

Involvement of top management is among the critical success factors that influence project success (Pinto & Slevin, 1987; Kerzner, 1987; Baccarini & Collins, 2003; Sudhakar, 2012; Marnewick, 2013; Standish Group, 2016; Almajed & Mayhew, 2013, 2014; Ahimbisibwe et al., 2015). Respondent2 said that *"…senior managers are involved to make sure processes are met"*. Respondent4 added that *"…we make sure the approval is obtained from the top management"*. Respondent5 commented that *"…I agree with the assurance process"*. Top management provides a decision-making framework throughout the implementation of the IT project activities. Top management also ensures close monitoring and controlling of project progress until its successful completion.

d) Adherence to the project management methodology

Adhering to a project management methodology increases the likelihood of successful projects (Standish Group, 2016; Joslin & Müller, 2014). Respondent1 said that *"…we have defined project management methodology, we are following Prince2 methodology, continuous adherence to project methodology is necessary, no matter which gates of the project you are in, we have to follow the methodology"*. Respondent3 commented that *"…we have high performance utility model which is derived from PMBOK"*. Respondent4 said that *"…we use PMBOK framework throughout the project life cycle of the project".* Respondent5 said that *"…we follow both agile and waterfall project management methodology"*. Respondents commented that adhering to the project management methodology is among the controls which they have in place to ensure that IT projects are delivered successfully in their organisations. Project team members should adhere to the project management methodology during the implementation of project activities in order to increase the chances of delivering successful projects.

e) Assessment of IT project fraud and corruption management

Respondents suggested that anti-corruption measures should be addressed during the implementation of IT project activities. Corruption in project management may occur in the form of bribery, fraud or at any level of the contractual structure. Respondent1 said that *"…fraud and corruption are covered under costs management where you see how contracts are managed, how costs are derived and how procurement is managed"*. Respondent2 commented that *"…I agree on what we have here"*. Respondent4 added that *"…I agree with the assessment of project fraud and corruption"*. Respondent5 said that *"…I agree with the proposed assurance process"*. The project governance, project team members and other project stakeholders are required to sign and comply with the anti-corruption agreement. The project manager should make sure any suspected corruption during the implementation of the IT project is reported and enforcement action is taken. Raising awareness among project team members by providing anti-corruption training is vital in preventing corruption in the execution phase.

f) Assessment of IT project conflict management

Conflict in project management is inevitable because it involves individuals from different backgrounds who are working together to complete the assigned tasks. Respondent2 said that *"…a top governance process is the one which make sure this process is met"*. Respondent4 commented that *"I agree with the assurance process".* Respondent5 added *"…I agree with the assurance process"*. When conflict is not managed properly during the implementation of the IT project activities it can delay the project to reach its goals.

g) Assessment of security management to the IT project deliverables

In order to ensure confidentiality, integrity and availability of information, the IT project deliverables should have sufficient security and privacy controls before it goes live. Respondent2 commented that *"…I agree with the assurance process"*. Respondent4 added that *"…I agree with the process"*. Respondent5 said that *"…I agree with the proposed assurance process"*. Awareness of information security to top management and other project stakeholders ensures that information security in the IT project deliverables is addressed and managed properly.

h) Assessment of the existence of a motivation scheme to the project team members

According to PMI (2017:514), "the overall success of the project depends upon the project team's commitment, which is directly related to their level of motivation". Respondent2 said that *"…I agree with the assurance process"*. Respondent3 commented that *"…I agree with* *the proposed assurance process".* Respondent4 added that *"…I agree with the process"*. Respondent5 said that *"…I agree with the proposed assurance process"*. Project team members with great motivation positively influence project success and provide value for money to projects (Beel, 2007). Project managers need to motivate their project team members to be committed and engaged in implementing the IT project activities.

i) Validation of the business case

During the implementation of the IT project activities, it is necessary to confirm that the business case is still valid and updated. Respondent2 said that *"…I agree with the assurance process"*. Respondent3 commented that *"…I agree with the assurance process".* Respondent4 also added that *"…I agree with the process"*. Respondent5 said that *"…I also agree with the proposed assurance process"*. The business case is a living document that needs to be updated throughout the project life cycle (Bradley, 2010). In the execution phase, the business case needs to be assessed to check if it is unaffected by internal and external events or changes.

j) Environmental assessment

The environmental assessment is among the themes which has emerged in the analysed data. Respondent3 said that *"…let say secondary factors include environment and people involved in the project".* Respondent4 commented that *"…I agree with the assurance process"*. Respondent5 said that *"I also agreed with the proposed assurance process"*. The conclusion that can be drawn is that assessing the external environment during the implementation of IT project activities is vital in delivering successful projects.

k) Assessment of organisational readiness for change

Organisational readiness for change confirms that an organisation is ready to implement the business change. Respondent1 said that *"…I agree with the assurance process, from our perspective we have defined processes in change management and controls".* Respondent2 commented that *"…I also agree with the assurance process"*. Respondent3 added that "…*we have change management process in place"*. Respondent4 commented that "…*I agree with the proposed assurance process*". The change management process drives the organisational transitions and ensures that the IT project meets its intended outcomes.

l) Audit report from the execution phase

Respondent1 said that *"…auditing project reveals the project performance".* Respondent2 commented that *"…I agree with the process, ours is more on to mitigate risks"*. Respondent3 added that *"…we do project audit to ensure that we adhere to the best practice and maintain* *high level of success”.* Respondent4 commented that *“…an auditing report adds value because it shows that the planned project activities are done as agreed and they are adhered to project management methodology”.* The audit report in the execution phase reveals the performance of the planned IT project activities in the project management plans. Based on the analysed data, nothing has changed in the IT project assurance processes in the execution phase.

7.4.4 Closing Phase

Data was collected and transcribed from the focus group interview on the IT project assurance processes in the closing phase of the IT project life cycle. The IT project assurance processes assessed the IT project readiness for closure and the audit report from the closing phase.

The researcher read through the transcripts, selected a segment of text and then derived codes inductively by using the code manager tool of the ATLAS.ti software package. The next process was to collect similar data segments and link them to the same code name. The process of collecting the similar data segments was based on the underlying focus group questions, research aim, research question and the proposed IT project assurance processes in the closing phase. The coded data were analysed, patterns were discovered and then themes emerged from the patterns. The themes that emerged in the closing phase were the IT project readiness for closure and the audit report from the closing phase.

To illustrate the relations in the data, the Network View Manager tool of ATLAS.ti has been used to generate the closing phase codes family which shows the relationships among the emerged themes. The relationship between the code nodes is shown by using lines which link code nodes to one another. The network view of the code families in closing phase is shown in figure 7-4.

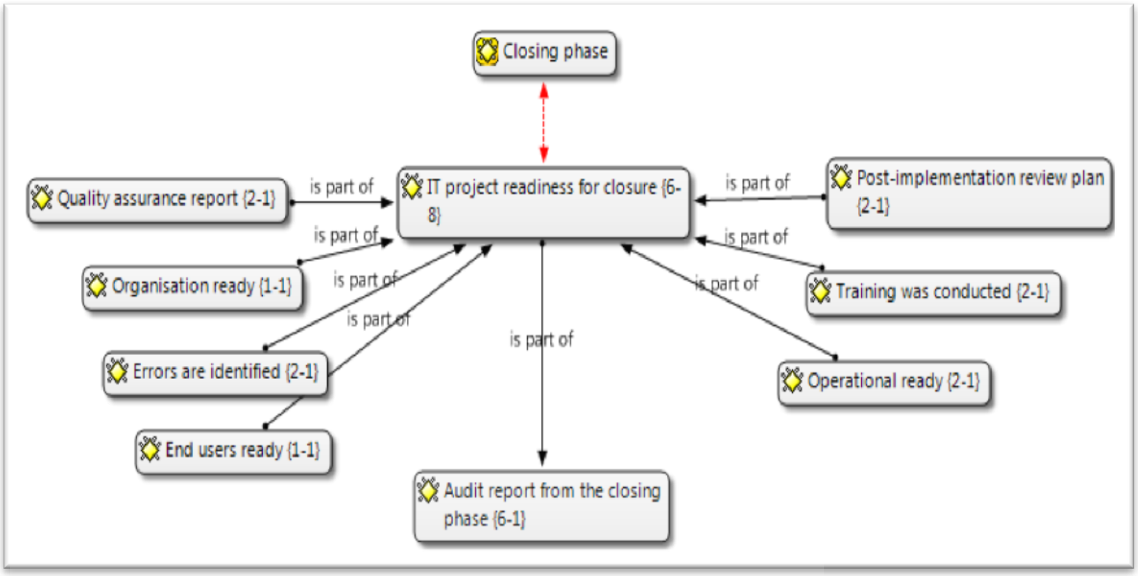

Figure 7-4 : Network view of codes family in the closing phase

Results of the data analysis

The themes that emerged from the analysed data in the closing phase of IT project life cycle are discussed as:

a) IT project readiness for closure

The respondents have commented that project readiness for closure confirms that IT project objectives are met and lessons learnt from the project are documented for future projects. Respondent1 said that *"… we have to assess, are the end-users ready, is the organisation ready, and plan for the post-implementation review"*. Respondent2 said that *"…I would like to add quality assurance report"*. Respondent4 commented that *"…all the project requirements are met, training was conducted, operational ready, errors are identified"*. IT project readiness for closure should confirm that end-users are trained, the quality assurance of the product is accepted by the project governance and the project stakeholders, there is a plan for post-implementation review and all the project requirements are met.

b) Audit report from the closing phase

The closeout audit is performed when all the IT project activities have been completed. The purpose of the closeout audit is to produce an audit report that formally closes the project (Burke, 2011; Hill, 2013). Respondent1 said that *"…I agree with the assurance process"*. Respondent2 commented that *"…I also agree with the assurance process"*. Respondent4 added that *"…I agree with the assurance process"*. Respondent5 said that "…*I also agree with the assurance process".* In the closing phase, the audit report confirms that the IT project is ready for closure.

Based on the analysed data, nothing has changed in the IT project assurance processes in the closing phase.

7.4.5 Operations and Maintenance Phase

Data were collected and transcribed from the focus group interview on the IT project assurance processes in the operations and maintenance phase of the IT project life cycle. The IT project assurance processes assessed the benefits realisation and the audit report from the operations and maintenance phase.

The researcher read through the transcripts, selected a segment of text and then derived codes inductively by using the code manager tool of the ATLAS.ti software package. The next process was to collect similar data segments and link them to the same code name. The process of collecting the similar data segments was based on the underlying focus group questions, research aim, research question and the proposed IT project assurance processes in the operations and maintenance phase. The coded data were analysed, patterns were discovered and then themes emerged from the patterns. The themes that emerged in the operations and maintenance phase were benefits realisation and the audit report from the operations and maintenance phase.

To illustrate the relations in the data, the Network View Manager tool of the ATLAS.ti software package has been used to generate the execution phase codes family which shows the relationships among the emerged themes. The relationship between the code nodes is shown by using lines which link code nodes to one another. The network view of the code families in operations and maintenance phase is shown in figure 7-5.

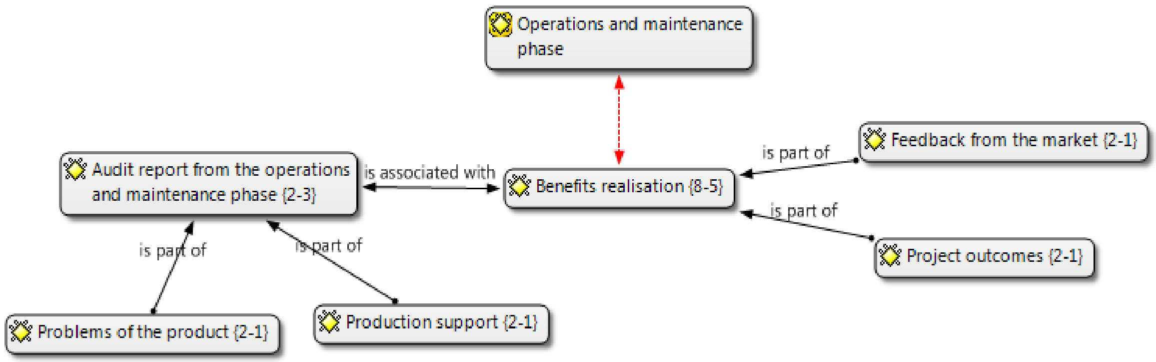

Figure 7-5 : Network view of codes family in the operations and maintenance phase

Results of the data analysis

The themes that emerged from the analysed data in the operations and maintenance phase of the IT project life cycle are discussed next.

a) Benefits realisation

The review of benefits realisation confirms that the benefits set out in the business case have been achieved (PRINCE2, 2009). Respondent1 said that *"…I agree with the assurance process, I may add project outcomes"*. Respondent2 said that *"…benefits realisation from the production as it has gone live, we need to realise high level objectives such as is the business grow and feedback from the market"*. Respondent3 said that *"…sometimes we get benefits when we combine more than one project"*. Respondent5 said, *"…I agree with the assurance process"*. Organisations need to ensure that the potential benefits arising from the use of IS/IT are realised (Badewi, 2016). In the operations and maintenance phase, organisations need to ensure that benefits realisation is sustained by providing support and maintenance of the IT project product.

b) Audit report from the operations and maintenance phase

An audit report reveals the operational performance of the product and the realised benefits from the product. Respondent2 said that *"…I agree with the assurance process"*. Respondent4 also said that *"…we need to consider production support and report which has benefits and problems of the product"*. Respondent5 commented that *"…I agree with the assurance process"*. In the operations and maintenance phase, the audit report identifies problems of the product and then recommends corrective actions to be taken to continue realising benefits from the product.

Based on the analysed data, nothing has changed in the IT project assurance processes in the operations and maintenance phase. Thus, according to the results of the analysed qualitative data, the next section provides an updated conceptual framework.

7.5 UPDATED CONCEPTUAL FRAMEWORK

The original conceptual information technology project management assurance framework has high-level IT project assurance processes in each phase of the IT project life cycle as discussed in more detail in chapter 4. These assurance processes can be tailored to ensure the successful delivery of an IT project.

Based on the qualitative data analysis results, the original conceptual framework had to be updated to reflect the reality observed from the analysed data. In Level 4: IT Project Assurance, the newly introduced IT project assurance processes in the initiation phase are 'Align the IT project with the existing programme'.

The IT project assurance processes in the planning, execution, closing and operations and maintenance phases remain as they have been incorporated into the original conceptual framework. Other components of the conceptual framework, namely Level 1: IT Project Life Cycle, Level 2: IT Project Deliverables and Level 3: IT Project Auditing, also remain as they are.

The updated IT project assurance process (highlighted) is illustrated in table 7-4, and the updated conceptual framework is shown in figure 7-6. In the updated conceptual framework, the newly introduced IT project assurance process, that is 'Align the IT project with the existing programme' is indicated as number 05 (with blue colour) in the assurance processes under 'PSAR' as depicted in figure 7-6.

Table 7-4: Updated IT project assurance process (highlighted)

Initiation phase	Planning phase	Execution phase	Closing phase	Operations and maintenance phase
• Strategic alignment of IT project with organisational strategy and business objectives • Business justification to invest in the IT project • Approval to start IT project • Audit report from the initiation phase • **Align IT project with the existing programme**	• Involvement of top management and project stakeholders • Project plans are developed, updated and realistic in achieving IT project outcomes • IT project management is aligned with project management methodology and standards • Validate business case • Assess organisational readiness to execute IT project • Audit report from the planning phase	• Performance of the implemented IT project activities against planned activities in the project management plans • Ensure adequate project funding • Involvement of top management and project stakeholders • Adherence to project management methodology • Assess IT project fraud and corruption management • Assess IT project conflict management • Assess IT security management to the IT project deliverables. • Assess existence of motivation scheme to the project team members • Validate business case • Environmental assessment • Assess organisational readiness for change • Audit report from the execution phase	• IT project readiness for closure • Audit report from the closing phase	• Benefits realisation • Audit report from the operations and maintenance phase

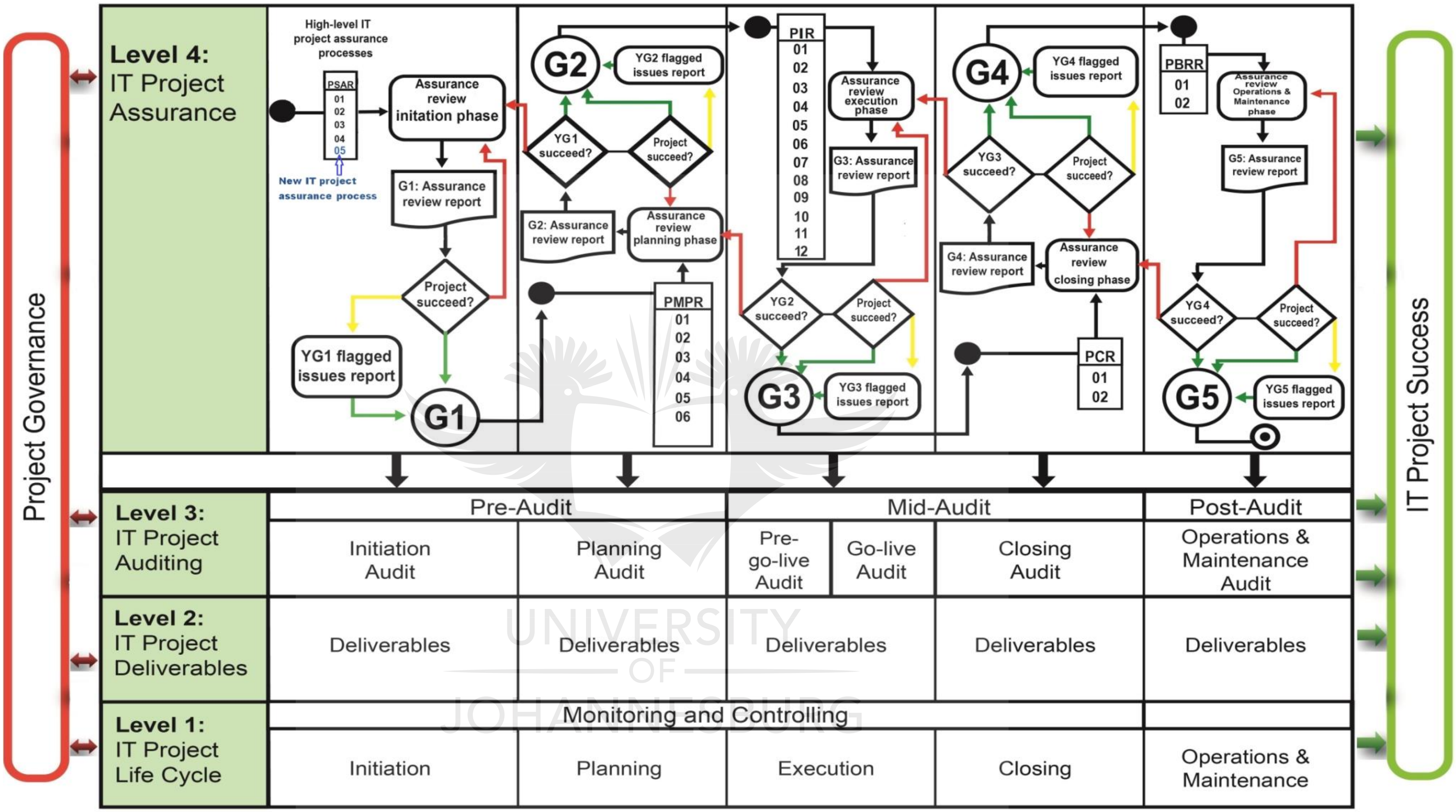

Figure 7-6 : Updated Conceptual Information Technology Project Management Assurance Framework

7.6 CONCLUSION

This chapter presented the qualitative data analysis and results. The focus group discussion was applied as a qualitative research method to validate the conceptual information technology project management assurance framework. The focus group discussion involved IT project managers from public and private sector organisations in South Africa. The digitally recorded focus group interview was transcribed and coded. Data were analysed by using the ATLAS.ti Version 7.0 software package, and the results were interpreted.

The data analysis results revealed that most of the emerged themes reflected the presented IT project assurance processes in the initiation, planning, execution, closing and operations and maintenance phases. However, in the initiation phase, a new IT project assurance process was introduced, namely 'Align the IT project with the existing programme'. This new IT project assurance process is applicable to the organisations with the existing programme. Based on the qualitative data analysis results, the original conceptual framework was updated.

Thus, the updated conceptual framework has value to both public and private sector organisations to assess if they are doing things right in order to deliver successful IT projects. The qualitative data analysis results are used to build a data collection instrument for the follow-up quantitative study.

The next chapter discusses the motivation for using quantitative research methods to validate the conceptual framework.

CHAPTER 8: MOTIVATION FOR USING THE QUANTITATIVE RESEARCH METHOD TO VALIDATE THE CONCEPTUAL FRAMEWORK

8.1 INTRODUCTION

In the previous chapter, the qualitative research method was used to validate the conceptual framework. The qualitative data was analysed and the findings were used to update the conceptual framework. The main goal of this chapter is to discuss the motivation for using the quantitative research method to validate the conceptual framework and is discussed in the next section.

8.2 MOTIVATION OF USING QUANTITATIVE METHOD

In the social sciences, high-quality data collection and findings are important to knowledge improvement (Axinn & Pearce, 2006). The high-quality findings can be achieved by using the mixed methods research approach which combines both qualitative and quantitative research methods. However, both qualitative and quantitative research methods have weaknesses and strengths (Axinn & Pearce, 2006). The mixed method approach uses the strengths of one method to counterbalance the weaknesses of the other method (Morgan, 2014). Changing the data collection method can provide information from one method that was not identified in another method. The advantage is that a biased coming from one particular method is not replicated in another method.

The triangulation of methods of research increases the trustworthiness and rigor of the findings which encompass truth value and applicability (Bryman, 2006; Webb et al., 1966).

Therefore, the motivation for using the quantitative method is discussed next.

8.2.1 Generalisation of the Findings

In quantitative research, generalisation is considered a major criterion for evaluating the quality of the findings (Kerlinger & Lee, 2000). To assess the generalisability of the qualitative findings, the quantitative research method allows generalising the findings to a larger target population (Krejcie & Morgan, 1970; Thomas, 2003). As the sample size increases, the margin of errors decreases for a particular level of confidence (Antonius, 2003; Fowler, 2014). Hence, the results of the qualitative data analysis are then tested in a larger sample in order to generalise the findings.

8.2.2 Research Paradigm

According to Guba (1990:20), “a paradigm is a patterned set of assumptions concerning reality (ontology), knowledge of that reality (epistemology), and the particular ways of knowing that reality (methodology)”. Bryman (2006) argues that the research method should be linked to the underlying research paradigm. In qualitative studies, qualitative research methods are linked to the paradigm of interpretivism, while quantitative research methods are linked to the paradigm of positivism as discussed in section 6.2.1. The positivism paradigm has been adopted for the quantitative research method as discussed in section 6.2.1. Morgan and Smircich (1980) argue that the positivist paradigm, which guides the quantitative mode of inquiry, is based on the assumption that social reality has an objective structure and that individuals are responding agents to this objective environment. The assumption behind the positivist rationale is that an objective physical and social world exists that can be measured and explained scientifically (Myers & Avison, 2002). Therefore, the quantitative research method is used to measure and explain the qualitative research findings.

8.2.3 Research Design

In this research study, the exploratory sequential mixed methods design has been adopted as discussed in section 6.4. Sequential mixed methods data collection strategies involve collecting data in an iterative process whereby the data collected in one phase contribute to the data collected in the next phase (Morgan, 2014; Tashakkori & Teddlie, 2010). The use of both the qualitative and the quantitative research methods provides a better understanding of the research problem than either approach alone (Bryman, 1988; Creswell, 2003).

Data are collected in quantitative research to (i) provide more data about results from the earlier phase of data collection and analysis, (ii) select a larger sample size which can best provide quantitative data and (iii) generalise findings by verifying and augmenting study results from members of a defined population (Creswell & Plano Clark, 2007).

The following section describes the unit of analysis and sampling technique to be used in the quantitative research study.

8.3 UNIT OF ANALYSIS AND SAMPLING TECHNIQUE USED IN THE QUANTITATIVE RESEARCH STUDY

8.3.1 Unit of Analysis

The objects of the study are referred to as 'units of analysis' (Runeson et al., 2012). The units of analysis used in this quantitative research study are IT project managers who are involved in the implementation and management of IT projects in their organisations.

8.3.2 Sampling Technique

A sampling technique is a process of selecting individuals, groups or organisations to be studied from an entire population (Fink, 2003; Kothari, 2004). The sampling technique used in this study is simple random sampling. Simple random sampling provides generalised results. Simple random sampling has been used to select IT project managers from a target population of project managers in both public and private sector organisations. Each IT project manager of the target population has an equal chance of being included in the sample.

8.3.3 Sample Size

The quantitative research method emphasises the importance of generalisability and reliability (Fink, 2003; Henn, Weinstein & Foard, 2006). The sample size has been determined by using the sample size table provided by Krejicie and Morgan (1970). Therefore, the present study uses the target population of 300 IT project managers who are involved in the implementation and management of IT projects in their organisations. The selected sample size is 169 IT project managers.

The following section discusses how the quantitative data have been collected as well as the data analysis framework.

8.4 DATA COLLECTION AND ANALYSIS FRAMEWORK

The previous section has discussed the sampling technique and determined the sample size of the present study. This section discusses in more detail how the quantitative data have been collected and analysed.

8.4.1 Data Collection Instrument

Quantitative data have been collected from project managers who have experience in managing IT projects in public and private sector organisations. Three structured survey questionnaires have been designed, using closed-ended questions illustrated in Appendix D. The first questionnaire regards successful IT projects. This questionnaire aims at answering the questions in relation to the most recent successful IT project that has been managed in the organisation. The second questionnaire pertains to challenged IT projects. This questionnaire aims at answering the questions in relation to the most recent challenged IT project that has been managed in the organisation. The third questionnaire concerns failed IT projects. This questionnaire aims at answering the questions in relation to the most recent failed IT projects that has been managed in the organisation.

8.4.2 Data Analysis Framework

This section presents the data analysis framework which is used in this quantitative research study shown in figure 8-1. The framework describes how the collected data are prepared for analysis and analysed, the interpretation of the results and a discussion of the findings.

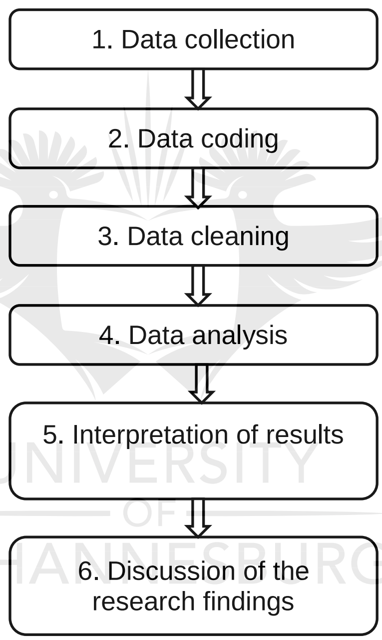

Figure 8-1 : Data analysis framework

8.4.2.1 Data collection

Data are collected using a structured questionnaire as discussed in section 8.4.1.

8.4.2.2 Data coding

Coding in the quantitative data involves quantifying the data into a numeric format (David & Sutton, 2004). In this quantitative research study, the collected data are assigned a numeric representation to the variables. A codebook is created to describe the meanings for each code used which makes the coded data understandable and manageable. The codebook acts as a guide for locating variables in the quantitative dataset as well as to load the data entry into the SPSS data file.

The survey responses, as coded data, are entered into the SPSS 24.0 software package to create a data file for analysis purposes. The case identification number is assigned to a set of responses for each record. The case identification number is used to access records in the data file and also to identify the responses during data cleaning more easily.

8.4.2.3 Data cleaning

Data cleaning is a crucial part of the data analysis, particularly when the quantitative data are collected (Bourque & Clark, 1992). Data cleaning involves removing errors and anomalies from the collected data so that it can be analysed efficiently.

8.4.2.4 Data analysis

The SPSS software package has been used to analyse the quantitative data in social sciences research (David & Sutton, 2004; Gray & Kinnear, 2012). In this study, the collected quantitative data are analysed using the SPSS 24.0 software package. The factor analysis is also conducted to determine possible correlations between the variables and factors (Pallant, 2013). The AMOS 24.0 is used to conduct confirmatory factor analysis to determine how the conceptual framework fits the data.

8.4.2.5 Interpretation of the results and discussion of the research findings

The interpretation of the results and a discussion on the research findings are discussed in more detail in the next chapter.

8.5 CONCLUSION

This chapter discussed the motivation for using the quantitative method to validate the conceptual framework. Both qualitative and quantitative research methods have weaknesses and strengths. Therefore, the mixed methods research approach uses the strengths of one method to offset the weaknesses of other method.

The motivation for using the qualitative method was discussed which included the generalisation of findings to a larger sample size, the underlying selected research paradigms, namely interpretivism and positivism, and the research approach, which used the exploratory sequential mixed methods research design.

The chapter also described the unit of analysis and sampling techniques, which were used in the quantitative research study. The quantitative data collection and analysis framework were discussed. The data analysis framework specifically covered data collection, data coding, data cleaning, data analysis, interpretation of results and a discussion of the research findings.

The next chapter will discuss the quantitative data analysis and its findings.

CHAPTER 9: DATA ANALYSIS AND FINDINGS

9.1 INTRODUCTION

The previous chapter discussed the motivation for using a quantitative research methodology to validate the conceptual framework. The goal of this chapter is to analyse data, and present results and findings. In order to achieve this goal, the first objective is to present the overall descriptive analysis of data collected from the questionnaires. The second objective is to present the specific descriptive analysis of data for successful, challenged and failed IT projects. The third objective is to determine whether there is a significant difference between the levels of quality implementation and importance levels of the IT project assurance processes across successful, challenged and failed IT projects. The next section discusses the data analysis framework.

9.2 DATA ANALYSIS FRAMEWORK

The data analysis framework was established in chapter 8 to facilitate the data analysis process. The following sections discuss in more details how the data have been collected and prepared for analysis.

9.2.1 Data Collection Instrument

Quantitative data was collected from project managers who had experience in managing IT projects in both public and private sector organisations. Three structured survey questionnaires were designed by using closed-ended questions as illustrated in Appendix D. The first questionnaire was concerned with successful IT projects. This questionnaire aimed at answering the questions in relation to the most recent successful IT project that had been managed in the organisation. The second questionnaire related to challenged IT projects. This questionnaire aimed at answering the questions in relation to the most recent challenged IT project that had been managed in the organisation. The third questionnaire was about failed IT projects. This questionnaire aimed at answering the questions in relation to the most recent failed IT project that had been managed in the organisation. These questionnaires were distributed using emails of the established database of the IT project managers. A total of 121 responses were received from IT project managers in both public and private sector organisations.

9.2.2 Data Coding

The coding process started by quantifying data that were converted to a numeric format. The data was then assigned numeric representations to nominal and ordinal variables. The code categories were established beforehand, namely they were generated inductively. A codebook was created (as illustrated in Appendix E) and used as a guide during the data coding process. A value was assigned to each variable attribute (response). The 121 responses were captured in a Microsoft Excel spreadsheet. The input values in the Excel sheet were validated to ensure that mistakes were not made. The spreadsheet was then imported into the SPSS 24.0 software package to create an SPSS data file for further analysis.

9.2.3 Data Cleaning

The case identification number was used to access records in the SPSS data file, and also to make identifying the responses during data cleaning easier. The 121 responses were not all completed and seven cases with missing values were identified. The questionnaires with missing values were emailed back to the respondents to complete the questionnaires. The seven returned questionnaires were captured in the Microsoft Excel spreadsheet and then imported into the SPSS data file. The following section discusses the data analysis.

9.3 DATA ANALYSIS

Data were analysed using the SPSS 24.0 software package. The following sections discuss the data analysis in more detail.

9.3.1 Reliability Test and Validity

The internal consistency has been used to measure questionnaire reliability. The Cronbach‘s alpha coefficient was used to test the reliability of the questionnaires (Cortina, 1993; Cronbach, 1951).

Table 9-1: Cronbach’s alpha reliability test result

IT project phase	No. of items	Cronbach’s alpha coefficient
Initiation phase	10	0.781
Planning phase	12	0.847
Execution phase	24	0.902
Closing phase	8	0.801
Operations and maintenance phase	10	0.869

According to Field (2009), the Cronbach’s alpha coefficient of 0.7 and above is accepted as representing good reliability. The Cronbach’s alpha coefficient was calculated for the project assurance processes in each phase of the IT project. The results in table 9-1 indicate that there is internal consistency and they represent good reliability. This result means that there is a consistency of measured items, the data collection instrument is reliable and data can be trusted.

Validity refers to the appropriateness of the questionnaire to measure what it intends to measure. The various validity tests, which are used to assess a survey questionnaire, are face, content, criterion and construct validity. This research used the content validity test. Content validity assesses the degree to which individual variables represent the construct being measured.

The content validity test was conducted before administering the questionnaire. Content validity was achieved as follows:

(i) Experts from the University of Johannesburg's statistics consultancy services and the faculty of the Department of Applied Information Systems reviewed the survey instrument to ensure that the appropriate data were collected. The experts provided useful reviews which were incorporated into the final survey instrument.

(ii) A pre-test of the survey instrument was carried out. Twelve questionnaires were pilot pre-tested using IT project managers from financial and public sector organisations. The pre-test aimed to test the content validity and reliability of the questionnaires to produce the same results under the same conditions. The results of the pilot pre-test were reviewed and few changes were incorporated into the final questionnaires.

9.3.2 Section A: Profile of The Respondents

A profile of respondents shows that 68% of the respondents were male and 32% were female. Among them, a total of 58 respondents were from the public sector, 61 from the private sector and two from another sector. Table 9-2 shows that private sector organisations have more successful IT projects than public sector organisations.

Table 9-2: Organisation type against project type

Organisation type	Project type			Total
	Successful project	Challenged project	Failed project	
Public sector	18	23	17	**58**
Private sector	28	21	12	**61**
Other	1	0	1	**2**
Total	**47**	**44**	**30**	**121**

The respondents from the private sector (52%) are more certified in project management than those from the public sector (21%). The project managers with more than five years of experience in managing IT projects deliver more successful IT projects than those with less than five years of experience.

The following sections discuss the descriptive data analysis for each phase of the IT project.

9.3.3 Section B: Initiation Phase

9.3.3.1 Overall descriptive data analysis

This section discusses the overall descriptive data analysis for the IT project assurance processes within the initiation phase. The questionnaires required respondents to select the most recent IT project managed in their organisation which had been either successful, challenged or failed. The questionnaires used two types of scales, i.e. a quality scale and an importance scale as illustrated in Appendix D. The respondents used the quality scale to rank how well the IT project assurance processes had been implemented. The respondents also used the importance scale to rank how important the IT project assurance processes were in achieving a successful IT project outcome.

The level of quality implementation (in percentage) of each IT project assurance process was calculated to determine how well each IT project assurance process had been implemented when a particular project outcome was achieved. From figure 9-1, the level of quality implementation of each IT project assurance process was calculated as the sum of the score of "Excellent" responses and the score of "Good" responses.

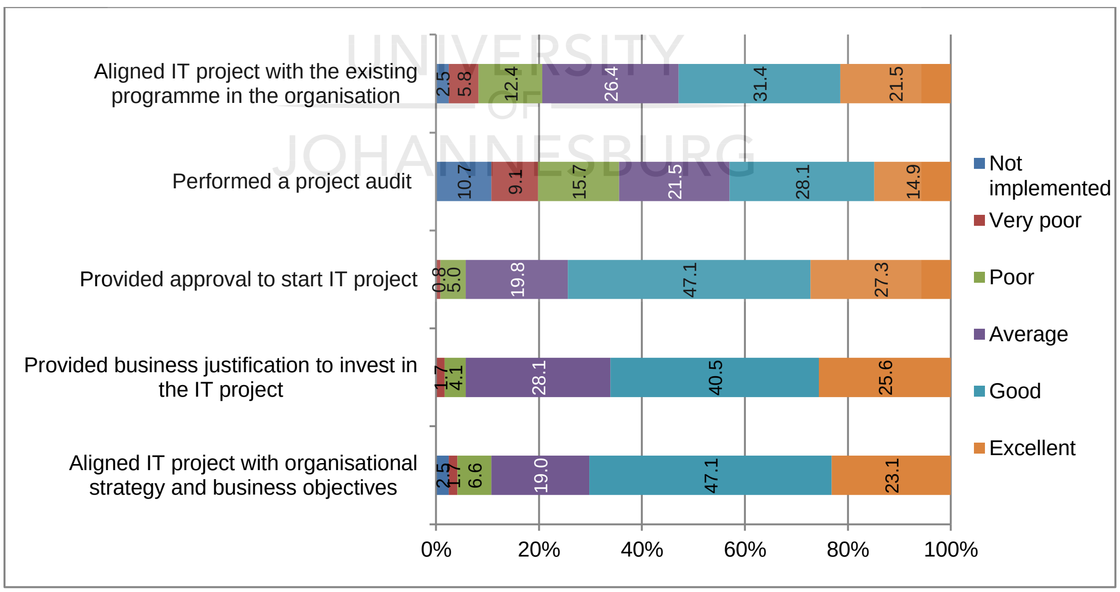

Figure 9-1 : Level of quality implementation of the IT project assurance processes

Data were analysed to examine how well the IT project assurance processes had been implemented. Figure 9-1 shows that most of the IT project assurance processes have been implemented. However, more than half (57%) of the respondents indicated that a project audit had not been performed in their most recent managed IT projects. This result indicated that some of the respondents did not see the importance of auditing IT projects in the initiation phase.

From Figure 9-2, the importance of each IT project assurance process was calculated as the sum of the score of “Critically important” responses and the score of “Important” responses. The data were also analysed to determine how important the IT project assurance processes were in achieving a successful IT project outcome.

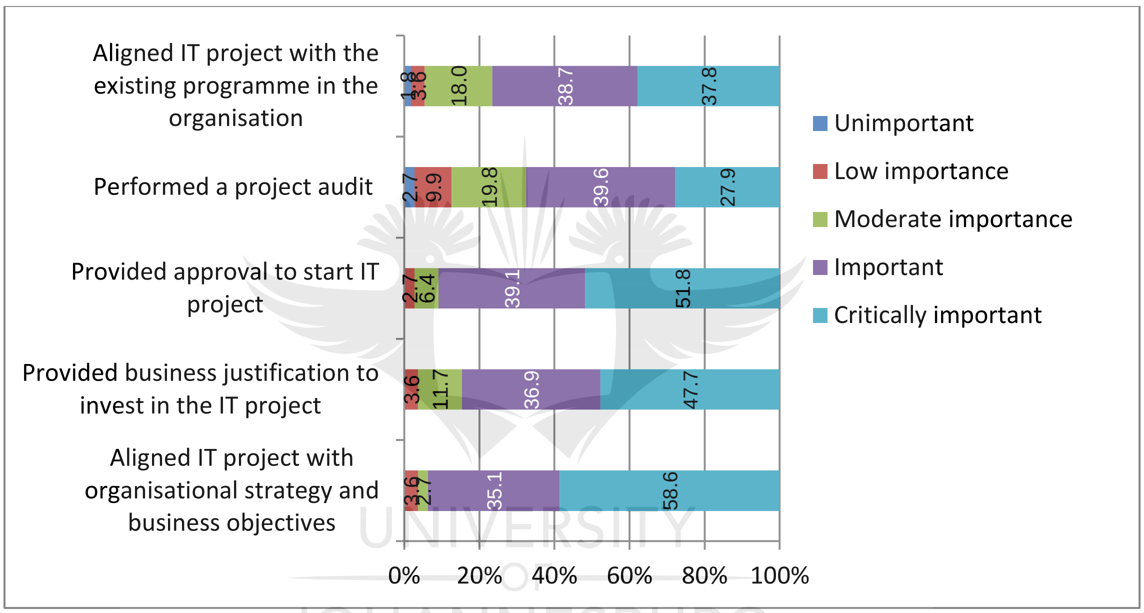

Figure 9-2 : Importance level of the IT project assurance processes

Figure 9-2 shows that most of the IT project assurance processes are important to achieve a successful IT project outcome. Aligning the IT project with the organisational strategy and business objectives has the highest score (93.7%) of all the project assurance processes. This entails that IT projects contribute to achieving an organisation’s strategic objectives. Thus, an IT project should be aligned with the organisational strategy and business objectives. 67.5% of respondents indicated that performing a project audit is important in achieving a successful IT project. This result is in contrast with the result of the level of quality implementation where 57% of the respondents did not see the importance of performing a project audit as illustrated in figure 9-1.

The weighted percentage was calculated to determine the most implemented and important IT project assurance processes in achieving a successful IT project outcome. The weighted percentage of each IT project assurance process was calculated as:

$$Weighted\ \% = \frac{Weighted\ score\ of\ each\ IT\ project\ assurance\ process}{(Number\ of\ respondents\ \times Maximum\ weight\ of\ scale)} \times 100$$

Table 9-3: Ranking of weighted percentage of IT project assurance processes by level of quality implementation

#	IT project assurance processes in initiation phase	Level of quality implementation (%)	Importance level (%)
1	Provided approval to start IT project	83	73
2	Provided business justification to invest in the IT project	81	72
3	Aligned IT project with organisational strategy and business objectives	79	75
4	Performed a project audit	65	63
5	Aligned IT project with the existing programme in the organisation	61	67

Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. Table 9-3 shows that the provided approval to start an IT project has the highest weighted percentage in the level of quality implementation of all the IT project assurance processes. In the importance level, an aligned IT project with organisational strategy and business objectives has the highest weighted percentage of all the project assurance processes. This result indicates that the IT project assurance process with the highest weighted percentage in the level of quality implementation does not score higher in the importance level. The result also shows that IT project assurance processes with the highest weighted percentage in the importance level do not score higher in the level of quality implementation.

9.3.3.2 Specific descriptive analysis for successful, challenged and failed IT projects

This section discusses the specific descriptive analysis for successful, challenged and failed IT projects on how the IT project assurance processes are implemented and important in achieving a successful IT project outcome. The weighted percentage of each IT project assurance process is calculated as illustrated in figure 9-3.

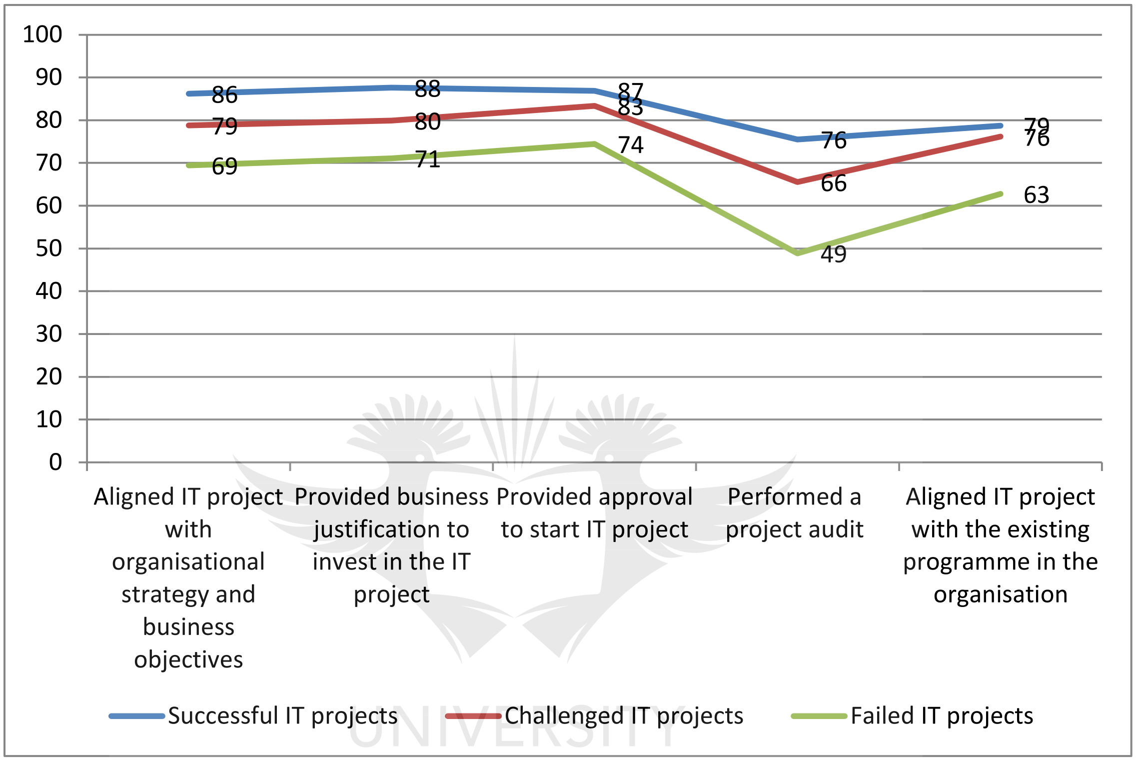

Figure 9-3 : Weighted percentage for level of quality implementation of the IT project assurance processes

Data were analysed for the successful, challenged and failed IT projects (i) to examine how well the IT project assurance processes had been implemented when a particular project outcome was achieved in the organisations and (ii) to determine how important the IT project assurance processes were in achieving a successful project outcome in the initiation phase. The results of the data analysis for each IT project assurance process are discussed next.

a) Align the IT project with the organisational strategy and business objectives

Figure 9-3 shows that most of the successful and challenged IT projects have been aligned with the organisational strategy and business objectives. Thirty-one percent (31%) of the respondents indicated that failed IT projects had not aligned the IT project with the organisational strategy and business objectives. As illustrated in figure 9-4, most of the respondents perceived that it was important to align the IT project with the organisational strategy and business objectives. The result means that an IT project should be aligned with the organisational strategy and business objectives to contribute to achieving the organisation's strategy and business objectives.

b) Provide business justification to invest in the IT project

Figure 9-3 shows that most of the successful and challenged IT projects have been provided business justification to invest in the IT project. Twenty-nine percent (29%) of the respondents indicated that failed IT projects were not provided business justification to invest in the IT project. As illustrated in figure 9-4, most of the respondents perceived that it was important to provide justification to invest in the IT project. The results mean that organisations should provide business justification to obtain top management's approval to invest in the IT project.

c) Provide approval to start the IT project

Figure 9-3 shows that most of the successful, challenged and failed IT projects were provided approval to start the projects. As illustrated in figure 9-4, most of the respondents indicated that it was important to provide approval to start an IT project. The results mean that the project governance should provide approval to allocate resources to start implementing IT project activities.

d) Perform a project audit

Figure 9-3 shows that most of the successful IT projects have been audited when a project outcome is achieved. However, 34% of the respondents indicated that challenged IT projects had not been audited. More than half (51%) of the failed IT projects were not audited in the initiation phase. As illustrated in figure 9-4, most of the respondents perceived that it was important to perform a project audit. The results mean that auditing an IT project increases the chances of achieving a successful IT project outcome.

e) Align the IT project with the existing programme in the organisation

Figure 9-3 shows that most of the successful and challenged IT projects had aligned with the existing programme in the organisation. Thirty-seven percent (37%) of respondents indicated that the failed IT projects had not been aligned with the existing programme in the organisation. As illustrated in figure 9-4, most of the respondents perceived that it was important to align IT projects with existing programmes in their organisations. The results imply that the IT project can be aligned with the existing programme in the organisation to contribute to achieving programme benefits and the organisation's strategic objectives.

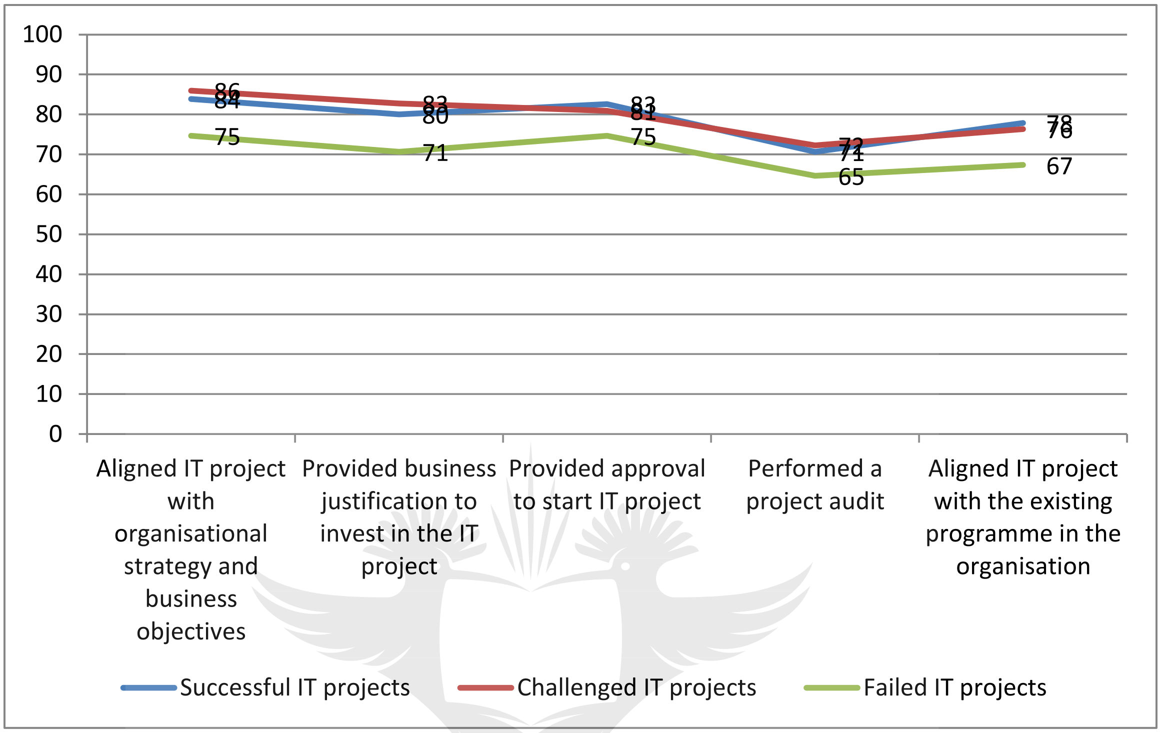

Figure 9-4 : Weighted percentage for importance level of the IT project assurance processes

Figure 9-3 shows that the results of successful, challenged and failed IT projects are not clustered together. This entails that there are large differences from the weighted percentage for the level of quality implementation between successful, challenged and failed IT projects. Figure 9-4 shows that the results of successful and challenged IT projects are clustered together. This entails that there are distinct differences from the weighted percentage for the importance level between successful and challenged IT projects.

Based on the above overall and specific data analysis results, most of the IT project assurance processes have been implemented better in successful IT projects than in challenged and failed IT projects. In the initiation phase, all the IT project assurance processes are perceived as importance processes in achieving a successful IT project outcome.

9.3.4 Section C: Planning Phase

9.3.4.1 Overall descriptive data analysis

The level of quality implementation (in percentage) of each IT project assurance process in the planning phase was calculated to determine how well the IT project assurance process had been implemented. The level of quality implementation of each IT project assurance was calculated as illustrated in figure 9-5.

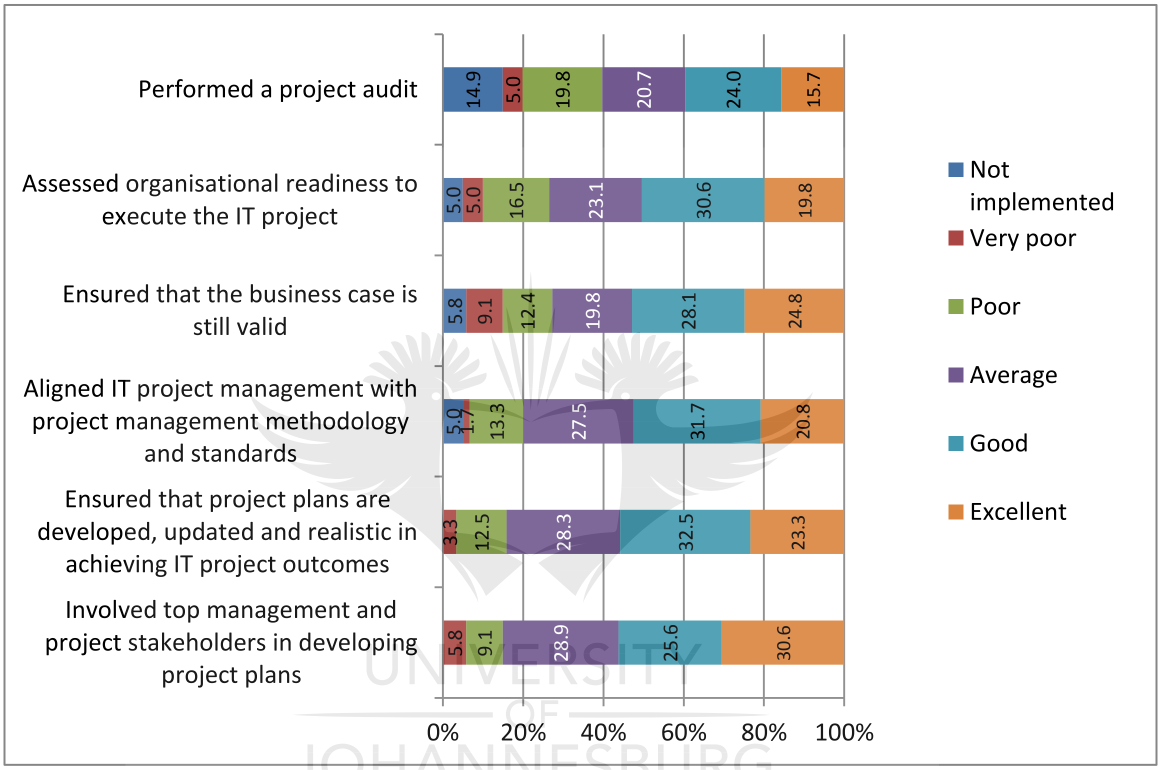

Figure 9-5 : Level of quality implementation of the IT project assurance processes

Figure 9-5 shows that most of the IT project assurance processes in the planning phase have not been implemented well in their recent managed IT projects. However, 60.3% of the respondents indicated that a project audit had not been performed. This result indicated that most of the respondents did not see the importance of auditing IT projects in the planning phase.

The importance of each IT project assurance process was calculated as illustrated in figure 9-6. The data were analysed to determine how important the IT project assurance processes were in achieving a successful IT project outcome.

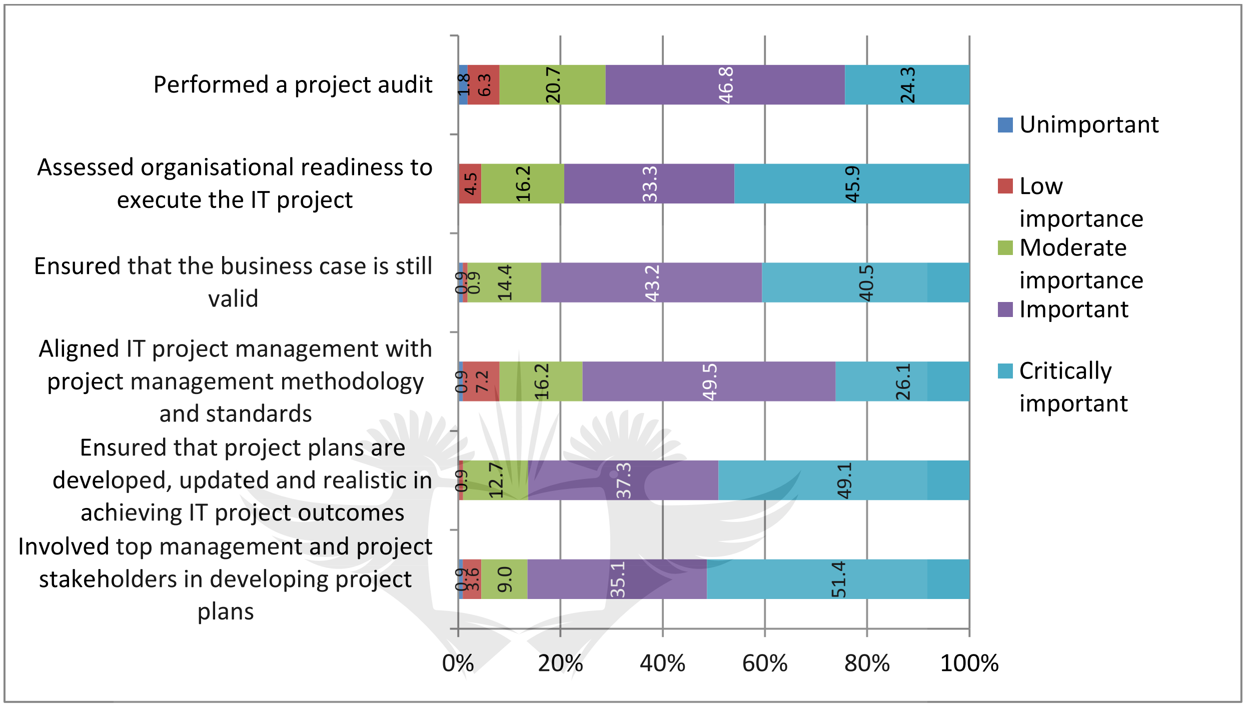

Figure 9-6 : Importance level of the IT project assurance processes

Figure 9-6 shows that most of the IT project assurance processes are important to achieve a successful IT project outcome. Involved top management and project stakeholders in developing project plans has the highest score (86.5%) of all the project assurance processes. This implies that the involvement of top management and project stakeholders in the planning phase ensures close monitoring and controlling of the IT project progress in order to achieve a successful project outcome. Seventy-one point one percent (71.1%) of respondents indicated that performing a project audit was important in achieving a successful IT project. This result is in contrast with the result of the level of quality implementation where 60.3% of respondents did not see the importance of performing a project audit as illustrated in figure 9-5.

The weighted percentage was calculated to determine the most implemented and important IT project assurance processes in achieving a successful IT project outcome.

Table 9-4: Ranking of weighted percentage of IT project assurance processes by the level of quality implementation

#	IT project assurance processes in planning phase	Level of quality implementation (%)	Importance level (%)
1	Involved top management and project stakeholders in developing project plans	78	79
2	Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	76	79
3	Aligned IT project management with project management methodology and standards	73	72
4	Ensured that the business case is still valid	72	77
5	Assessed organisational readiness to execute the IT project	71	77
6	Performed a project audit	63	71

Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. Table 9-4 shows that involved top management and project stakeholders in developing project plans has the highest weighted percentage in both the level of quality implementation and the importance level of all the IT project assurance processes. Ensuring that project plans are developed, updated and realistic in achieving IT project outcomes has also the highest weighted percentage in the importance level. This result indicates that not all the IT project assurance processes with the highest weighted percentage in the level of quality implementation have the highest score in the importance level. The result also shows that IT project assurance processes with the highest weighted percentage in the importance level do not score higher in the level of quality implementation.

9.3.4.2 Specific descriptive analysis for successful, challenged and failed IT projects

This section discusses the specific descriptive analysis for successful, challenged and failed IT projects on how the IT project assurance processes are implemented and how important they are in achieving a successful IT project outcome. The weighted percentage of each IT project assurance process has been calculated as illustrated in figure 9-7.

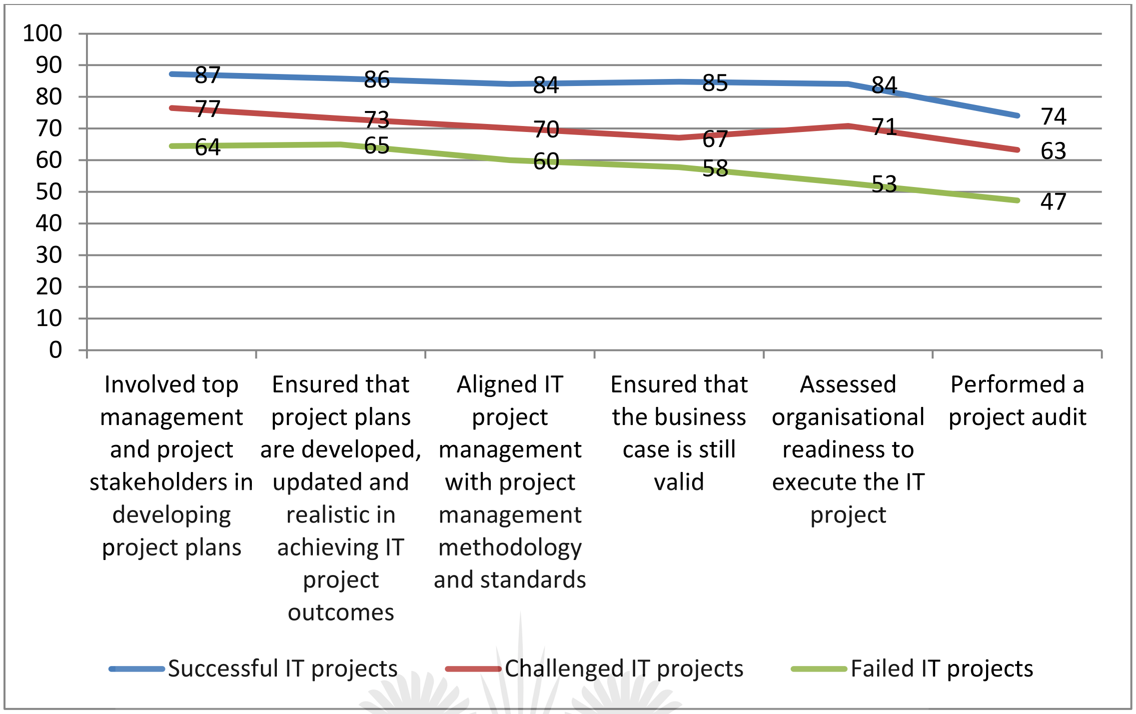

Figure 9-7 : Weighted percentage for level of quality implementation of the IT project assurance processes

Data were analysed for the successful, challenged and failed IT projects (i) to examine how well the IT project assurance processes had been implemented when a particular project outcome was achieved in the organisation and (ii) to determine how important the IT project assurance processes were in achieving a successful project outcome in the planning phase. The results of the data analysis for each IT project assurance process are discussed below.

a) Involve top management and project stakeholders in developing the project plans

Figure 9-7 shows that most of the successful and challenged IT projects involved top management and project stakeholders in developing the project plans. Thirty-six percent (36%) of the respondents indicated that failed IT projects had not involved top management and project stakeholders in developing the project plans. As illustrated in figure 9-8, most of the respondents agreed that it was important to involve top management and project stakeholders in developing the project plans. The results mean that top management and project stakeholders should be engaged throughout the project life cycle to monitor and control the progress of the implementation of the planned project activities.

b) Ensure that project plans are developed, updated and realistic in achieving IT project outcomes

Figure 9-7 shows that most of the successful and challenged IT projects have been ensuring that the project plans are developed, updated and realistic in achieving the IT project outcomes. Thirty-five percent (35%) of the respondents indicated that failed IT projects were not ensured that the project plans had been developed, updated and realistic in achieving IT project outcomes. As illustrated in figure 9-8, most of the respondents agreed that it was important to ensure that the project plans be developed, updated and realistic in achieving IT project outcomes. The results indicate that top management should make sure the project plans are realistic because they are used to implement IT project activities in order to achieve the project goals and objectives.

c) Align the IT project management with the project management methodology and standards

Figure 9-7 shows that most of the successful IT projects had been aligned with the project management methodology and standards. However, 30% of the respondents indicated that challenged IT projects had not been aligned with the project management methodology and standards. Forty percent (40%) of the respondents indicated that failed IT projects had not been aligned with the project management methodology and standards. As illustrated in figure 9-8, most of the respondents indicated that it was important to align the IT project with the project management methodology and standards. The results mean that the project management methodology and standards can be used as a roadmap to implement IT project activities to achieve a successful project outcome.

d) Ensure that the business case is still valid

Figure 9-7 shows that most of the successful IT projects were ensuring that the business case is still valid. However, 33% of the respondents indicated that the business case had not been validated in the challenged IT projects. Forty-two percent (42%) of the respondents also indicated that the business case had not been validated in the failed IT projects. As illustrated in figure 9-8, most of the respondents indicated that it was important to ensure that the business case was still valid. The results mean that, during the planning phase, the business case needs to be evaluated to check if it is unaffected by internal and external events or changes.

e) Assess organisational readiness to execute the IT project

Figure 9-7 shows that most of the successful and challenged IT projects have been assessing organisational readiness to execute the IT project. Forty-seven percent (47%) of respondents indicated that the failed IT projects had not assessed organisational readiness to execute the IT project. As illustrated in figure 9-8, most of the respondents agreed that it was important to assess organisational readiness to execute the IT project. The results mean that organisational readiness should be assessed to determine whether the organisation is ready to start executing IT project activities as stipulated in the project management plans.

f) Perform a project audit

Figure 9-7 shows that most of the successful IT projects have been audited within the planning phase. However, 39% of the respondents indicated that challenged IT projects had not been audited. Forty-three percent (43%) of the failed IT projects were not audited. As illustrated in figure 9-8, most of the respondents agreed that it was important to perform a project audit during the planning phase. The results mean that auditing IT projects increases the chances of achieving a successful IT project outcome.

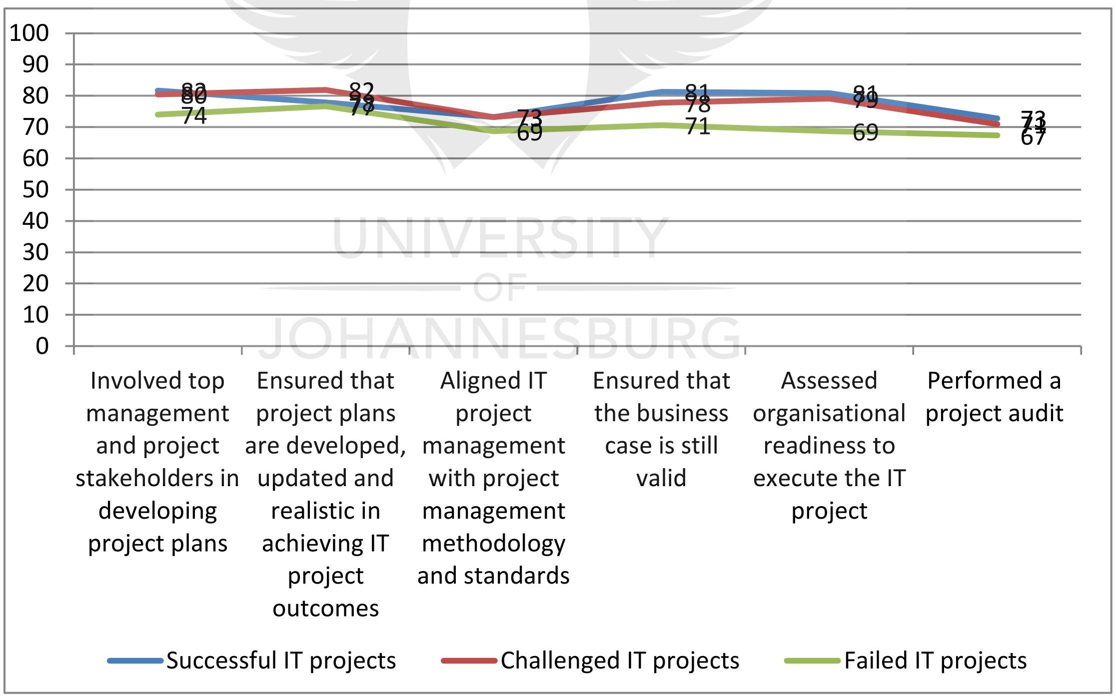

Figure 9-8 : Weighted percentage for importance level of the project assurance processes

Based on the above overall and specific data analysis results, most of the IT project assurance processes have been implemented well in successful IT projects, while in challenged and failed IT projects it is not the case. In the planning phase, all the IT project assurance processes are perceived as importance processes in achieving a successful IT project outcome.

9.3.5 Section D: Execution Phase

9.3.5.1 Overall descriptive data analysis

The level of quality implementation of each IT project assurance process in the execution phase was calculated (as illustrated in figure 9-9) to determine how well each IT project assurance process had been implemented.

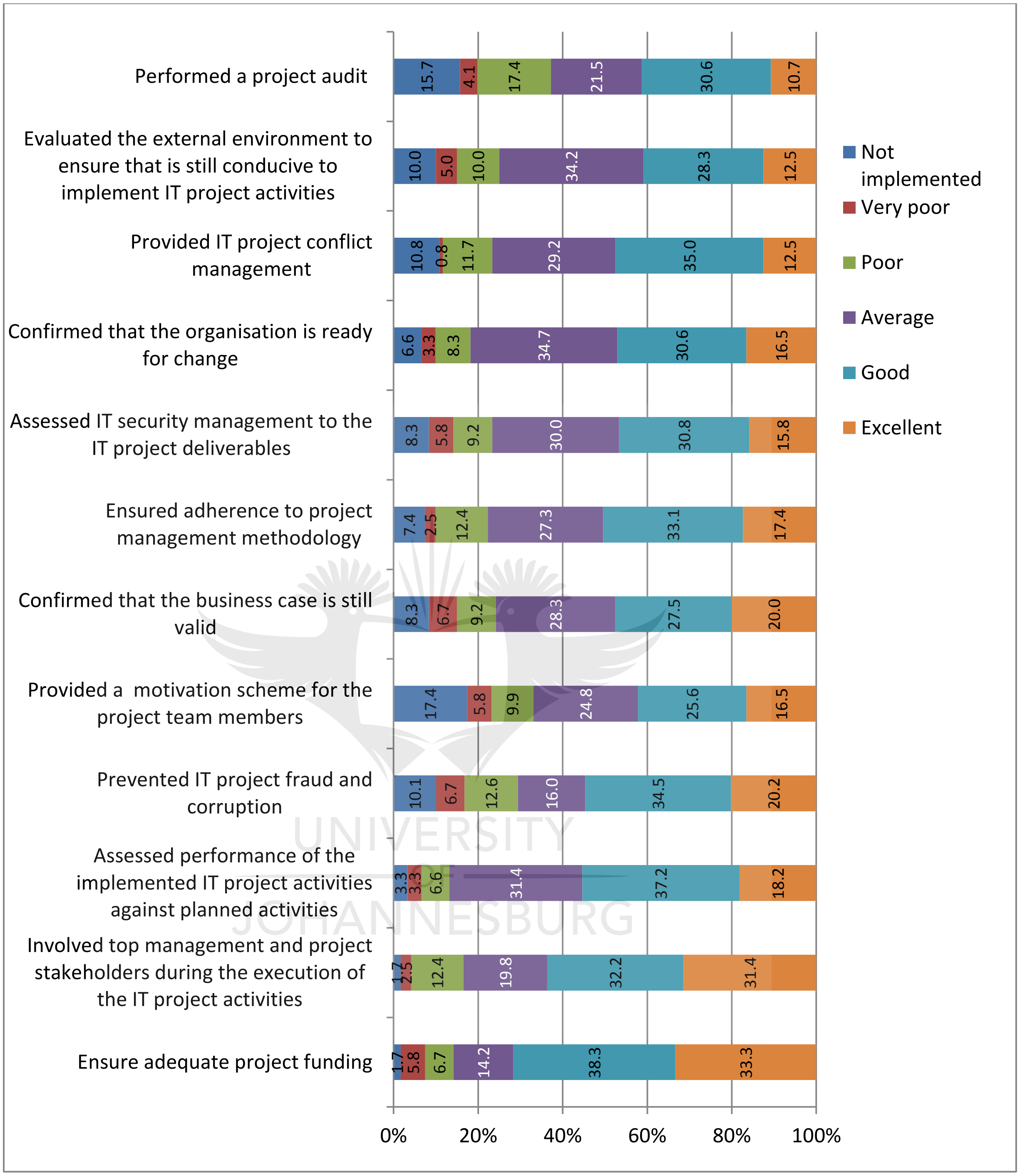

Figure 9-9 : Level of quality implementation of the IT project assurance processes

Figure 9-9 shows that most of the project assurance processes in the execution phase have not been implemented well. However, 59.2% of the respondents do not understand the importance of evaluating the external environment to ensure that is still conducive to implement IT project activities. Fifty-eight point seven percent (58.7%) of the respondents indicated that s project audit had not been performed. This result indicates that most of the respondents do not see the importance of auditing IT projects in the execution phase. The importance of each IT project assurance process was calculated as illustrated in figure 9-10. The data were analysed to determine how important the IT project assurance processes were in achieving a successful IT project outcome.

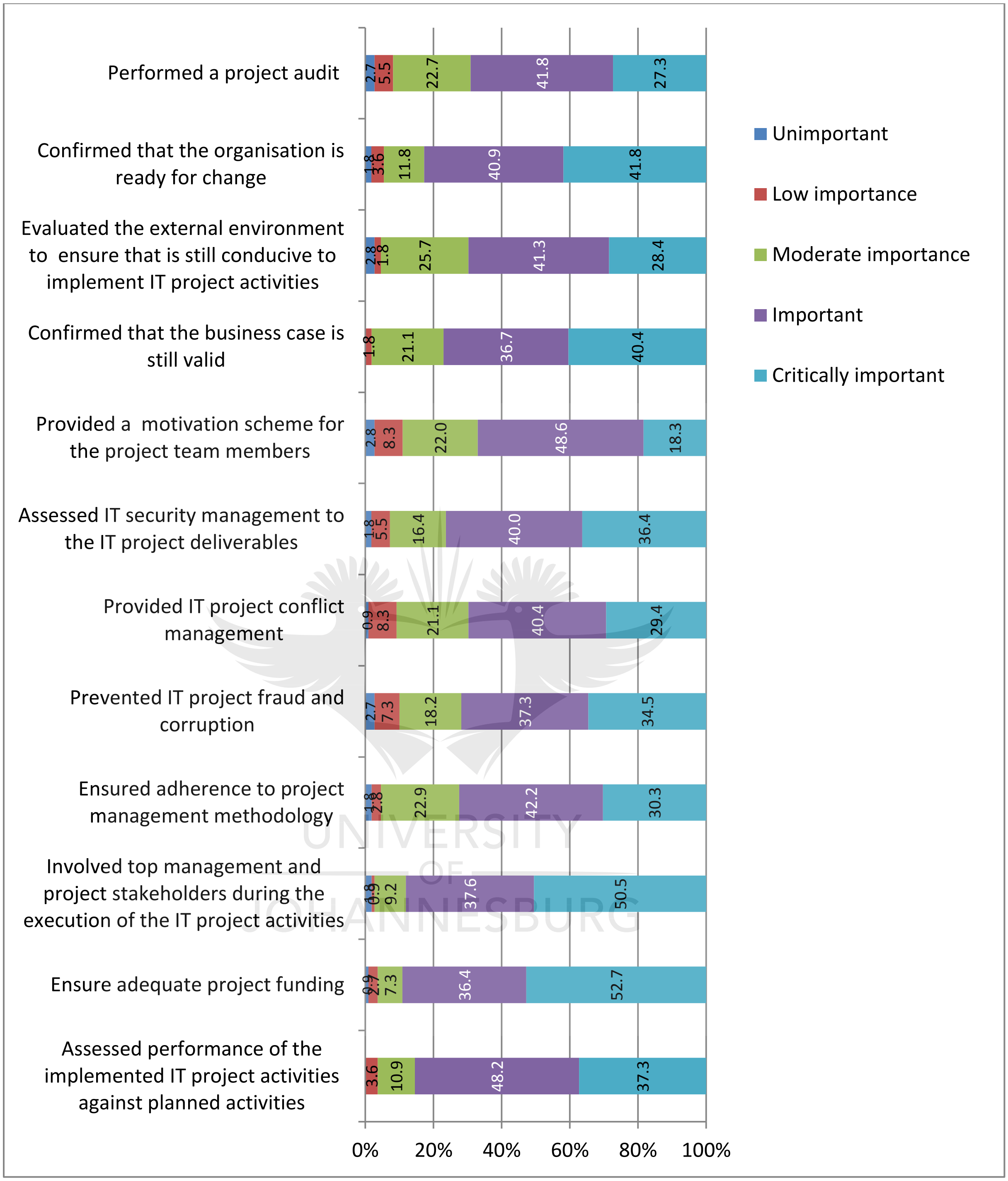

Figure 9-10 : Importance level of the IT project assurance processes

Figure 9-10 shows that most of the IT project assurance processes are important to achieve a successful IT project outcome. Ensuring adequate project funding has the highest score (89.1%)

of all the IT project assurance processes. This implies that organisations need to ensure that project funds are available throughout the project life cycle to implement IT project activities. Sixty-nine point one percent (69.1%) of respondents have indicated that performing a project audit is important in achieving a successful IT project. This result is in contrast with the result of the level of quality implementation where 58.7% of respondents do not understand the importance of performing a project audit as illustrated in figure 9-9.

The weighted percentage was calculated to determine the most implemented and important IT project assurance processes in achieving a successful IT project outcome.

Table 9-5: Ranking of weighted percentage of IT project assurance processes by the level of quality implementation

#	IT project assurance processes in execution phase	Level of quality implementation (%)	Importance level (%)
1	Ensured adequate project funding	80	80
2	Involved top management and project stakeholders during the execution of the IT project activities	79	78
3	Assessed performance of the implemented IT project activities against planned activities in the project management plans	75	76
4	Ensured adherence to project management methodology	71	71
5	Confirmed that the organisation is ready for change	71	76
6	Prevented IT project fraud and corruption	69	72
7	Assessed IT security management to the IT project activities	69	73
8	Confirmed that business case is still valid	69	75
9	Provided IT project conflict management	68	70
10	Evaluated the external environment to ensure that is still conducive to implement IT project activities	67	70
11	Provided a motivation scheme for the project team members	64	67
12	Performed a project audit	63	70

Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. Table 9-5 shows that ensured adequate project funding has the highest weighted percentage in both the level of quality implementation and importance level rest of all the IT project assurance processes. This result indicates that not all the IT project assurance processes with the highest weighted percentage in the level of quality implementation have the highest score in the importance level. The result also implies that IT project assurance processes with the highest weighted percentage in the importance level do not score higher in the level of quality implementation.

9.3.5.2 Specific descriptive analysis for successful, challenged and failed IT projects

This section discusses the specific descriptive analysis for successful, challenged and failed IT projects on how the IT project assurance processes are implemented and important in achieving a successful IT project outcome.

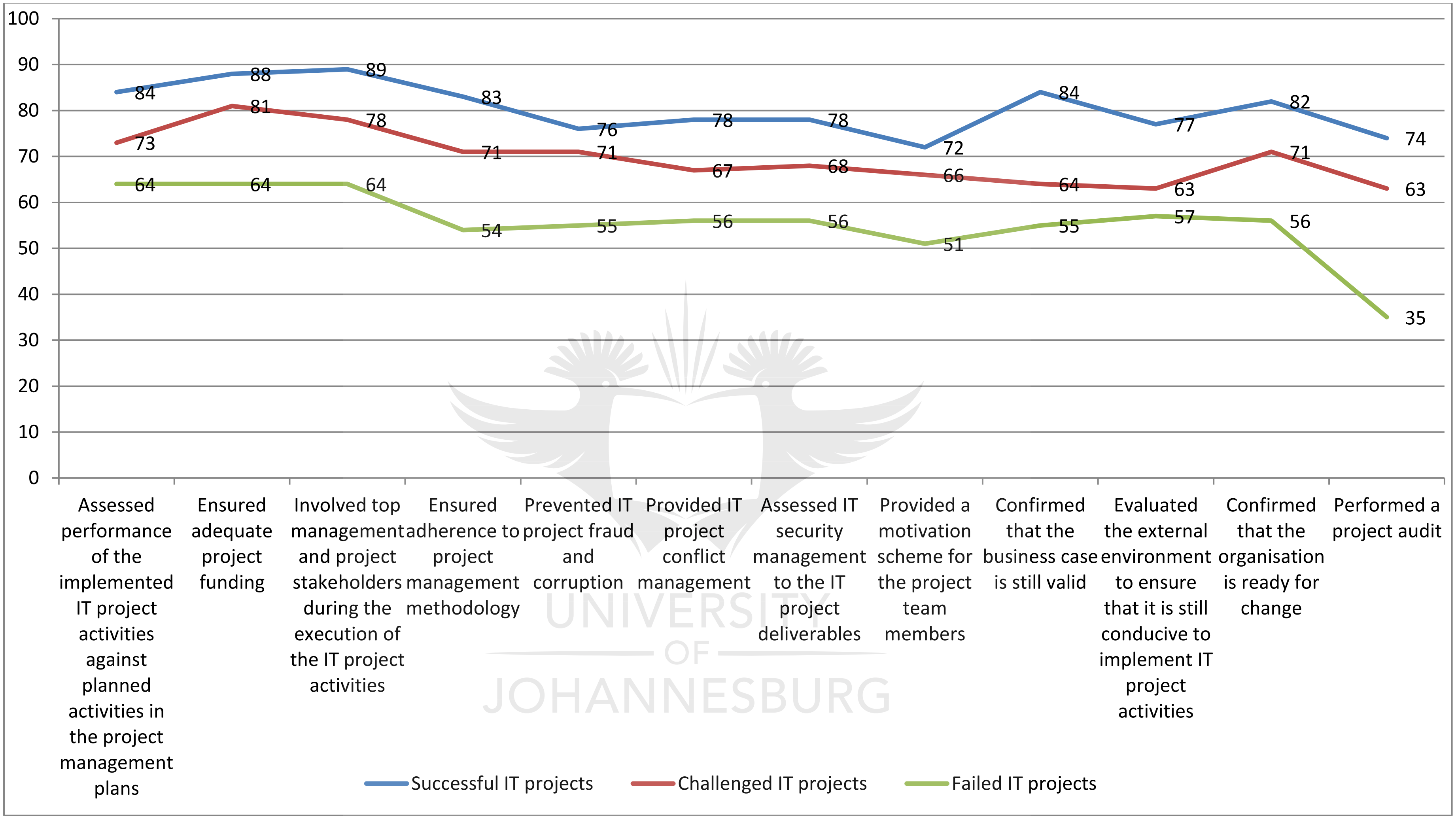

Figure 9-11 : Weighted percentage for level of quality implementation of the IT project assurance processes

The weighted percentage of each IT project assurance process was calculated as illustrated in Figure 9-11. Data were then analysed for the successful, challenged and failed IT projects to (i) examine how well the IT project assurance processes had been implemented when a particular project outcome had been achieved in the organisation and (ii) to determine how important the IT project assurance processes were in achieving a successful project outcome in the planning phase. The results of data analysis for each IT project assurance processes are discussed below.

a) Assessed performance of the implemented IT project activities against planned activities in the project management plans

Figure 9-11 shows that most of the successful and challenged IT projects have been assessing the performance of the implemented IT project activities against planned activities in the project management plans. Thirty-six percent (36%) of the respondents indicated that failed IT projects had not assessed the performance of the implemented IT project activities against planned activities in the project management plans. As illustrated in figure 9-12, most of the respondents agreed that it was important to assess the performance of the implemented IT project activities against planned activities in the project management plans. The results mean that the performance of the implemented IT project activities should be measured against the planned IT project activities in order to monitor the progress of the IT project in the execution phase.

b) Ensured adequate project funding

Figure 9-11 shows that most of the successful and challenged IT projects have been ensuring adequate project funding. Thirty-six percent (36%) of the respondents indicated that failed IT projects had not ensured adequate project funding. As illustrated in figure 9-12, most of the respondents agreed that it was important to ensure adequate project funding. The results mean that organisations should have sufficient funds to execute IT project activities.

c) Involved top management and project stakeholders during the execution of the IT project activities

Figure 9-11 shows that most of the successful and challenged IT projects have been involving top management and project stakeholders during the execution of the IT project activities. Thirty-six percent (36%) of the respondents indicated that failed IT projects had not involved top management and project stakeholders during the execution of the IT project activities. As illustrated in figure 9-12, most of the respondents agreed that it was important to involve top management and project stakeholders during the execution of the IT project activities. The results mean that top management and project stakeholders should be engaged throughout the project life cycle to monitor and control the progress of the implementation of the IT project activities.

d) Ensured adherence to project management methodology

Figure 9-11 shows that most of the successful IT projects have been ensuring adherence to the project management methodology. Twenty-nine percent (29%) of the respondents indicated that challenged IT projects had not ensured adherence to the project management methodology. Forty-six percent (46%) of the respondents indicated that failed IT projects had not ensured adherence to the project management methodology. As illustrated in figure 9-12, most of the respondents agreed that it was important to ensure adherence to the project management methodology. The results mean that, during the implementation of IT project activities, project managers should ensure adhering to the project management methodology to increase the chances of delivering a successful project outcome.

e) Prevented IT project fraud and corruption

Figure 9-11 shows that most of the successful IT projects have been preventing IT project fraud and corruption. However, 29% of the respondents indicated that challenged IT projects had not prevented IT project fraud and corruption. Forty-five percent (45%) of the respondents indicated that failed IT projects had not prevented IT project fraud and corruption. As illustrated in figure 9-12, most of the respondents indicated that it was important to prevent IT project fraud and corruption. The results mean that project anti-corruption awareness should be provided to project governance, project managers and project team members. Awareness training can help prevent IT project fraud and corruption during the implementation of the IT project activities.

f) Provided IT project conflict management

Figure 9-11 shows that most of the successful IT projects have been providing IT project conflict management. However, 33% of the respondents indicated that conflict management had not been provided to challenged IT projects. Forty-four percent (44%) of the respondents indicated that conflict management had not been provided to failed IT projects. As illustrated in figure 9-12, most of the respondents indicated that it was important to provide conflict management to IT projects. The results mean that conflict during the implementation of IT project activities is inevitable. Project managers should ensure resolution of conflicts throughout the IT project life cycle so that they not delay the project to achieve its objectives.

g) Assessed IT security management to the IT project deliverables

Figure 9-11 shows that most of the successful IT projects have been assessing IT security management to the IT project deliverables. Thirty-two percent (32%) of respondents indicated that the challenged IT projects had not been assessed IT security management to the IT project deliverables. Forty-four percent (44%) of respondents indicated that the failed IT projects had not been assessed IT security management to the IT project deliverables. As illustrated in figure 9-12, most of the respondents agreed that it was important to assess IT security management to the IT project deliverables. The results mean that before the project product goes live, it should have sufficient security controls to ensure confidentiality, integrity and availability of information.

h) Provided a motivation scheme for the project team members

Figure 9-11 shows that most of the successful IT projects have been providing a motivation scheme for the project team members. Thirty-four percent (34%) of respondents indicated that the challenged IT projects had not been provided with a motivation scheme for the project team members. Forty-nine percent (49%) of respondents indicated that the failed IT projects had not been provided with a motivation scheme to the project team members. As illustrated in figure 9-12, most of the respondents agreed that it was important to provide a motivation scheme to the project team members. The results mean that motivating project team members affects the productivity throughout the project life cycle. Project team members with great motivation positively increase the chances of project success.

i) Confirmed that the business case is still valid

Figure 9-11 shows that most of the successful IT projects have been confirming that the business case is still valid. However, 36% of the respondents indicated that the business case had not been validated in the challenged IT projects. Forty-five percent (45%) of the respondents indicated that business case had not been validated in the failed IT projects. As illustrated in figure 9-12, most of the respondents agreed that it was important to confirm that the business case be still valid. The results imply that during the implementation of the IT project activities, the business case should be evaluated to check if it is unaffected by internal and external events or changes.

j) Evaluated the external environment to ensure that is still conducive to implement IT project activities

Figure 9-11 shows that most of the successful IT projects have been evaluating the external environment to ensure that it was still conducive to implement IT project activities. However, 37% of the respondents indicated that the external environment had not been evaluated in the challenged IT projects to ensure that it was still conducive to implement IT project activities. Forty-three percent (43%) of the respondents indicated that the external environment had not been evaluated in the failed IT projects to ensure that it was still conducive to implement IT project activities. As illustrated in figure 9-12, most of the respondents agreed that it was important to evaluate the external environment to ensure that it is still conducive to implement IT project activities. The results mean that assessing the external environment during the implementation of IT project activities is important in delivering a successful project outcome.

k) Confirmed that the organisation is ready for change

Figure 9-11 shows that most of the successful and challenged IT projects have been confirming that the organisation is ready for change. However, 44% of the respondents indicated that with failed IT projects it had not been confirmed that the organisation was ready for change. As illustrated in figure 9-12, most of the respondents agreed that it was important to confirm that the organisation was ready for change. The results mean that organisational readiness for change confirms that organisations are ready to implement the business change.

l) Performed a project audit

Figure 9-11 shows that most of the successful IT projects have been audited within the execution phase. However, 37% of the respondents indicated that challenged IT projects had not been audited. Sixty-five percent (65%) of the respondents indicated that the failed IT projects had not been audited. As illustrated in figure 9-12, most of the respondents agreed that it was important to perform a project audit during the execution phase. The results mean that auditing IT projects increases the chances of achieving a successful IT project outcome.

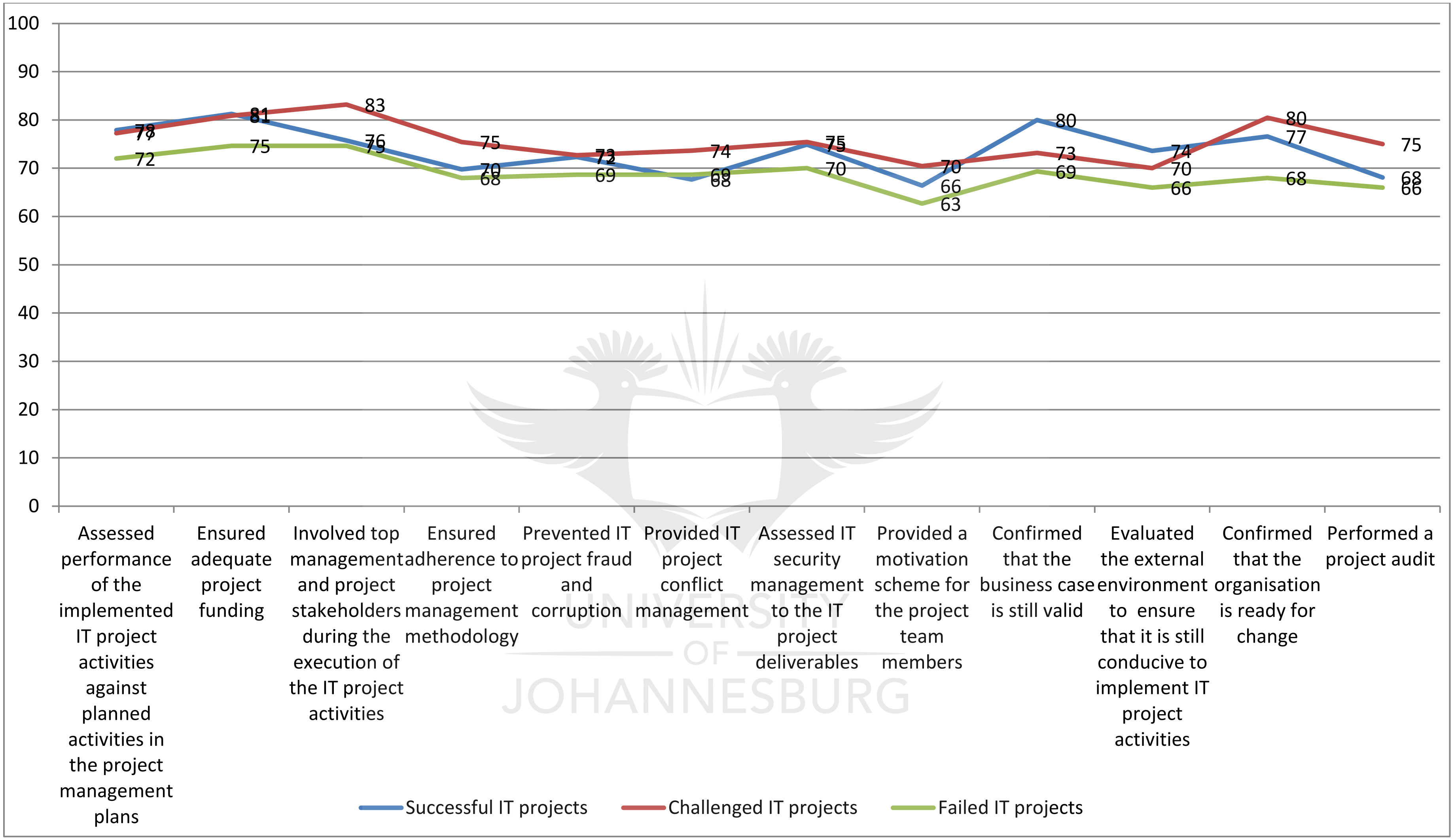

Figure 9-12 : Weighted percentage for importance level of the IT project assurance processes

Based on the above overall and specific data analysis results, most of the IT project assurance processes were implemented better in successful IT projects than in challenged and failed IT projects. In the execution phase, all the IT project assurance processes are perceived as important processes in achieving a successful IT project outcome.

9.3.6 Section E: Closing Phase

9.3.5.3 Overall descriptive data analysis

The level of quality implementation (in percentage) of each IT project assurance process in the closing phase was calculated (as illustrated in figure 9-13) to determine how well each IT project assurance process had been implemented.

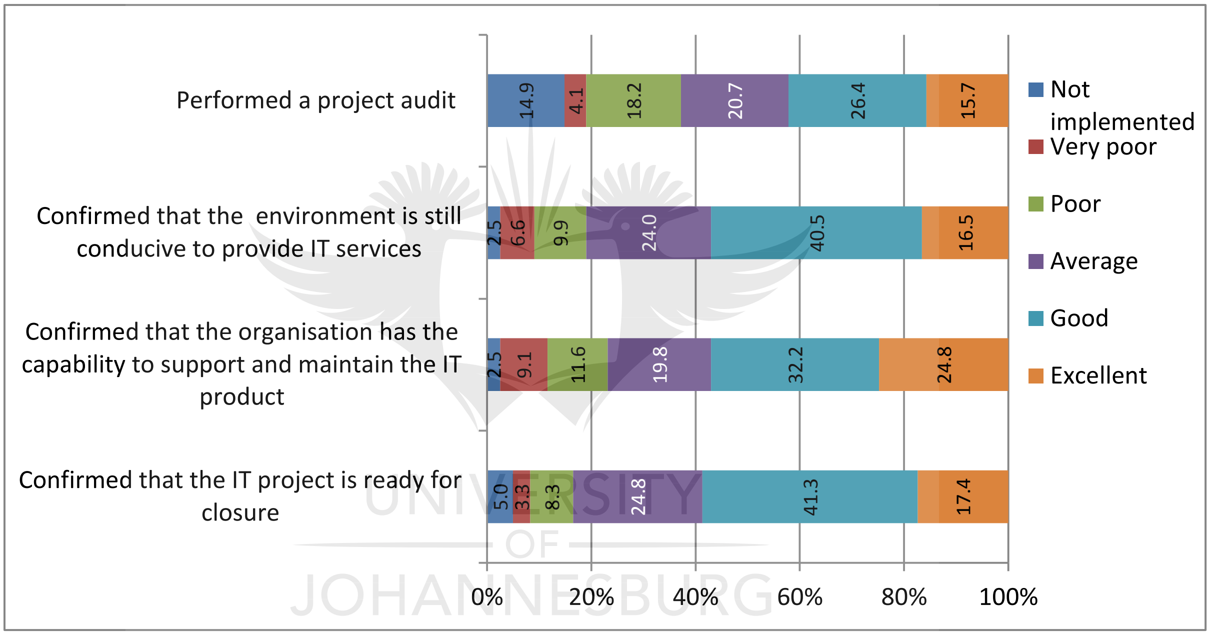

Figure 9-13 : Level of quality implementation of the IT project assurance processes

Figure 9-13 shows that most of the IT project assurance processes in the closing phase have not been implemented well. Forty-one point three percent (41.3%) of the respondents indicated that organisations had not confirmed that the IT project was ready for closure, while 57.9% of the respondents indicated that a project audit had not been performed. This result indicates that most of the respondents do not understand the importance of auditing IT projects in the closing phase.

The importance of each IT project assurance process was calculated as illustrated in figure 9-14. The data were analysed to determine how important the IT project assurance processes were in achieving a successful IT project outcome.

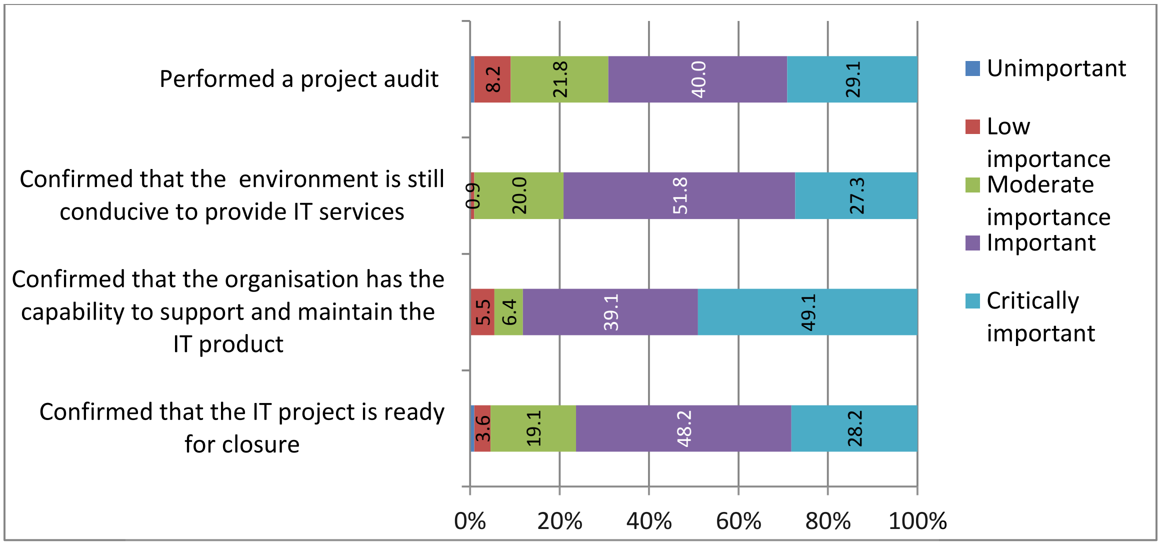

Figure 9-14 : Importance level of project assurance processes

Figure 9-14 shows that most of the IT project assurance processes are important to achieve a successful IT project outcome. Sixty-nine point one percent (69.1%) of respondents indicated that a project audit was important in achieving a successful IT project. This result is in contrast with the result of the level of quality implementation where 57.9% of respondents did not understand the importance of performing a project audit as illustrated in figure 9-13.

The weighted percentage was calculated to determine the most implemented and important IT project assurance processes in achieving a successful IT project outcome.

Table 9-6: Ranking of weighted percentage of IT project assurance processes by the level of quality implementation

#	IT project assurance processes in closing phase	Level of quality implementation (%)	Importance level (%)
1	Confirmed that the organisation has the capability to support and maintain the IT product	65	79
2	Confirmed that the IT project is ready for closure	63	73
3	Confirmed that the environment is still conducive to provide IT services	62	74
4	Performed a project audit	55	71

Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. Table 9-6 confirmed that the organisation had the capability to support and maintain the IT product, and had the highest weighted percentage in both the level of quality implementation and importance level of all the IT project assurance processes. This result indicates that not all the IT project assurance processes with the highest weighted percentage in the level of quality implementation have the highest score in the importance level. The result also implies that IT project assurance processes with the highest weighted percentage in the importance level do not score higher in the level of quality implementation.

9.3.5.4 Specific descriptive analysis for successful, challenged and failed IT projects

This section discusses the specific descriptive analysis for successful, challenged and failed IT projects on how the IT project assurance processes are implemented and their importance in achieving a successful IT project outcome. The weighted percentage of each IT project assurance process has been calculated as illustrated in Figure 9-15.

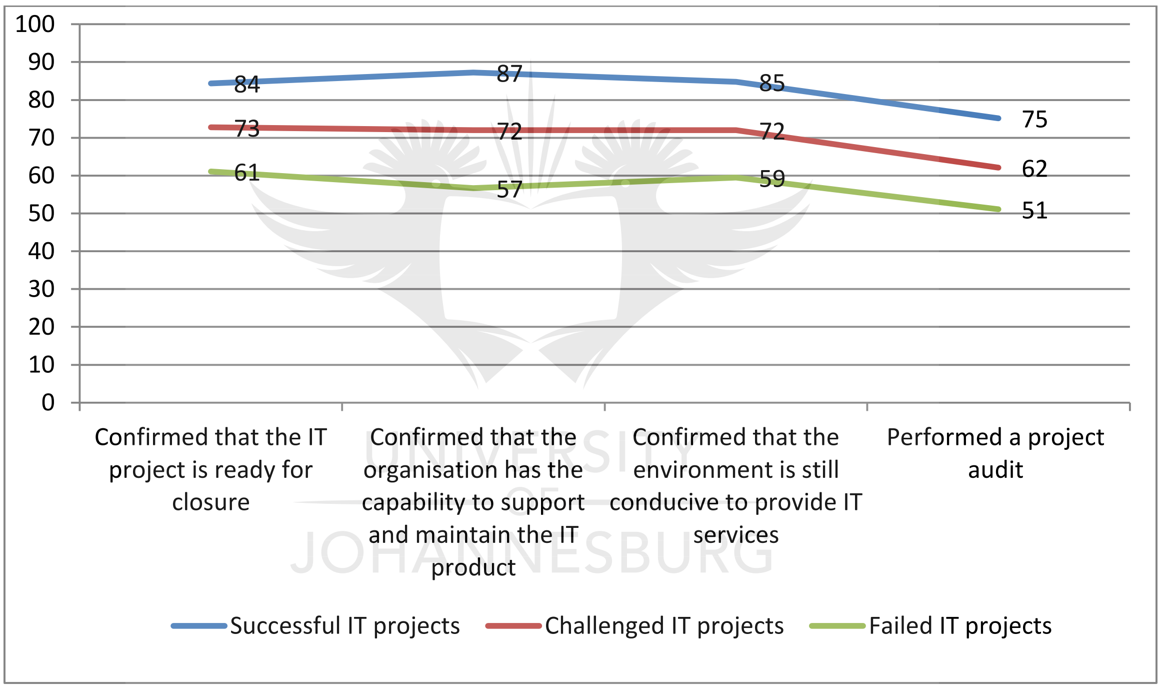

Figure 9-15 : Weighted percentage for level of quality implementation of the IT project assurance processes

Data were analysed for the successful, challenged and failed IT projects (i) to examine how well the IT project assurance processes had been implemented when a particular project outcome was achieved in the organisation and (ii) to determine how important the IT project assurance processes were in achieving a successful project outcome in the closing phase. The results of data analysis for IT each project assurance processes are discussed below.

a) Confirmed that the IT project is ready for closure

Figure 9-15 shows that most of the successful and challenged IT projects have been confirming that the IT project is ready for closure. Thirty-nine percent (39%) of the respondents indicated that failed IT projects were not confirmed that they were ready for closure. As illustrated in figure 9-16, most of the respondents agreed that it was important to confirm that the IT projects were ready for closure. The results mean that project readiness for closure confirms that IT project objectives have been met, lessons learnt from the project have been documented and the post-implementation plan has been prepared.

b) Confirmed that the organisation has the capability to support and maintain the IT product

Figure 9-15 shows that most of the successful and challenged IT projects have been confirming that the organisation has the capability to support and maintain the IT product. Forty-three percent (43%) of the respondents indicated that failed IT projects had not been confirmed that the organisation had the capability to support and maintain the IT product. As illustrated in figure 9-16, most of the respondents agreed that it was important to confirm that the organisation had the capability to support and maintain the IT product. The results mean that organisations should ensure that they have the internal capability to support and maintain the IT product.

c) Confirmed that the environment is still conducive to provide IT services

Figure 9-15 shows that most of the successful and challenged IT projects have been confirming that the environment is still conducive to provide IT services. Forty-one percent (41%) of the respondents indicated that failed IT projects had not been confirmed that the environment was still conducive to provide IT services. As illustrated in figure 9-16, most of the respondents agreed that it was important to confirm that the environment was still conducive to provide IT services. The results mean that organisations should assess the internal and external environments to confirm that they are still conducive to provide IT services.

d) Performed a project audit

Figure 9-15 shows that most of the successful, challenged and failed IT projects have not been audited well. However, 49% of the respondents indicated that failed IT projects had not been audited. As illustrated in figure 9-16, most of the respondents agreed that it was important to perform a project audit during the closing phase. The results mean that auditing the IT project increases the chances of achieving a successful IT project outcome.

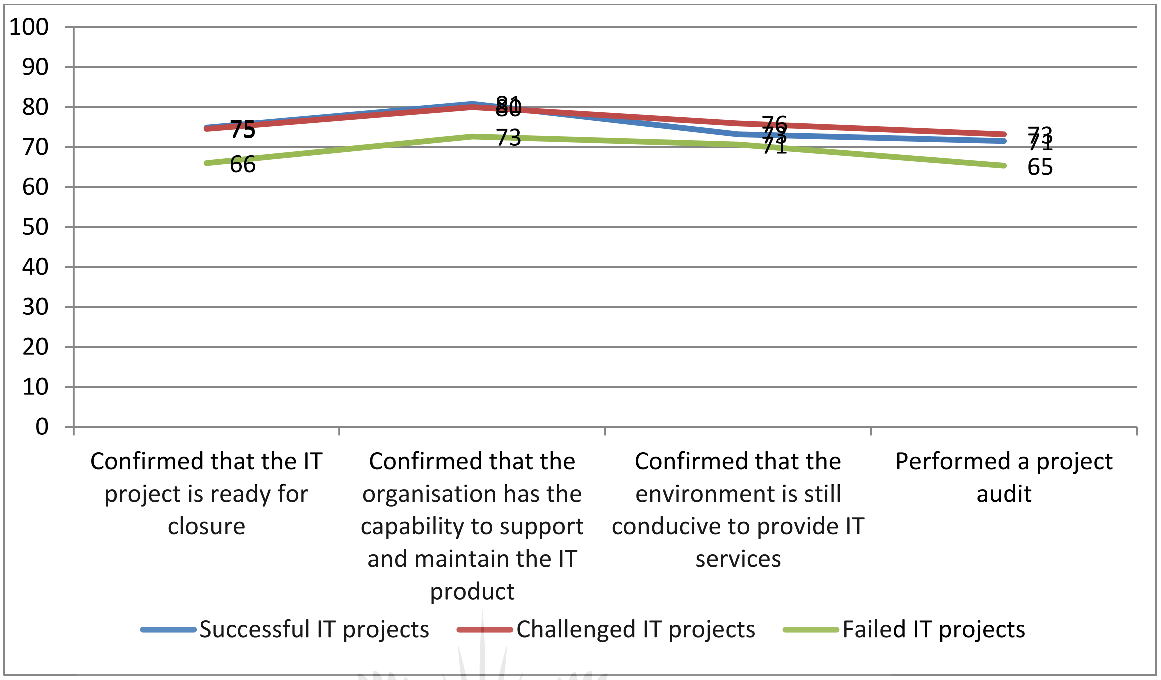

Figure 9-16 : Weighted percentage for importance level of the IT project assurance processes

Based on the above overall and specific data analysis results, most of the IT project assurance processes were implemented better in successful IT projects than in challenged and failed IT projects. In the closing phase, all the IT project assurance processes were perceived to be important processes in achieving a successful IT project outcome.

9.3.6 Section F: Operations and Maintenance Phase

9.3.6.1 Overall descriptive data analysis

The level of quality implementation (in percentage) of each IT project assurance process in the operations and maintenance phase was calculated (as illustrated in figure 9-17) to determine how well each IT project assurance process had been implemented.

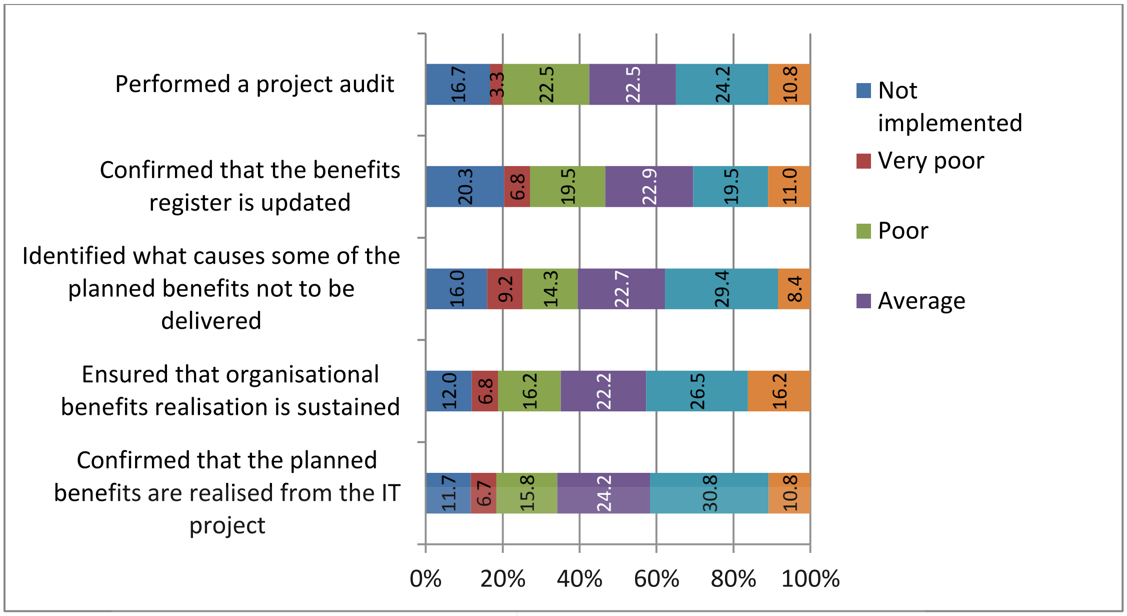

Figure 9-17 : Level of quality implementation of the IT project assurance processes

Figure 9-17 shows that most of the IT project assurance processes in the operations and maintenance phase have not been implemented well. Fifty-eight point four percent (58.4%) of the respondents indicated that organisations did not confirm that the planned benefits had been realised from the IT project. Sixty-nine point five percent (69.5%) of the respondents indicated that organisations did not update the project benefits register while 65% of the respondents indicated that a project audit had not been performed. This result indicates that most of the respondents do not understand the importance of auditing IT projects. The overall results reveal that all the IT project assurance processes in the operations and maintenance phase have not been implemented well.

The importance of each IT project assurance process was calculated as illustrated in figure 9-18. The data were analysed to determine how important the IT project assurance processes were in achieving a successful IT project outcome.

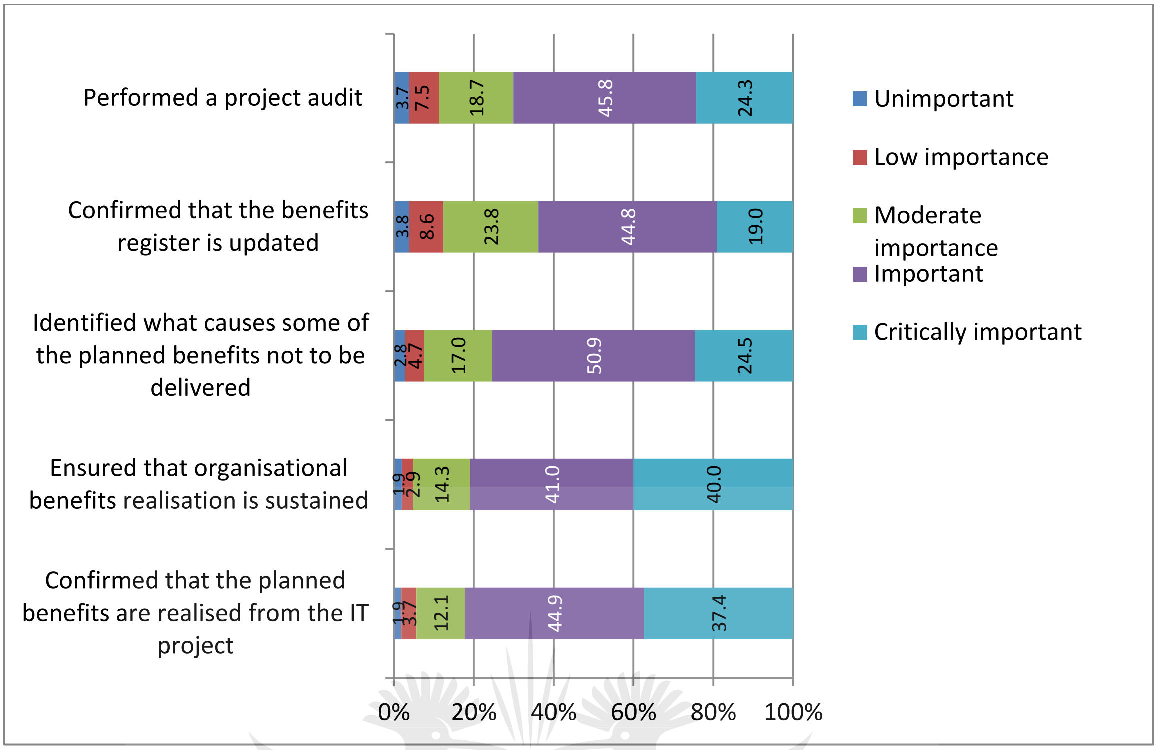

Figure 9-18 : Importance level of the IT project assurance processes

Figure 9-18 shows that most of the IT project assurance processes are important to achieve a successful IT project outcome. Seventy point one percent (70.1%) of respondents indicated that a project audit was important in achieving a successful IT project. This result is in contrast with the result of level of quality implementation where 65% of respondents did not understand the importance of performing a project audit as illustrated in figure 9-17.

The weighted percentage was calculated to determine the most implemented and important IT project assurance processes in achieving a successful IT project outcome.

Table 9-7: Ranking of weighted percentage of IT project assurance processes by the level of quality implementation

#	IT project assurance processes in operations and maintenance phase	Level of quality implementation (%)	Importance level (%)
1	Confirmed that the planned benefits are realised from the IT project	64	73
2	Ensured that organisational benefits realisation is sustained	63	72
3	Performed a project audit	61	67

4	Identified what causes some of the planned benefits not to be delivered	60	68
5	Confirmed that the benefits register is updated	56	64

Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. Table 9-7 confirmed that the planned benefits realised from the IT project had the highest weighted percentage in both the level of quality implementation and the importance level of all the IT project assurance processes. This result indicates that not all the IT project assurance processes with the highest weighted percentage in the level of quality implementation had the highest score in the importance level. The result also shows that the IT project assurance processes with the highest weighted percentage in the importance level did not score higher in the level of quality implementation.

9.3.6.2 Specific descriptive analysis for successful, challenged and failed IT projects

This section discusses the specific descriptive analysis for successful, challenged and failed IT projects on how the IT project assurance processes are implemented and how important they are in achieving a successful IT project outcome. The weighted percentage of each IT project assurance process has been calculated as illustrated in figure 9-19.

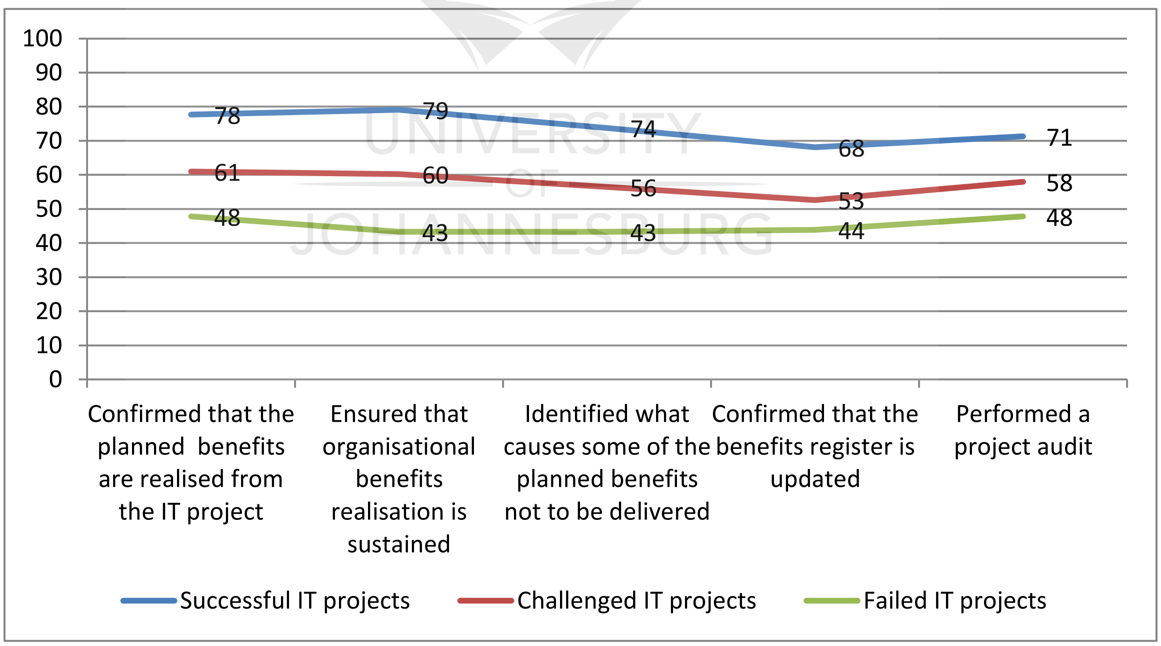

Figure 9-19 : Weighted percentage for level of quality implementation of the IT project assurance processes

Data were analysed for the successful, challenged and failed IT projects (i) to examine how well the IT project assurance processes had been implemented when a particular project outcome was achieved in the organisations, and (ii) to determine how important the IT project assurance processes were in achieving a successful project outcome in the operations and maintenance phase. The results of data analysis for each IT project assurance processes are discussed next.

a) Confirmed that the planned benefits are realised from the IT project

Figure 9-19 shows that most of the successful IT projects have been confirming that the planned benefits are realised from the IT project. Thirty-nine percent (39%) of the respondents indicated that challenged IT projects had not confirmed that the planned benefits were realised from the IT project. Fifty-two percent (52%) of the respondents indicated that failed IT projects had not been confirmed that planned benefits were realised from the IT project. As illustrated in figure 9-20, most of the respondents agreed that it was important to confirm that planned benefits had been realised from the IT project. The results mean that organisations should ensure that benefits arising from the effective use of the IT product are realised.

b) Ensured that organisational benefits realisation is sustained

Figure 9-19 shows that most of the successful IT projects have been ensuring that organisational benefits realisation is sustained. Forty percent (40%) of the respondents indicated that challenged IT projects had not ensured that organisational benefits realisation was sustained while 57% of the respondents indicated that failed IT projects had not ensured that organisational benefits realisation is sustained. As illustrated in figure 9-20, most of the respondents agreed that it was important to ensure that organisational benefits realisation was sustained. The results mean that organisations should ensure benefits are sustained throughout the change initiative. Thus, benefits monitoring and controlling are significant in the organisation.

c) Identified what causes some of the planned benefits not to be delivered

Figure 9-19 shows that most of the successful IT projects have been identifying what causes some of the planned benefits not to be delivered. Forty-four percent (44%) of the respondents indicated that challenged IT projects had not identified the causes of the planned benefits not to be delivered while 57% of the respondents indicated that failed IT projects had not identified the causes of the planned benefits not to be delivered. As illustrated in figure 9-20, most of the respondents agreed that it was important to identify what caused some of the planned benefits not to be delivered. The results mean that organisations should identify what causes the project benefits not to be delivered and establish a benefits action plan.

d) Confirmed that the benefits register is updated

Figure 9-19 shows that most of the successful IT projects updated the benefits register. Forty-seven percent (47%) of the respondents indicated that challenged IT projects had not updated the benefits register while 56% of the respondents indicated that failed IT projects had not updated the benefits register. As illustrated in figure 9-20, most of the respondents agreed that it was important to confirm that the benefits register be updated. The results mean that organisations should ensure that emerging benefits from the effective use of the IT product are documented and reported.

e) Performed a project audit

Figure 9-19 shows that most of the successful IT projects were audited. However, 42% of the respondents indicated that challenged IT projects had not been audited and 52% of the respondents indicated that failed IT projects had not been audited. As illustrated in figure 9-20, most of the respondents agreed that it was important to perform a project audit during the operations and maintenance phase. The results mean that auditing an IT project in the operations and maintenance phase identifies problems of the IT product, and it then recommends corrective actions to be taken to continue realising benefits from the IT product.

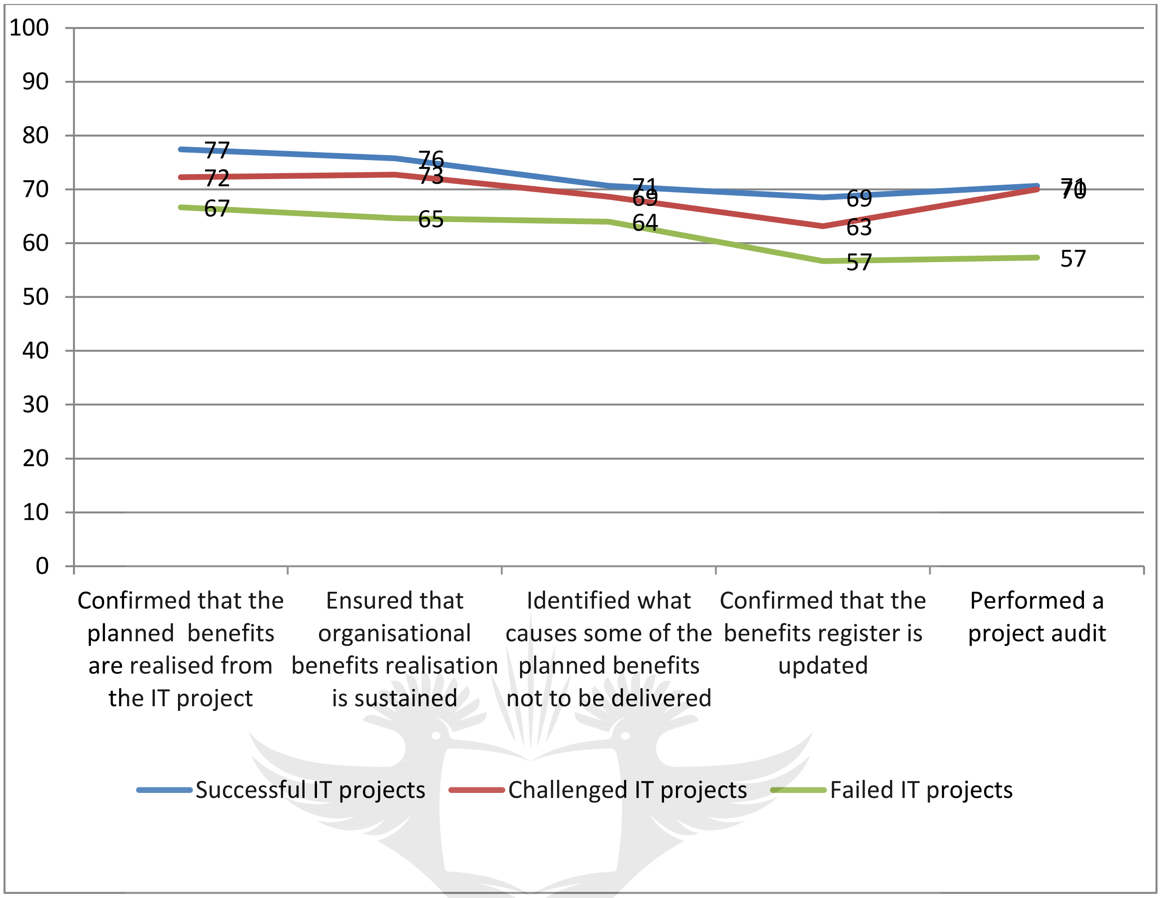

Figure 9-20 : Weighted percentage for importance level of the IT project assurance processes

Based on the above overall and specific data analysis results, most of the IT project assurance processes have been implemented better in successful IT projects than in challenged and failed IT projects. In the operations and maintenance phase, all the IT project assurance processes are perceived as important processes in achieving a successful IT project outcome.

The overall and specific descriptive data analysis results can be summarised as illustrated in figure 9-21.

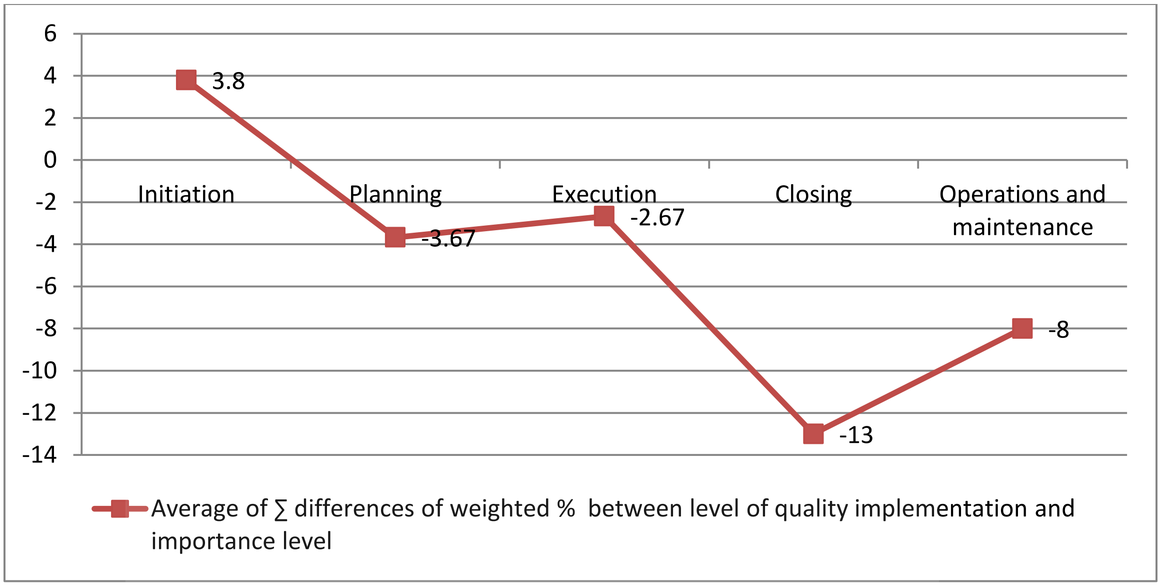

Figure 9-21 : Average of sum of differences of weighted percentage

Figure 9-21 shows that the initiation phase has a positive value (3.8). This positive value entails that most of the IT project assurance processes are implemented and important in the initiation phase. The planning phase has a negative value (-3.67). This indicates that the IT project assurance processes are important in the planning phase, but they are not implemented well. The execution phase has a negative value (-2.67). This indicates that the IT project assurance processes are important in the execution phase, but they are not implemented well. The closing phase has a negative value (-13) which is the highest value of all the other phases. This indicates that the IT project assurance processes are important in the closing phase, but they are not implemented well. The operations and maintenance phase has a negative value (-8). This result indicates that the IT project assurance processes are important in the operations and maintenance phase, but they are not implemented well.

The following section discusses the analysis of variance.

9.4 ANALYSIS OF VARIANCE

The main purpose of this section is to determine whether there is a significant difference between the levels of quality implementation and importance levels of the IT project assurance processes across the three groups of projects, namely successful, challenged and failed IT projects. The ANOVA F-test has been used to determine whether there is a significant difference between the three groups (Argyrous, 2011:367). Therefore, a one-way Analysis of Variance (ANOVA) was used to evaluate the equality of the quality implementation and importance levels of IT project assurance processes across the three groups. An F-test was also used to determine whether there is a significant difference between the levels of quality implementation and the importance levels of IT project assurance processes across the three groups. Using SPSS one-way ANOVA, the quality implementation and the importance levels of the IT project assurance processes for each group were calculated. The results for each IT project phase are discussed below.

9.4.1 Section B: Initiation Phase

In order to conduct the ANOVA F-test for the level of quality implementation of IT project assurance processes, the following are the null hypotheses stated for each variable:

- *"H_{PSAR10}: The level of quality implementation for PSAR1 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR20}: The level of quality implementation for PSAR2 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR30}: The level of quality implementation for PSAR3 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR40}: The level of quality implementation for PSAR4 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR50}: The level of quality implementation for PSAR5 is equal for successful, challenged and failed IT projects."*

The ANOVA result in table 9-8 shows that there is a small variation between the levels of quality implementation of the IT project assurance processes for successful, failed and challenged IT projects. There is a large variance between the levels of quality implementation of the IT project assurance processes within each group. The F-scores have p-values (Sig.) less than 0.05 for all the variables i.e. PSAR1, PSAR2, PSAR3, PSAR4 and PSAR5. These results indicate that there is a significant difference between the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypothesis is rejected for PSAR1, PSAR2, PSAR3, PSAR4 and PSAR5. The same result was revealed in specific descriptive analysis for successful, challenged and failed IT projects as shown in figure 9-3.

Table 9-8: ANOVA result for successful, challenged and failed IT projects in the level of quality implementation

Variables		Sum of Squares	df	Mean Square	F	Sig.
PSAR1: Aligned IT project with organisational strategy and business objectives	Between Groups	18.517	2	9.259	8.844	**.000**
	Within Groups	123.532	118	1.047		
	Total	142.050	120			
PSAR2: Provided business justification to invest in the IT project	Between Groups	18.055	2	9.027	12.997	**.000**
	Within Groups	81.962	118	.695		
	Total	100.017	120			
PSAR3: Provided approval to start IT project	Between Groups	10.363	2	5.182	7.707	**.001**
	Within Groups	79.339	118	.672		
	Total	89.702	120			
PSAR4: Performed a project audit	Between Groups	46.809	2	23.405	11.586	**.000**
	Within Groups	238.364	118	2.020		
	Total	285.174	120			
PSAR5: Aligned IT project with the existing programme in the organisation	Between Groups	18.087	2	9.043	6.220	**.003**
	Within Groups	171.566	118	1.454		
	Total	189.653	120			

Once the F-test had been concluded and the null hypotheses rejected, the post hoc comparison was used to determine which groups were significantly different. The Scheffé's post hoc comparison is the most used method because it is the least likely to find a significance difference and it also examines subgroups formed by various combinations rather than just pairwise comparisons (Argyrous, 2011:376). The result of the post hoc comparison includes only significant values as illustrated in table 9-9.

Table 9-9: Scheffé post hoc comparison in the level of quality implementation of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PSAR1: Aligned IT project with organisational strategy and business objectives	Successful project	Failed project	1.004*	.239	**.000**	.41	1.60
PSAR2: Provided business justification to invest in the IT project	Successful project	Challenged project	.460*	.175	**.035**	.03	.89
		Failed project	.989*	.195	**.000**	.51	1.47
	Challenged project	Failed project	.529*	.197	**.031**	.04	1.02
PSAR3: Provided approval to start IT project	Successful project	Failed project	.746*	.192	**.001**	.27	1.22
	Challenged project	Failed project	.533*	.194	**.026**	.05	1.01
PSAR4: Performed a project audit	Successful project	Failed project	1.599*	.332	**.000**	.78	2.42
	Challenged project	Failed project	.998*	.337	**.014**	.16	1.83
PSAR5: Aligned IT project with the existing programme in the organisation	Successful project	Failed project	.957*	.282	**.004**	.26	1.66
	Challenged project	Failed project	.802*	.285	**.022**	.09	1.51

***. The mean difference is significant at the 0.05 level.**

Table 9-9 shows that one of the six p-values (Sig.) is less than 0.05 for PSAR1. This result indicates that a significant difference exists between the comparison of levels of quality implementation for successful and failed projects. This implies that successful IT projects are aligning with the organisational strategy and business objectives. However, failed IT projects have not been aligning with the organisational strategy and business objectives.

Three of the six p-values (Sig.) are less than 0.05 for PSAR2. This result indicates that a significant difference exists between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that successful and challenged IT projects were providing business justification for the investment in the IT projects. However, failed IT projects have not been providing business justification for the investment in the IT projects. The same result was revealed in a specific descriptive analysis for successful, challenged and failed IT projects as shown in figure 9-3.

Two of the six p-values (Sig.) are less than 0.05 for PSAR3, PSAR4 and PSAR5. These results indicate that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that successful and challenged IT projects have been provided approval to start, audited as well as aligned with an existing programme within the organisation. However, failed IT projects have not been provided approval to start, have not been audited and not aligned with an existing programme within the organisation.

In order to conduct the ANOVA F-test for the importance level of the IT project assurance processes, the following are the null hypotheses stated for each variable:

- *"H_{PSAR10}: The importance level for PSAR1 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR20}: The importance level for PSAR2 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR30}: The importance level for PSAR3 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR40}: The importance level for PSAR4 is equal for successful, challenged and failed IT projects."*
- *"H_{PSAR50}: The importance level for PSAR5 is equal for successful, challenged and failed IT projects."*

The ANOVA results in table 9-10 show that there is a small variation between the importance levels of the IT project assurance processes for successful, failed and challenged IT projects. There is a small variance between the importance levels of the IT project assurance processes within each group. The F-scores have p-values (Sig.) less than 0.05 for PSAR1, PSAR2 and PSAR3. These results indicate that there is a significant difference between the importance levels of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypothesis is rejected for PSAR1, PSAR2 and PSAR3.

Table 9-10: ANOVA results for successful, challenged and failed IT projects in the importance level

Variables		Sum of Squares	df	Mean Square	F	Sig.
PSAR1: Aligned IT project with organisational strategy and business objectives	Between Groups	4.101	2	2.051	4.130	**.019**
	Within Groups	53.629	108	.497		
	Total	57.730	110			
PSAR2: Provided business justification to invest in the IT project	Between Groups	4.779	2	2.389	3.795	**.026**
	Within Groups	67.996	108	.630		
	Total	72.775	110			
PSAR3: Provided approval to start IT project	Between Groups	3.868	2	1.934	3.795	**.026**
	Within Groups	54.532	107	.510		
	Total	58.400	109			
PSAR4: Performed a project audit	Between Groups	1.568	2	.784	.717	.490
	Within Groups	118.072	108	1.093		
	Total	119.640	110			
PSAR5: Aligned IT project with the existing programme in the organisation	Between Groups	4.442	2	2.221	2.637	.076
	Within Groups	90.981	108	.842		
	Total	95.423	110			

The F-scores have p-values (Sig.) greater than 0.05 for PSAR4 and PSAR5. This result indicates that there is no a significant difference between the importance levels of the IT project assurance processes across successful, challenged and failed IT projects. The null hypotheses for PSAR4 and PSAR5 are not rejected. This implies that it is important to perform a project audit and align the IT projects with an existing programme in the organisation in successful, challenged and failed IT projects. The same result has been revealed in the specific descriptive analysis for successful, challenged and failed IT projects as shown in figure 9-4.

The result of the post hoc comparison includes only the significant values for PSAR1, PSAR2 and PSAR3 as illustrated in table 9-11.

Table 9-11: Scheffé post hoc comparison in the importance level of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PSAR1: Aligned IT project with organisational strategy and business objectives	Successful project	Failed project	.433*	.173	**.047**	.00	.86
	Challenged project	Failed project	.462*	.175	**.034**	.03	.90
PSAR2: Provided business justification to invest in the IT project	Challenged project	Failed project	.513*	.197	**.037**	.02	1.00
PSAR3: Provided approval to start IT project	Successful project	Failed project	.471*	.176	**.031**	.03	.91
***. The mean difference is significant at the 0.05 level.**							

Table 9-11 shows that two of the six p-values (Sig.) are less than 0.05 for PSAR1. This result indicates that significant differences exist between the importance levels for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that, in successful and challenged projects, the alignment of IT projects with the organisational strategy and business objectives are perceived as an important process in the initiation phase of the IT project.

One of the six p-values (Sig.) is less than 0.05 for PSAR2. This result indicates that a significant difference exists between the comparison of importance levels for challenged and failed projects. This implies that, in challenged projects, the business justification for investment in the IT project is perceived as an important process in the initiation phase of the IT project.

One of the six p-values (Sig.) is less than 0.05 for PSAR3. This result indicates that a significant difference exists between the comparison of the importance levels for successful and failed projects. This implies that, in successful projects, the approval to start the IT projects are perceived as an important process in the initiation phase of the IT projects.

9.4.2 Section C: Planning Phase

To conduct ANOVA F-test for the level of quality implementation of the IT project assurance processes in the planning phase, the following are the null hypotheses stated for each variable:

- "H_{PMPR10}: *The level of quality implementation for PMPR1 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR20}: *The level of quality implementation for PMPR2 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR30}: *The level of quality implementation for PMPR3 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR40}: *The level of quality implementation for PMPR4 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR50}: *The level of quality implementation for PMPR5 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR60}: *The level of quality implementation for PMPR6 is equal for successful, challenged and failed IT projects."*

The ANOVA results in table 9-12 show that there is a small variation between the levels of quality implementation of the IT project assurance processes for successful, failed and challenged IT projects. There is a small variance between the levels of quality implementation of the IT project assurance processes within each group. The F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e. PMPR1, PMPR2, PMPR3, PMPR4, PMPR5 and PMPR6. These results indicate that there is a significant difference between the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypothesis is rejected for PMPR1, PMPR2, PMPR3, PMPR4, PMPR5 and PMPR6.

Table 9-12: ANOVA result for successful, challenged and failed IT projects in the level of quality implementation

Variables		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
PMPR1: Involved top management and project stakeholders in developing project plans	Between Groups	34.579	2	17.289	15.630	**.000**
	Within Groups	130.529	118	1.106		
	Total	165.107	120			
PMPR2: Ensured that project plans are	Between Groups	36.799	2	18.399	21.105	**.000**
	Within Groups	102.001	117	.872		

Variables		Sum of Squares	df	Mean Square	F	Sig.
developed, updated and realistic in achieving IT project outcomes	Total	138.800	119			
PMPR3: Aligned IT project management with project management methodology and standards	Between Groups	46.873	2	23.436	18.491	**.000**
	Within Groups	148.294	117	1.267		
	Total	195.167	119			
PMPR4: Ensured that the business case is still valid	Between Groups	53.186	2	26.593	14.794	**.000**
	Within Groups	212.104	118	1.797		
	Total	265.289	120			
PMPR5: Assessed organisational readiness to execute the IT project	Between Groups	64.544	2	32.272	24.359	**.000**
	Within Groups	156.332	118	1.325		
	Total	220.876	120			
PMPR6: Performed a project audit	Between Groups	47.685	2	23.843	10.700	**.000**
	Within Groups	262.943	118	2.228		
	Total	310.628	120			

Once the F-test is concluded, the null hypotheses are rejected. The results of the post hoc comparison include only significant values as illustrated in table 9-13.

Table 9-13: Scheffé post hoc comparison in the level of quality implementation of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PMPR1: Involved top management and project stakeholders in developing project plans	Successful project	Challenged project	.643*	.221	**.017**	.10	1.19
		Failed project	1.367*	.246	**.000**	.76	1.98
	Challenged project	Failed project	.724*	.249	**.017**	.11	1.34
PMPR2: Ensured that project plans are	Successful project	Challenged project	.875*	.197	**.000**	.39	1.36

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
developed, updated and realistic in achieving IT project outcomes		Failed project	1.361*	.219	**.000**	.82	1.90
PMPR3: Aligned IT project management with project management methodology and standards	Successful project	Challenged project	.948*	.237	**.001**	.36	1.54
		Failed project	1.552*	.264	**.000**	.90	2.21
PMPR4: Ensured that the business case is still valid	Successful project	Challenged project	1.062*	.281	**.001**	.37	1.76
		Failed project	1.618*	.313	**.000**	.84	2.40
PMPR5: Assessed organisational readiness to execute the IT project	Successful project	Challenged project	.793*	.241	**.006**	.19	1.39
		Failed project	1.876*	.269	**.000**	1.21	2.54
	Challenged project	Failed project	1.083*	.273	**.001**	.41	1.76
PMPR6: Performed a project audit	Successful project	Failed project	1.613*	.349	**.000**	.75	2.48
	Challenged Project	Failed project	.962*	.353	**.028**	.09	1.84

***. The mean difference is significant at the 0.05 level.**

Table 9-13 shows that three of the six p-values (Sig.) are less than 0.05 for PMPR1. This result indicates that significant differences exist between the levels of quality implementation of the IT project assurance processes for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that successful and challenged IT projects have been involving top management and project stakeholders in developing project plans. However, failed IT projects have not been involving top management and project stakeholders in developing project plans.

Two of the six p-values (Sig.) are less than 0.05 for PMPR2. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, and (ii) successful and failed projects. This implies that successful projects have been ensuring that project plans are developed, updated and realistic in achieving IT project outcomes. However, challenged and failed IT projects have not ensured that project plans are developed, updated and realistic in achieving IT project outcomes.

Two of the six p-values (Sig.) are less than 0.05 for PMPR3. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that successful projects have been aligning IT project management with a project management methodology and standards. However, challenged and failed IT projects have not aligned IT project management with project management methodologies and standards.

Two of the six p-values (Sig.) are less than 0.05 for PMPR4. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that successful projects have been ensuring that the business case is still valid. However, challenged and failed IT projects have not ensured that the business case is still valid.

Three of the six p-values (Sig.) are less than 0.05 for PMPR5. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects as well as (iii) challenged and failed projects. This implies that successful and challenged projects have been assessing organisational readiness to execute the IT project. However, failed IT projects have not been assessing organisational readiness to execute the IT project.

Two of the six p-values (Sig.) are less than 0.05 for PMPR6. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that successful and challenged projects have been audited. However, failed projects have not been audited.

To conduct the ANOVA F-test for the importance level of the IT project assurance processes, the following are the null hypotheses stated for each variable:

- "H_{PMPR10}: *The importance level for PMPR1 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR20}: *The importance level for PMPR2 is equal for successful, challenged and failed IT projects."*
- *"*H_{PMPR30}: *The importance level for PMPR3 is equal for successful, challenged and failed IT projects."*

- *"H$_{PMPR40}$: The importance level for PMPR4 is equal for successful, challenged and failed IT projects."*
- *"H$_{PMPR50}$: The importance level for PMPR5 is equal for successful, challenged and failed IT projects."*
- *"H$_{PMPR60}$: The importance level for PMPR6 is equal for successful, challenged and failed IT projects."*

The ANOVA results in table 9-14 show that there is a small variation between the importance levels of the IT project assurance processes for successful, failed and challenged IT projects. There is also a small variance of importance levels of the IT project assurance processes within each group. The F-scores have p-values (Sig.) greater than 0.05 for PMPR1, PMPR2, PMPR3 and PMPR6. This result indicates that there is no a significant difference in the importance level of the IT project assurance processes across the successful, challenged and failed IT projects.

Table 9-14: ANOVA result for successful, challenged and failed IT projects in the importance level

Variables		Sum of Squares	Df	Mean Square	F	Sig.
PMPR1: Involved top management and project stakeholders in developing project plans	Between Groups	2.082	2	1.041	1.437	.242
	Within Groups	78.242	108	.724		
	Total	80.324	110			
PMPR2: Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	Between Groups	.289	2	.144	.264	.769
	Within Groups	58.584	107	.548		
	Total	58.873	109			
PMPR3: Aligned IT project management with project management methodology and standards	Between Groups	.569	2	.284	.354	.703
	Within Groups	86.855	108	.804		
	Total	87.423	110			
PMPR4: Ensured that the business case is still valid	Between Groups	4.549	2	2.275	3.823	**.025**
	Within Groups	64.261	108	.595		
	Total	68.811	110			
PMPR5: Assessed organisational readiness to	Between Groups	6.134	2	3.067	4.241	**.017**
	Within Groups	78.100	108	.723		

Variables		Sum of Squares	Df	Mean Square	F	Sig.
execute the IT project	Total	84.234	110			
PMPR6: Performed a project audit	Between Groups	1.093	2	.546	.637	.531
	Within Groups	92.601	108	.857		
	Total	93.694	110			

The null hypotheses for PMPR1, PMPR2, PMPR3 and PMPR6 are not rejected. This implies that the successful, challenged and failed IT projects perceive that it is important to: (i) involve top management and project stakeholders in developing project plans, (ii) ensure that project plans are developed, updated and realistic in achieving IT project outcomes, (iii) align IT project management with project management methodology and standards, and (iv) perform a project audit.

The F-scores have p-value (Sig.) less than 0.05 for PMPR4 and PMPR5. This result indicates that, there is a significant difference in the importance level of the IT project assurance processes across the successful, challenged and failed IT projects. Therefore, the null hypotheses for PMPR4 and PMPR5 are rejected. The result of the post hoc comparison includes only significant values for PMPR4 and PMPR5 as illustrated in table 9-15.

Table 9-15: Scheffé post hoc comparison in the importance level of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PMPR4: Ensured that the business case is still valid	Successful project	Failed project	.516*	.189	**.028**	.05	.99
PMPR5: Assessed organisational readiness to execute the IT project	Successful project	Failed project	.604*	.209	**.018**	.09	1.12
***. The mean difference is significant at the 0.05 level.**							

Table 9-15 shows that, one of the six p-values (Sig.) is less than 0.05 for PMPR4. This result indicates that a significant difference exists between the comparison of importance levels of the IT project assurance processes for Successful and Failed projects. This implies that, in successful projects, ensuring that the business case is still valid is perceived as an important process in the planning phase of the IT project.

One of the six p-values (Sig.) is less than 0.05 for PMPR5. This result indicates that a significant difference exists between the comparison of importance levels of the IT project assurance processes for Successful and Failed projects. This implies that, in successful projects, assessing organisational readiness to execute IT project is perceived as an important process in the planning phase of the IT project.

9.4.3 Section D: Execution Phase

To conduct the ANOVA F-test for the level of quality implementation of the IT project assurance processes in the execution phase, the following are the null hypotheses stated for each variable:

- "H_{PIR10}: *The level of quality implementation for PIR1 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR20}: The level of quality implementation for PIR2 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR30}: The level of quality implementation for PIR3 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR40}: The level of quality implementation for PIR4 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR50}: The level of quality implementation for PIR5 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR60}: The level of quality implementation for PIR6 is equal for successful, challenged and failed IT projects."*
- "H_{PIR70}: *The level of quality implementation for PIR7 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR80}: The level of quality implementation for PIR8 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR90}: The level of quality implementation for PIR9 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR100}: The level of quality implementation for PIR10 is equal for successful, challenged and failed IT projects."*

- *"H_{PIR110}: The level of quality implementation for PIR11 is equal for successful, challenged and failed IT projects."*
- *"H_{PIR120}: The level of quality implementation for PIR12 is equal for successful, challenged and failed IT projects."*

The ANOVA results in table 9-16 show that there is a small variation between the levels of quality implementation of the IT project assurance processes for successful, failed and challenged IT projects. There is a large variance of levels of quality implementation of the IT project assurance processes within each group.

Table 9-16: ANOVA result for successful, challenged and failed IT projects in the level of quality implementation

Variables		Sum of Squares	Df	Mean Square	F	Sig.
PIR1: Assessed performance of the implemented IT project activities against planned activities in the project management plans	Between Groups	29.091	2	14.545	12.890	**.000**
	Within Groups	133.157	118	1.128		
	Total	162.248	120			
PIR2: Ensured adequate project funding	Between Groups	28.599	2	14.299	11.053	**.000**
	Within Groups	151.368	117	1.294		
	Total	179.967	119			
PIR3: Involved top management and project stakeholders during the execution of the IT project activities	Between Groups	40.094	2	20.047	17.933	**.000**
	Within Groups	131.906	118	1.118		
	Total	172.000	120			
PIR4: Ensured adherence to project management methodology	Between Groups	55.851	2	27.925	19.780	**.000**
	Within Groups	166.595	118	1.412		
	Total	222.446	120			
PIR5: Prevented IT project fraud and corruption	Between Groups	32.434	2	16.217	7.363	**.001**
	Within Groups	255.499	116	2.203		
	Total	287.933	118			
PIR6: Provided IT project conflict management	Between Groups	32.209	2	16.105	9.310	**.000**
	Within Groups	202.383	117	1.730		

Variables		Sum of Squares	Df	Mean Square	F	Sig.
	Total	234.592	119			
PIR7: Assessed IT security management to the IT project deliverables	Between Groups	31.627	2	15.813	8.936	**.000**
	Within Groups	207.040	117	1.770		
	Total	238.667	119			
PIR8: Provided a motivation scheme for the project team members	Between Groups	29.730	2	14.865	5.703	**.004**
	Within Groups	307.592	118	2.607		
	Total	337.322	120			
PIR9: Confirmed that the business case is still valid	Between Groups	59.131	2	29.565	17.464	**.000**
	Within Groups	198.069	117	1.693		
	Total	257.200	119			
PIR10: Evaluated the external environment to ensure that is still conducive to implement IT project activities	Between Groups	28.185	2	14.092	7.863	**.001**
	Within Groups	209.682	117	1.792		
	Total	237.867	119			
PIR11: Confirmed that the organisation is ready for change	Between Groups	44.000	2	22.000	16.137	**.000**
	Within Groups	160.876	118	1.363		
	Total	204.876	120			
PIR12: Performed a project audit	Between Groups	44.629	2	22.314	10.482	**.000**
	Within Groups	251.206	118	2.129		
	Total	295.835	120			

The F-scores have p-value (Sig.) less than 0.05 for all the variables. This result indicates that there is a significant difference in the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypotheses are rejected for PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR9, PIR10, PIR11 and PIR12. The result of the post hoc comparison includes only significant values as illustrated in table 9-17.

Table 9-17: Scheffé post hoc comparison in the level of quality implementation of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PIR1: Assessed performance of the implemented IT project activities against planned activities in the project management plans	Successful project	Challenged project	.700*	.223	**.009**	.15	1.25
		Failed project	1.230*	.248	**.000**	.62	1.85
PIR2: Ensured adequate project funding	Successful project	Failed project	1.255*	.269	**.000**	.59	1.92
	Challenged project	Failed project	.886*	.272	**.006**	.21	1.56
PIR3: Involved top management and project stakeholders during the execution of the IT project activities	Successful project	Challenged project	.681*	.222	**.011**	.13	1.23
		Failed project	1.474*	.247	**.000**	.86	2.09
	Challenged project						
		Failed project	.792*	.250	**.008**	.17	1.41
PIR4: Ensured adherence to project management methodology	Successful project	Challenged project	.729*	.249	**.016**	.11	1.35
		Failed project	1.745*	.278	**.000**	1.06	2.43
	Challenged project	Failed project	1.017*	.281	**.002**	.32	1.71
PIR5: Prevented IT project fraud and corruption	Successful project	Failed project	1.287*	.348	**.002**	.42	2.15
	Challenged project	Failed project	1.072*	.353	**.012**	.20	1.95
PIR6: Provided IT project conflict management	Successful project	Failed project	1.326*	.307	**.000**	.56	2.09
	Challenged project	Failed project	.806*	.313	**.040**	.03	1.58
PIR7: Assessed IT security management to	Successful project	Failed project	1.314*	.311	**.000**	.54	2.08

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
the IT project deliverables							
	Challenged project	Failed project	.796*	.316	**.046**	.01	1.58
PIR8: Provided a motivation scheme for the project team members	Successful project	Failed project	1.265*	.377	**.005**	.33	2.20
PIR9: Confirmed that the business case is still valid	Successful project	Challenged project	1.091*	.275	**.001**	.41	1.77
		Failed project	1.721*	.304	**.000**	.97	2.48
PIR10: Evaluated the external environment to ensure that is still conducive to implement IT project activities	Successful project	Challenged project	.735*	.283	**.037**	.03	1.44
		Failed project	1.196*	.313	**.001**	.42	1.97
PIR11: Confirmed that the organisation is ready for change	Successful project	Challenged project	.665*	.245	**.028**	.06	1.27
		Failed project	1.548*	.273	**.000**	.87	2.22
	Challenged project	Successful project					
		Failed project	.883*	.276	**.007**	.20	1.57
PIR12: Performed a project audit	Successful project	Failed project	1.559*	.341	**.000**	.71	2.40
	Challenged project	Failed project	.883*	.345	**.042**	.03	1.74

***. The mean difference is significant at the 0.05 level.**

Table 9-17 shows that two of the six p-values (Sig.) are less than 0.05 for PIR1. This result indicates that significant differences exist between the levels of quality implementation of the IT project assurance processes for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful IT projects have been assessing performance of the implemented IT project activities against planned activities in the project management plans. However, the challenged and failed IT projects have not been assessing performance of the implemented IT project activities against planned activities in the project management plans.

Two of the six p-values (Sig.) are less than 0.05 for PIR2. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful and challenged projects have been ensuring adequate project funding. However, failed projects have not been ensuring adequate project funding.

Three of the six p-values (Sig.) are less than 0.05 for PIR3. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged projects have been involving top management and project stakeholders during the execution of the IT project activities. However, failed projects have not been involving top management and project stakeholders during the execution of the IT project activities.

Three of the six p-values (Sig.) are less than 0.05 for PIR4. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged projects have been ensuring adherence to project management methodologies. However, failed projects have not been ensuring adherence to project management methodologies.

Two of the six p-values (Sig.) are less than 0.05 for PIR5. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful and challenged projects have been preventing IT project fraud and corruption. However, failed projects have not been preventing IT project fraud and corruption.

Two of the six p-values (Sig.) are less than 0.05 for PIR6. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that the successful and challenged projects have been providing project conflict management. However, failed projects have not been providing project conflict management.

Two of the six p-values (Sig.) are less than 0.05 for PIR7. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that the successful and challenged projects have been assessing IT security management to the IT project deliverables. However, failed projects have not been assessing IT security management to the IT project deliverables.

One of the six p-values (Sig.) is less than 0.05 for PIR8. This result indicates that a significant difference exists between the comparison of levels of quality implementation for successful and failed projects. This implies that the successful projects have been providing a motivation scheme for the project team members. However, failed projects have not been providing a motivation scheme for the project team members.

Two of the six p-values (Sig.) are less than 0.05 for PIR9. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful projects have been confirming that the business case is still valid. However, challenged and failed projects have not been confirming that the business case is still valid.

Two of the six p-values (Sig.) are less than 0.05 for PIR10. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful projects have been evaluating the external environment to ensure that is still conducive to implement IT project activities. However, failed projects have not been evaluating the external environment to ensure that is still conducive to implement IT project activities.

Three of the six p-values (Sig.) are less than 0.05 for PIR11. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged projects have been confirming that the organisation is ready for change. However, failed projects have not been confirming that the organisation is ready for change.

Two of the six p-values (Sig.) are less than 0.05 for PIR12. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and failed projects and (ii) challenged and failed projects. This implies that the successful and challenged projects have been audited. However, failed projects have not been audited.

To conduct ANOVA F-test for importance level, the following are the null hypotheses stated for each variable:

- “H_{PIR10}: *The importance level for PIR1 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR20}: *The importance level for PIR2 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR30}: *The importance level for PIR3 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR40}: *The importance level for PIR4 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR50}: *The importance level for PIR5 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR60}: *The importance level for PIR6 is equal for successful, challenged and failed IT projects.”*
- “H_{PIR70}: *The importance level for PIR7 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR80}: *The importance level for PIR8 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR90}: *The importance level for PIR9 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR100}: *The importance level for PIR10 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR110}: *The importance level for PIR11 is equal for successful, challenged and failed IT projects.”*
- *“*H_{PIR120}: *The importance level for PIR12 is equal for successful, challenged and failed IT projects.”*

The ANOVA result in table 9-18 shows that there is a small variation between the importance levels for successful, failed and challenged IT projects. There is also a small variance of importance levels within each group. The F-scores have p-values (Sig.) greater than 0.05 for

PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10 and PIR12. This result indicates that there is no a significant difference in the importance levels across the successful, challenged and failed IT projects. The null hypotheses for PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10 and PIR12 are not rejected. This implies that the successful, challenged and failed IT projects perceived PIR1, PIR2, PIR3, PIR4, PIR5, PIR6, PIR7, PIR8, PIR10 and PIR12 as the important processes in the execution phase of the IT project.

Table 9-18: ANOVA result for successful, challenged and failed IT projects in the importance level

Variables		Sum of Squares	Df	Mean Square	F	Sig.
PIR1: Assessed performance of the implemented IT project activities against planned activities in the project management plans	Between Groups	2.226	2	1.113	1.898	.155
	Within Groups	62.765	107	.587		
	Total	64.991	109			
PIR2: Ensured adequate project funding	Between Groups	2.687	2	1.343	2.082	.130
	Within Groups	69.032	107	.645		
	Total	71.718	109			
PIR3: Involved top management and project stakeholders during the execution of the IT project activities	Between Groups	1.490	2	.745	1.083	.342
	Within Groups	72.950	106	.688		
	Total	74.440	108			
PIR4: Ensured adherence to project management methodology	Between Groups	.486	2	.243	.295	.745
	Within Groups	87.368	106	.824		
	Total	87.853	108			
PIR5: Prevented IT project fraud and corruption	Between Groups	.966	2	.483	.447	.641
	Within Groups	115.589	107	1.080		
	Total	116.555	109			
PIR6: Provided IT project conflict management	Between Groups	1.633	2	.817	.892	.413
	Within Groups	97.046	106	.916		
	Total	98.679	108			
PIR7: Assessed IT security management to the IT project deliverables	Between Groups	2.809	2	1.405	1.549	.217
	Within Groups	97.045	107	.907		
	Total	99.855	109			
PIR8: Provided a	Between Groups	1.979	2	.990	1.090	.340

Variables		Sum of Squares	Df	Mean Square	F	Sig.
motivation scheme for the project team members	Within Groups	96.204	106	.908		
	Total	98.183	108			
PIR9: Confirmed that the business case is still valid	Between Groups	7.490	2	3.745	6.121	**.003**
	Within Groups	64.859	106	.612		
	Total	72.349	108			
PIR10: Evaluated the external environment to ensure that is still conducive to implement IT project activities	Between Groups	3.578	2	1.789	2.119	.125
	Within Groups	89.505	106	.844		
	Total	93.083	108			
PIR11: Confirmed that the organisation is ready for change	Between Groups	5.602	2	2.801	3.563	**.032**
	Within Groups	84.116	107	.786		
	Total	89.718	109			
PIR12: Performed a project audit	Between Groups	2.221	2	1.110	1.171	.314
	Within Groups	101.452	107	.948		
	Total	103.673	109			

The F-scores have p-values (Sig.) less than 0.05 for PIR9 and PIR11. This result indicates that there is a significant difference in the importance levels of the IT project assurance processes across the successful, challenged and failed IT projects. Therefore, the null hypotheses for PIR9 and PIR11 are rejected. The result of the post hoc comparison includes only significant values for PIR9 as illustrated in table 9-19.

Table 9-19: Scheffé post hoc comparison in the importance level of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PIR9: Confirmed that the business case is still valid	Successful project	Challenged project	.451*	.173	**.037**	.02	.88
		Failed project	.624*	.193	**.007**	.15	1.10

***. The mean difference is significant at the 0.05 level.**

Table 9-19 shows that two of the six p-values (Sig.) are less than 0.05 for PIR9. This result indicates that the significant differences exist between the importance levels of the IT project assurance processes for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that, in successful projects, confirming that the business case is still valid is perceived as an important process in the execution phase of the IT project.

All six p-values (Sig.) are greater than 0.05 for PIR11. This result indicates that no significant difference exists between the importance levels for successful, challenged and failed projects. This implies that in successful, challenged and failed projects, confirming that the organisation is ready for change is perceived as an important process in the execution phase of the IT project.

9.4.4 Section E: Closing Phase

To conduct the ANOVA F-test for level of quality implementation of the IT project assurance processes in the closing phase, the following are the null hypotheses stated for each variable:

- "H_{PCR10}: *The level of quality implementation for PCR1 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR20}: *The level of quality implementation for PCR2 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR30}: *The level of quality implementation for PCR3 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR40}: *The level of quality implementation for PCR4 is equal for successful, challenged and failed IT projects."*

The ANOVA result in table 9-20 shows that there is a small variation between the levels of quality implementation of the IT project assurance processes for successful, failed and challenged IT projects. There is also a small variance of levels of quality implementation within each group. The F-scores have p-values (Sig.) less than 0.05 for all the variables i.e. PCR1, PCR2, PCR3, and PCR4. This result indicates that there is a significant difference in the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypotheses are rejected for PCR1, PCR2, PCR3, and PCR4.

Table 9-20: ANOVA result for successful, challenged and failed IT projects in the level of quality implementation

Variables		Sum of Squares	df	Mean Square	F	Sig.
PCR1: Confirmed that the IT project is ready for closure	Between Groups	36.426	2	18.213	14.171	**.000**
	Within Groups	151.657	118	1.285		
	Total	188.083	120			
PCR2: Confirmed that the organisation has the capability to support and maintain the IT product	Between Groups	62.730	2	31.365	23.548	**.000**
	Within Groups	157.171	118	1.332		
	Total	219.901	120			
PCR3: Confirmed that the environment is still conducive to provide IT services	Between Groups	43.081	2	21.541	18.888	**.000**
	Within Groups	134.572	118	1.140		
	Total	177.653	120			
PCR4: Performed a project audit	Between Groups	39.546	2	19.773	8.631	**.000**
	Within Groups	270.339	118	2.291		
	Total	309.884	120			

Once the F-test was concluded and the null hypotheses are rejected. The result of the post hoc comparison includes only significant values as illustrated in table 9-21.

Table 9-21: Scheffé post hoc comparison in the level of quality implementation of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
PCR1: Confirmed that the IT project is ready for closure	Successful project	Challenged project	.700*	.238	**.015**	.11	1.29
		Failed project	1.397*	.265	**.000**	.74	2.05
	Challenged project	Failed project	.697*	.268	**.038**	.03	1.36
PCR2: Confirmed that the organisation has the capability to support and maintain the IT product	Successful project	Challenged project	.916*	.242	**.001**	.32	1.52
		Failed project	1.834*	.270	**.000**	1.17	2.50
	Challenged project	Failed project	.918*	.273	**.005**	.24	1.60

PCR3: Confirmed that the environment is still conducive to provide IT services	Successful project	Challenged project	.767*	.224	**.004**	.21	1.32
		Failed project	1.518*	.250	**.000**	.90	2.14
	Challenged project	Failed project	.752*	.253	**.014**	.12	1.38
PCR4: Performed a project audit	Successful project	Failed project	1.444*	.354	**.000**	.57	2.32
***. The mean difference is significant at the 0.05 level.**							

Table 9-21 shows that three of the six p-values (Sig.) are less than 0.05 for PCR1. This result indicates that the significant differences exist between the levels of quality implementation of the IT project assurance processes for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged IT projects have been confirming that the IT project is ready for closure. However, failed IT projects have not been confirming that the IT project is ready for closure.

Three of the six p-values (Sig.) are less than 0.05 for PCR2. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged IT projects have been confirming that the organisation has the capacity to support and maintain the IT product. However, failed IT projects have not been confirming that the organisation has the capacity to support and maintain the IT product.

Three of the six p-values (Sig.) are less than 0.05 for PCR3. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged IT projects have been confirming that the environment is still conducive to provide IT services. However, failed IT projects have not been confirming that the environment is still conducive to provide IT services.

One of the six p-values (Sig.) is less than 0.05 for PCR4. This result indicates that a significant difference exists between the comparison of the levels of quality implementation for Successful and Failed projects. This implies that the successful IT projects have been audited. However, failed IT projects have not been audited.

To conduct ANOVA F-test for the importance level of the IT project assurance processes, the following are the null hypotheses stated for each variable:

- "H_{PCR10}: *The importance level for PCR1 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR20}: *The importance level for PCR2 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR30}: *The importance level for PCR3 is equal for successful, challenged and failed IT projects."*
- *"*H_{PCR40}: *The importance level for PCR4 is equal for successful, challenged and failed IT projects."*

The ANOVA result in table 9-22 shows that there is a small variation between the importance levels of the IT project assurance processes for successful, failed and challenged IT projects. There is also a small variance of importance levels within each group. The F-score has a p-value (Sig.) of less than 0.05 for PCR1. This result indicates that there is a significant difference in the importance levels of the IT project assurance processes across successful, challenged and failed IT projects. The null hypothesis is rejected.

Table 9-22: ANOVA result for successful, challenged and failed IT projects in the importance level

Variables		Sum of Squares	df	Mean Square	F	Sig.
PCR1: Confirmed that the IT project is ready for closure	Between Groups	4.515	2	2.257	3.333	**.039**
	Within Groups	72.476	107	.677		
	Total	76.991	109			
PCR2: Confirmed that the organisation has the capability to support and maintain the IT product	Between Groups	3.937	2	1.968	3.012	.053
	Within Groups	69.927	107	.654		
	Total	73.864	109			
PCR3: Confirmed that the environment is still conducive to provide IT services	Between Groups	.521	2	.261	.463	.631
	Within Groups	60.251	107	.563		
	Total	60.773	109			
PCR4: Performed a project audit	Between Groups	2.387	2	1.193	1.315	.273
	Within Groups	97.077	107	.907		
	Total	99.464	109			

The F-scores have p-values (Sig.) greater than 0.05 for PCR2, PCR3 and PCR4. This result indicates that there is no significant difference in the importance level of the IT project assurance processes across successful, challenged and failed IT projects. The null hypotheses are not rejected. This implies that the successful, challenged and failed IT projects perceive that it is important to: (i) confirm that the organisation has the capability to support and maintain the IT product, (ii) confirm that the environment is still conducive to provide IT services, and (iii) perform a project audit.

The result of the post hoc comparison includes only significant values for PCR1 as illustrated in table 9-23.

Table 9-23: Scheffé post hoc comparison in the importance level of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PCR1: Confirmed that the IT project is ready for closure	Successful project	Failed project	.524*	.203	**.040**	.02	1.03
***. The mean difference is significant at the 0.05 level.**							

One of the six p-values (Sig.) is less than 0.05 for PCR1. This result indicates that a significant difference exists between the comparison of the importance levels of the IT project assurance processes for successful and failed projects. This implies that, in successful projects, confirming that the IT project is ready for closure is perceived as an important process in the closing phase of the IT project.

9.4.5 Section F: Operations and maintenance phase

To conduct the ANOVA F-test for level of quality implementation of the IT project assurance processes in the operations and maintenance phase, the following are the null hypotheses stated for each variable:

- “H_{PBRR10}: *The level of quality implementation for PBRR1 is equal for successful, challenged and failed IT projects.”*
- “H_{PBRR20}: *The level of quality implementation for PBRR2 is equal for successful, challenged and failed IT projects.”*

- "H_{PBRR30}: *The level of quality implementation for PBRR3 is equal for successful, challenged and failed IT projects."*
- "H_{PBRR40}: *The level of quality implementation for PBRR4 is equal for successful, challenged and failed IT projects."*
- "H_{PBRR50}: *The level of quality implementation for PBRR5 is equal for successful, challenged and failed IT projects."*

The ANOVA result in table 9-24 shows that there is a small variation between the levels of quality implementation of the IT project assurance processes for successful, failed and challenged IT projects. There is also a small variance of the levels of quality implementation of the IT project assurance processes within each group. The F-scores have p-values (Sig.) less than 0.05 for all the variables, i.e. PBRR1, PBRR2, PBRR3, PBRR4 and PBRR5. This result indicates that there is a significant difference in the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. Therefore, the null hypothesis is rejected for PBRR1, PBRR2, PBRR3, PBRR4 and PBRR5.

Table 9-24: ANOVA result for successful, challenged and failed IT projects in the level of quality implementation

Variable		Sum of Squares	df	Mean Square	F	Sig.
PBRR1: Confirmed that the planned benefits are realised from the IT project	Between Groups	60.161	2	30.080	17.235	**.000**
	Within Groups	204.206	117	1.745		
	Total	264.367	119			
PBRR2: Ensured that organisational benefits realisation is sustained	Between Groups	62.780	2	31.390	16.216	**.000**
	Within Groups	220.673	114	1.936		
	Total	283.453	116			
PBRR3: Identified what causes some of the planned benefits not to be delivered	Between Groups	61.780	2	30.890	15.505	**.000**
	Within Groups	231.094	116	1.992		
	Total	292.874	118			
PBRR4: Confirmed that the benefits register is updated	Between Groups	44.872	2	22.436	9.608	**.000**
	Within Groups	268.552	115	2.335		
	Total	313.424	117			
PBRR5: Performed a project audit	Between Groups	37.191	2	18.596	8.583	**.000**
	Within Groups	253.476	117	2.166		
	Total	290.667	119			

Once the F-test has been concluded, the null hypotheses are rejected. The result of the post hoc comparison includes only significant values as illustrated in table 9-25.

Table 9-25: Scheffé post hoc comparison in the level of quality implementation of the IT project assurance processes

Dependent Variable	(I) Project type	(J) Project type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PBRR1: Confirmed that the planned benefits are realised from the IT project	Successful project	Challenged project	.915*	.279	**.006**	.22	1.61
		Failed project	1.793*	.309	**.000**	1.03	2.56
	Challenged project	Failed project	.878*	.314	**.023**	.10	1.66
PBRR2: Ensured that organisational benefits realisation is sustained	Successful project	Challenged project	1.047*	.294	**.002**	.32	1.78
		Failed project	1.856*	.336	**.000**	1.02	2.69
PBRR3: Identified what causes some of the planned benefits not to be delivered	Successful project	Challenged project	.878*	.300	**.016**	.13	1.62
		Failed project	1.826*	.330	**.000**	1.01	2.64
	Challenged project	Failed project	.948*	.337	**.022**	.11	1.78
PBRR4: Confirmed that the benefits register is updated	Successful project	Challenged project	.864*	.326	**.033**	.06	1.67
		Failed project	1.541*	.359	**.000**	.65	2.43
PBRR5: Performed a project audit	Successful project	Failed project	1.410*	.344	**.000**	.56	2.26

***. The mean difference is significant at the 0.05 level.**

Table 9-25 shows that three of the six p-values (Sig.) are less than 0.05 for PBRR1. This result indicates that significant differences exist between the levels of quality implementation of the IT project assurance processes for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged IT projects have been confirming that the planned benefits are realised from the IT project. However, failed IT projects have not been confirming that the planned benefits are realised from the IT project.

Two of the six p-values (Sig.) are less than 0.05 for PBRR2. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful IT projects have been ensuring that organisational benefits realisation is sustained. However, challenged and failed IT projects have not been ensuring that organisational benefits realisation is sustained.

Three of the six p-values (Sig.) are less than 0.05 for PBRR3. This result indicates that the significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects, (ii) successful and failed projects, and (iii) challenged and failed projects. This implies that the successful and challenged IT projects have been identifying what causes some of the planned benefits not to be delivered. However, failed IT projects have not been identifying what causes some of the planned benefits not to be delivered.

Two of the six p-values (Sig.) are less than 0.05 for PBRR4. This result indicates that significant differences exist between the levels of quality implementation for each of the following comparisons: (i) successful and challenged projects and (ii) successful and failed projects. This implies that the successful IT projects have been updating the benefits register. However, challenged and failed IT projects have not been updating the benefits register.

One of the six p-values (Sig.) is less than 0.05 for PBRR5. This result indicates that a significant difference exists between the comparison of the levels of quality implementation for successful and failed projects. This implies that the successful IT projects have been audited. However, failed IT projects have not been audited.

To conduct the ANOVA F-test for the importance level of the IT project assurance processes, the following are the null hypotheses stated for each variable:

- "H_{PBRR10}: *The importance level for PBRR1 is equal for successful, challenged and failed IT projects."*
- "H_{PBRR20}: *The importance level for PBRR2 is equal for successful, challenged and failed IT projects."*
- "H_{PBRR30}: *The importance level for PBRR3 is equal for successful, challenged and failed IT projects."*
- "H_{PBRR40}: *The importance level for PBRR4 is equal for successful, challenged and failed IT projects."*

- "H$_{PBRR50}$*: The importance level for PBRR5 is equal for successful, challenged and failed IT projects."*

The ANOVA result in table 9-26 shows that there is a small variation between the importance levels of the IT project assurance processes for successful, failed and challenged IT projects. There is also a small variance of importance levels of the IT project assurance processes within each group. The F-scores have p-values (Sig.) greater than 0.05 for PBRR1, PBRR2, PBRR3, PBRR4 and PBRR5. This result indicates that there is no significant difference in the importance levels across successful, challenged and failed IT projects. The null hypothesis is not rejected for PBRR1, PBRR2, PBRR3, PBRR4 and PBRR5.

Table 9-26: ANOVA result for successful, challenged and failed IT projects in the importance level

Variables		Sum of Squares	df	Mean Square	F	Sig.
PBRR1: Confirmed that the planned benefits are realised from the IT project	Between Groups	3.933	2	1.967	2.510	**.086**
	Within Groups	81.487	104	.784		
	Total	85.421	106			
PBRR2: Ensured that organisational benefits realisation is sustained	Between Groups	.690	2	.345	.418	**.659**
	Within Groups	84.167	102	.825		
	Total	84.857	104			
PBRR3: Identified what causes some of the planned benefits not to be delivered	Between Groups	.235	2	.117	.135	**.874**
	Within Groups	89.624	103	.870		
	Total	89.858	105			
PBRR4: Confirmed that the benefits register is updated	Between Groups	4.963	2	2.482	2.522	**.085**
	Within Groups	100.370	102	.984		
	Total	105.333	104			
PBRR5: Performed a project audit	Between Groups	4.312	2	2.156	2.132	.124
	Within Groups	105.165	104	1.011		
	Total	109.477	106			

This implies that the successful, challenged and failed IT projects perceive that it is important to: (i) confirm that the planned benefits are realised from the IT project, (ii) ensure that organisational benefits realisation is sustained, (iii) identify what causes some of the planned benefits not to be delivered, (iv) confirm that the benefits register is updated, and (v) perform a project audit.

The following section discusses the mapping of the data analysis results to a conceptual information technology project management assurance framework.

9.5 MAPPING OF WEIGHTED PERCENTAGE RESULTS TO A CONCEPTUAL FRAMEWORK

The conceptual information technology project management assurance framework has been validated and updated as discussed in chapter 7. The conceptual framework consists of high-level IT project assurance processes. The weighted percentage results are taken from the overall descriptive data analysis. Each IT project assurance process of the conceptual framework is mapped onto the weighted percentage of the level of quality implementation and the importance level of the IT project assurance processes as shown in table 9-27.

According to the data analysis results, green colour coding items (greater than 75%) indicate high levels of quality implementation and importance levels of IT project assurance processes. Amber colour coding items (less than 75% and greater than 50%) indicate intermediate levels of quality implementation and importance of IT project assurance processes. Table 9-27 illustrates that eight (from item 1 to 8) out of 32 IT project assurance processes have been implemented well. This entails that almost more than a quarter of all the IT project assurance processes are not implemented well in the organisations. The findings (from item 1 to 8) have connection with literature review on factors influencing project success as discussed in chapter 3. For example adequate project funding, involving top management and project stakeholders throughout the project life cycle have been influencing project success in the studied organisations.

Table 9-27: Mapping of weighted percentage of the IT project assurance processes to the conceptual framework

#	IT PROJECT ASSURANCE PROCESSES	LEVEL OF QUALITY IMPLEMENTATION (%)	IMPORTANCE LEVEL (%)
1	**PSAR3:** Provided approval to start IT project	83	73
2	**PSAR2**: Provided justification to invest in the IT project	81	72
3	**PIR2:** Ensured adequate project funding	80	80
4	**PSAR1:** Aligned IT project with organisational strategy and business objectives	79	75
5	**PIR3**: Involved top management and project stakeholders during the	79	78

#	IT PROJECT ASSURANCE PROCESSES	LEVEL OF QUALITY IMPLEMENTATION (%)	IMPORTANCE LEVEL (%)
	execution of the IT project activities		
6	**PMPR1:** Involved top management and project stakeholders in developing project plans	78	79
7	**PMPR2:** Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	76	79
8	**PIR1:** Assessed performance of the implemented IT project activities against planned activities in the project management plans	75	76
9	**PMPR3:** Aligned IT project management with project management methodology and standards	73	72
10	**PMPR4:** Ensured that business case is still valid in planning phase	72	77
11	**PMPR5:** Assessed organisational readiness to execute the IT project	71	77
12	**PIR11:** Confirmed that the organisation is ready for change	71	76
13	**PIR4:** Ensured adherence to project management methodology	71	71
14	**PIR9:** Confirmed that business case is still valid in execution phase	69	75
15	**PIR7:** Assessed IT security management to the IT project deliverables	69	73
16	**PIR5:** Prevented IT project fraud and corruption	69	72
17	**PIR6:** Provided IT project conflict management	68	70
18	**PIR10:** Evaluated the external environment to ensure that is still	67	70

#	IT PROJECT ASSURANCE PROCESSES	LEVEL OF QUALITY IMPLEMENTATION (%)	IMPORTANCE LEVEL (%)
	conducive to implement IT project activities		
19	**PCR2:** Confirmed that organisation has the capability to support and maintain the IT product	65	79
20	**PSAR4:** Perform project audit (initiation phase)	65	63
21	**PBRR1:** Confirmed that the planned benefits are realised from the IT product	64	73
22	**PIR8**: Provided motivation scheme for the project team members	64	67
23	**PCR1:** Confirmed that IT project is ready for closure	63	73
24	**PBRR2:** Ensured that organisational benefits realisation is sustained	63	72
25	**PMPR6:** Performed a project audit (planning phase)	63	71
26	**PIR12:** Performed a project audit (execution phase)	63	70
27	**PCR3:** Confirmed that the environment is still conducive to provide IT services	62	74
28	**PSAR5:** Aligned IT project with the existing programme in the organisation	61	67
29	**PBRR5:** Performed a project audit (operations and maintenance phase)	61	67
30	**PBRR3:** Identified what causes some of the planned benefits not to be delivered	60	68
31	**PBRR4:** Confirmed that the benefits register is updated	56	64
32	**PCR4:** Performed a project audit (closing phase)	55	71

9.6 CONCLUSION

This chapter analysed quantitative data, and presented results and findings. Data were analysed to examine how well the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. The overall results of the descriptive data analyses revealed that the levels of quality implementation of the IT project assurance processes throughout the project phases had not been implemented well. The overall result of the descriptive data analyses revealed that all the IT project assurance processes were important in achieving a successful IT project outcome.

The chapter also presented the specific descriptive data analysis for successful, challenged and failed IT projects. The data analysis examined how the IT project assurance processes had been implemented and how important they were in achieving a successful IT project outcome. The results revealed that most of the IT project assurance processes had been implemented better in successful IT projects than in challenged and failed IT projects. Most of the successful, challenged and failed IT projects perceived that all the IT project assurance processes were important in achieving a successful IT project outcome.

The one-way Analysis of Variance (ANOVA) was used to evaluate the equality of the levels of quality implementation and importance of IT project assurance processes across successful, challenged and failed IT projects. The analysis of variance revealed that there was a small variation between the levels of quality implementation and importance of the IT project assurance processes across successful, challenged and failed IT projects.

The F-test was used to determine whether there was a significant difference between the levels of quality implementation and importance of the IT project assurance processes across successful, challenged and failed IT projects. The data analysis results revealed that there was a significant difference between the levels of quality implementation of the IT project assurance processes across successful, challenged and failed IT projects. The overall results revealed that successful, challenged and failed IT projects perceived that IT project assurance processes were important throughout the IT life cycle.

The mapping of weighted percentages to the conceptual framework was also discussed in this chapter. The mapping revealed that eight out of 32 IT project assurance processes had been implemented well. Almost more than a quarter of all the IT project assurance processes were not implemented well in the organisations.

The next chapter conducts a factor analysis, and presents the results and findings thereof.

CHAPTER 10: FACTOR ANALYSIS

10.1 INTRODUCTION

The previous chapter discussed data analysis and findings. The goals of this chapter are to conduct a factor analysis to determine possible correlations among the variables and factors as well as to determine how the conceptual information technology project management assurance framework fits the data. The first objective is to conduct an exploratory factor analysis for both the level of quality implementation and the importance level of the IT project assurance processes. The second objective is to conduct a confirmatory factor analysis to determine how the conceptual information technology project management assurance framework fits the data for both the level of quality implementation and the importance level of the IT project assurance processes.

The next section describes the factor analysis.

10.2 FACTOR ANALYSIS

A factor analysis is a multivariate statistical procedure commonly utilised in the field of information systems, psychology, commerce and education (Byrant, Yarnold & Michelson, 1999). A factor analysis reduces a large number of variables (factors) into a smaller set and it allows creating a model from a set of latent variables. According to Williams, Brown and Onsman (2010), the two main factor analysis techniques are the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA).

The following section discusses the exploratory factor analysis in the level of quality implementation of the IT project assurance processes.

10.3 EFA FOR LEVEL OF QUALITY IMPLEMENTATION OF THE IT PROJECT ASSURANCE PROCESSES

The objectives of the exploratory factor analysis were to reduce the number of factors (variables), examine the correlation among the variables and prepare the data for a confirmatory factor analysis. An EFA was conducted using SPSS 24.0. The process of conducting the EFA involved the following stages: (i) factor extraction, (ii) factor rotation, (iii) a data adequacy test, (iv) a convergent validity test, (v) a reliability test, and (vi) a discriminant validity test. These stages are discussed in the following sections.

10.3.1 Factor Extraction

Factor extraction is a process of determining the smallest number of factors that best explain the relationship among the variables (Pallant, 2013). As shown in table 10-1, the factor extraction methods that can be used are a principal components analysis, principal axis factoring, maximum likelihood, unweighted least squares, generalised least squares, alpha factoring and image factoring (Costello & Osborne, 2005; Pallant, 2013; Tabachnick & Fidell, 2007).

Table 10-1: Factor extraction methods

Factor extraction methods	Characteristics	References
Principal components analysis (PCA)	• A data reduction method that reduces a large number of variables into smaller number of components. • Does not provide the goodness of fit of the model. • Does not separate out errors of measurement from shared variance. • The extracted components tend to overestimate the linear patterns of relationships among sets of variables.	(Costello & Osborne, 2005; Fabrigar et al., 1999; Gorsuch, 1997; Tabachnick & Fidell, 2007)
Principal axis factoring (PAF)	• Recommended when the data violate the assumption of multivariate normality. • Provides a limited range of goodness-of-fit indexes and does not allow for the computation of confidence intervals and significance tests. • Sometimes the iterative methods used in PAF can lead to final communalities greater than 1.00 (i.e. implies that more than the total shared variance is explained by a given factor)	(Costello & Osborne, 2005; Kline, 2005; Pallant, 2013)
Maximum likelihood (ML)	• It is based on the assumption that the distribution for each item is normal. • Allows for the computation of a wide range of indexes of the goodness of fit of the model.	(Brown, 2006; Fabrigar et al., 1999; Gaskin, 2016)

Factor extraction methods	Characteristics	References
	• Permits statistical significance testing of factor loadings and correlations among factors and the computation of confidence intervals. • Provides a Model Fit estimate and is commonly used in AMOS for CFA and structural equation modeling.	
Unweighted least squares (ULS)	• Useful when the item distributions are non-normal. • Minimizes the sum of the squared differences between the observed and reproduced correlation matrices. • Will still run if the correlation matrix is not positive-definite (i.e., some eigenvalues are negative)	(Nunnally & Bernstein, 1994; Pett, Lackey & Sullivan, 2003)
Generalized least squares (GLS)	• A technique for estimating the unknown parameters in a linear regression model. • Minimizes the sum of the squared differences between the observed and reproduced correlation matrices. • Correlations are weighted by the inverse of their uniqueness, so that variables with high uniqueness are given less weight than those with low uniqueness.	(Pett et al., 2003)
Alpha factoring	• Uses Cronbach's alpha or the intercorrelations among the items to obtain a measure of internal consistency of the extracted factors. • Has not been a popular extraction tool, possibly because the approach yields too few extracted factors.	(Harman , 1976; Pett et al., 2003:114)
Image factoring	• It is based on image theory, the common variance in a given variable is defined as its linear regression on remaining variables	(Kaiser, 1963; Pett et al., 2003:114)

Factor extraction methods	Characteristics	References
	in the correlation matrix rather than a function of hypothetical factors as in CFA. • Not commonly used as a factor extraction method in research literature.	

In the present study, maximum likelihood was used as a factor extraction method because it provided a model fit estimate. This method is commonly used in AMOS for CFAs and structural equation modelling (Brown, 2006; Gaskin, 2016).

10.3.2 Factor Rotation

The retained factors are rotated for easier interpretation. The two approaches for factor rotation are orthogonal rotation and oblique rotation (Brown, 2006:21; Hair et al., 2014; Pallant, 2013:183; Pett et al., 2003). Orthogonal rotation assumes that the factors are uncorrelated as well as easier to interpret and report (DeCoster, 1998; Rummel, 1970; Tabachnick & Fidell, 2007). The common orthogonal techniques are quartimax and varimax rotation. Quartimax minimises the number of factors needed to explain each variable (Gorsuch, 1983) while varimax minimises the number of variables that have high loadings on each factor. The common oblique rotation techniques are the direct oblimin and promax techniques. The direct oblimin technique allows the factors to be non-orthogonal, is used when factors are allowed to be correlated and it takes time of reaching a solution (Field, 2009). The promax technique is useful for larger data sets and has the advantage of achieving better results than the direct oblimin technique (Pett et al., 2003). Therefore, the promax rotation technique has been applied in the present study because it gives out the pattern matrix which is required to evaluate EFA convergent validity. Pattern matrix is also important in a confirmatory factor analysis.

10.3.3 EFA Data Adequacy

Before testing for data adequacy, Pallant (2013) recommends the evaluation of data adequacy for an EFA. The evaluation of data determines the sample size required for an EFA. Hair et al. (2014:101) suggest that a sample size of 100 or greater is adequate for an EFA. In the present study, the sample size is 121 which is adequate for an exploratory factor analysis.

The EFA data adequacy was first tested by using the Kaiser-Meyer-Olkin (KMO) test which measures the sampling adequacy (Kaiser, 1974; Pallant, 2013). A KMO value of 0.7 is said to be "middling", 0.8 is "meritorious" and 0.9 is "marvellous" (Gaskin, 2016; Kaiser, 1974:35). As table

10-2 illustrates, the KMO value was 0.917. This means that the KMO value is acceptable and the data are adequate.

Table 10-2: KMO and Bartlett's test result for level of quality implementation of the IT project assurance processes

Kaiser-Meyer-Olkin measure of sampling adequacy		.917
Bartlett's Test of sphericity	Approx. Chi-Square	2539.393
	Df	300
	Sig.	.000

The second test of data adequacy assessed the Bartlett test of sphericity. Bartlett's test of sphericity (Barlett, 1954) provides a chi-square output that should be significant ($p<.05$). The result in table 10-2 indicates that the significant value is less than 0.05 which implies that the data are adequate.

The third test of adequacy for an exploratory factor analysis assessed the extraction values in the communalities table. According to Gaskin (2016), communality values of less than 0.3 are low and should be eliminated. As shown in table 10-3, all the extracted communalities have values greater than 0.3 except for observed variable PSAR1_Q which has to be removed. This means that the data are adequate.

Table 10-3: Communalities for the level of quality implementation of the IT project assurance processes

Communalities		
Observed variable	**Initial**	**Extraction**
PSAR1_Q	***.552***	***.205***
PSAR2_Q	.538	.409
PSAR3_Q	.558	.442
PSAR4_Q	.837	.820
PSAR5_Q	.568	.480
PMPR1_Q	.630	.464
PMPR2_Q	.654	.572
PMPR3_Q	.747	.623
PMPR4_Q	.763	.804
PMPR6_Q	.831	.764
PIR1_Q	.680	.521
PIR2_Q	.684	.678
PIR3_Q	.727	.668

Communalities		
Observed variable	Initial	Extraction
PIR4_Q	.823	.703
PIR5_Q	.712	.691
PIR6_Q	.772	.763
PIR7_Q	.782	.799
PIR8_Q	.703	.561
PIR9_Q	.813	.780
PIR10_Q	.637	.506
PIR11_Q	.696	.612
PIR12_Q	.813	.782
PCR1_Q	.778	.692
PCR2_Q	.815	.837
PCR3_Q	.847	.823
PCR4_Q	.795	.718
PBRR1_Q	.853	.800
PBRR2_Q	.906	.871
PBRR3_Q	.782	.728
PBRR4_Q	.856	.826
PBRR5_Q	.894	.882
PMPR5_Q	.774	.696
Extraction Method: Maximum Likelihood		

The fourth test of adequacy for an exploratory factor analysis has assessed the total variance explained to determine the number of significant factors. As table 10-4 illustrates, five factors have been identified. It implies that five factors account for 69.561% of the variance. The EFA test result is acceptable because these five factors each has an eigenvalue greater than 1.0 which is a common criterion for a factor to be useful (Pallant, 2013:190). This result means that the data are adequate.

Table 10-4: Total variance explained for the level of quality implementation of the IT project assurance processes

Factor	Eigenvalues	Extraction Sums of Squared Loadings		
	Total	Total	% of Variance	Cumulative %
1	12.918	12.508	50.031	50.031
2	2.201	1.910	7.638	57.669
3	1.482	1.167	4.667	62.337
4	1.292	1.071	4.283	66.620
5	1.001	.735	2.941	**69.561**

Extraction Method: Maximum Likelihood

The fifth test of adequacy for an exploratory factor analysis assessed the goodness-of-fit result. According to Hair et al. (2014), the significant value for goodness-of-fit is less than 0.05.

Table 10-5: Goodness-of-fit result

Goodness-of-fit Test		
Chi-Square	Df	Sig.
510.510	319	.000

As shown in table 10-5, the goodness-of-fit result indicates that the significant value is less than 0.05 which means that the data are adequate.

10.3.4 EFA Convergent Validity

Convergent validity is an approach to demonstrate that multiple measures of constructs are related to one another (Lehmann, 1988) which means variables within a single factor are highly correlated (Gaskin, 2016). In the exploratory factor analysis, convergent validity has been used to determine whether the variables are highly correlated by assessing the factor loadings in the pattern matrix. According to Hair et al. (2014), in order to conduct structural equation modelling (SEM), factor loadings should be greater than 0.5. In the level of quality implementation of the IT project assurance processes, the maximum likelihood analysis has been re-run six times (as shown in Appendix F) and the items with factor loadings less than 0.5 have been removed. The removed items are PMPR5_Q, PSAR2_Q, PIR1_Q, PIR4_Q, PMPR3_Q, and PSAR5_Q. The observed variables with factor loadings greater than 0.5 are shown in table 10-6.

Table 10-6: Pattern matrix for level of quality implementation of the IT project assurance processes

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR3_Q	**.864**				
PBRR2_Q	**.831**				
PBRR1_Q	**.810**				
PBRR4_Q	**.755**				
PIR9_Q	**.718**				
PIR8_Q	**.624**			.345	
PMPR4_Q	**.623**				
PIR11_Q	**.620**		.405		
PIR10_Q	**.556**				
PSAR4_Q		**.855**			
PBRR5_Q		**.814**			
PCR4_Q		**.759**			
PIR12_Q		**.742**			
PMPR6_Q		**.660**			
PIR2_Q			**.764**		
PIR3_Q			**.748**		
PSAR3_Q			**.690**		
PMPR2_Q			**.565**		
PMPR1_Q			**.518**		
PIR7_Q				**.883**	
PIR5_Q				**.819**	
PIR6_Q				**.813**	
PCR2_Q					**.681**
PCR1_Q					**.660**
PCR3_Q					**.555**
Extraction Method: Maximum Likelihood Rotation Method: Promax with Kaiser Normalization[a]					
a. Rotation converged in 11 iterations					

10.3.5 EFA Reliability Test

The reliability test was conducted for the level of quality implementation of the IT project assurance processes. The Cronbach's alpha coefficient was used to test the reliability of the exploratory factor analysis. The Cronbach's alpha coefficient of 0.7 and above is accepted as representing good reliability (Field, 2009; Gaskin, 2016).

Table 10-7: Cronbach's alpha reliability test result for level of quality implementation of the IT project assurance processes

Factors	Factor name	Cronbach's alpha coefficient
Factor 1 (PBRR3_Q, PBRR2_Q, PBRR1_Q, PIR9_Q, PIR8_Q, PMPR4_Q, PIR11_Q, PIR10_Q)	Benefits realisation	0.924
Factor 2 (PSAR4_Q, PBRR5_Q, PCR4_Q, PIR12_Q, PMPR6_Q)	Project auditing	0.936
Factor 3 (PIR2_Q, PIR1_Q, PSAR3_Q, PMPR2_Q, PMPR1_Q)	Top management involvement	0.84
Factor 4 (PIR7_Q, PIR5_Q, PIR6_Q)	Secure project deliverables	0.884
Factor 5 (PCR2_Q, PCR1_Q, PCR3_Q)	Support and maintenance	0.912

The Cronbach's alpha coefficient is above 0.7 for all the factors as shown in table 10-7. This result indicates that the EFA reliability test is valid for the level of quality implementation of the IT project assurance processes.

10.3.6 EFA Discriminant Validity

Discriminant validity means that factors are distinct and uncorrelated (Gaskin, 2016). In the exploratory factors analysis, discriminant validity has been used to determine whether the variables relate more strongly to their own factor than to another factor using two methods. The first method examines the pattern matrix (as shown in table 10-6). According to Gaskin (2016), variables should load significantly only on one factor. In the pattern matrix, cross-loadings exist in the observed variables PIR8_Q and PIR11_Q with cross-loading differences 0.279 and 0.215 respectively. The cross-loading differences differ by more than 0.2 which indicate good discriminant validity (Gaskin, 2016).

The second method examines the factor correlation matrix as shown in table 10-8. According to Gaskin (2016), correlations between factors should not exceed 0.7. The result indicates that factors 1, 2, 3, 4 and 5 are statistically correlated.

Table 10-8: Factor correlation matrix

Factor Correlation Matrix					
Factor	**1**	**2**	**3**	**4**	**5**
1	1.000	.697	.558	.553	.483
2	.697	1.000	.481	.438	.419
3	.558	.481	1.000	.635	.368
4	.553	.438	.635	1.000	.251
5	.483	.419	.368	.251	1.000
Extraction Method: Maximum Likelihood Rotation Method: Promax with Kaiser Normalization					

The following section discusses the confirmatory factor analysis for the level of quality implementation of the IT project assurance processes.

10.4 CFA FOR THE LEVEL OF QUALITY IMPLEMENTATION OF THE IT PROJECT ASSURANCE PROCESSES

The confirmatory factor analysis (CFA) is "a type of structural equation modelling (SEM) that deals with measurement models, that is, the relationships between observed measures and latent variables or factors" (Brown, 2006:1). A confirmatory factor analysis has been conducted to confirm the factor structure extracted from the EFA and to determine how the conceptual framework fits the data.

AMOS 24.0 was used to conduct the CFA. The EFA pattern matrix (as shown in table 10-6) was imported into the AMOS, using the pattern matrix model builder plugin. The plugin allows pasting the copied contents of a pattern matrix into a dialog box, and then auto create the measurement model from the results of the pattern matrix (Gaskin, 2013).

The initial structural model was then generated (as shown in figure 10-1) with five factors, namely as benefits realisation, project auditing, top management involvement, secure project deliverables, and support and maintenance.

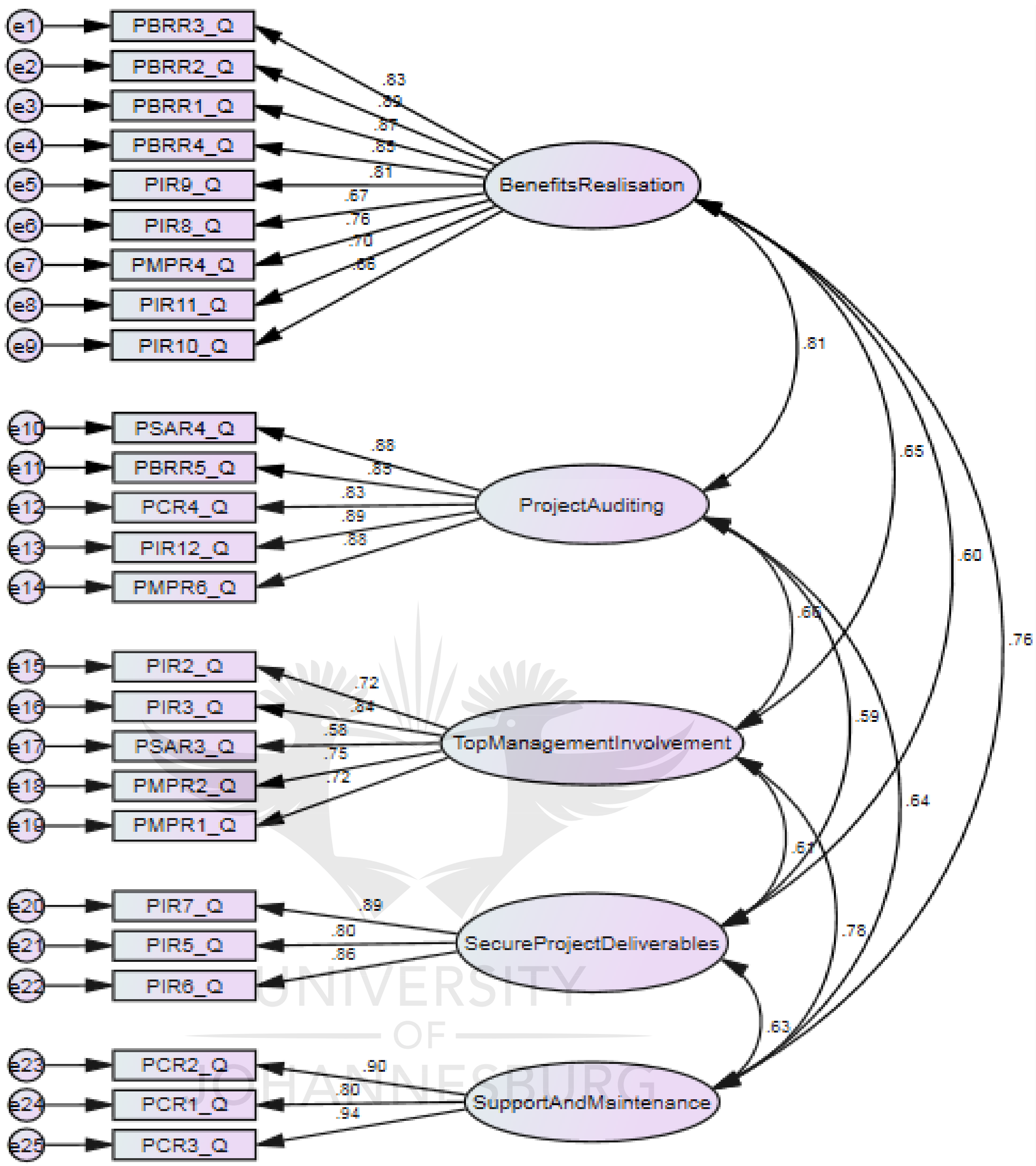

Figure 10-1 : Initial structural model for level of quality implementation of the IT project assurance processes

Figure 10-1 illustrates that the observed variables PBRR3_Q, PBBR2_Q, PBRR1_Q, PBRR4_Q, PIR9_Q, PIR8_Q, PMPR4_Q, PIR11_Q and PIR10_Q are the predictors of benefits realisation with regression weightings of 0.83, 0.89, 0.87, 0.85, 0.81, 0.67, 0.76, 0.70 and 0.66 respectively. The observed variables PSAR4_Q, PBRR5_Q, PCR4_Q, PIR12_Q and PMPR6_Q are the predictors of project auditing with regression weightings of 0.88, 0.85, 0.83, 0.89 and 0.88 respectively. The observed variables PIR2_Q, PIR3_Q, PSAR3_Q, PMPR2_Q and PMPR1_Q are the predictors of top management involvement with regression weightings of 0.72, 0.84, 0.58, 0.75 and 0.72 respectively. The observed variables PIR7_Q, PIR5_Q and PIR6_Q are the predictors of secure project deliverables with regression weightings of 0.89, 0.80 and 0.86 respectively. The observed variables PCR2_Q, PCR1_Q and PCR3_Q are the predictors of support and maintenance with regression weightings of 0.90, 0.80 and 0.94 respectively.

According to the literature, the types of model fits indices that can be used to evaluate a model fit are Chi squared/degree of freedom (CMIN/DF), root mean square residual (RMR), goodness-of-fit index (GFI), adjusted goodness-of-fit statistic (AGFI), normal-fit index (NFI), Tucker-Lewis index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA) and PCLOSE (RMSEA significance). The present study has opted for CMIN/DF, CIF and RMSEA because they are found to be the most insensitive to sample size, model misspecification and parameter estimate. They are also commonly used to evaluate a model fit (Hu & Bentler, 1999; Kline, 2005). The opted indices are described below.

- *Chi squared/degree of freedom (CMIN/DF):* CMIN/DF is an absolute fit measure that determines how well the model fits the data and is least affected by sample size (Fan et al., 1999; Hu & Bentler, 1999). This measure provides the most fundamental indication of how well the proposed theory fits the data (McDonald & Ho, 2002). The recommended model fit cut-off criteria for CMIN/DF are the following: CMIN/DF <3 is good; <5 is permissible (Gaskin, 2016; Gaskin & Lim, 2016; Hair et al., 2014).

- *Comparative fit index (CFI):* CFI is a relative fit measure that compares the chi-square value to a baseline model (Bentler, 1990; McDonald & Ho, 2002; Miles & Shevlin, 2007). The CFI takes into account a sample size that performs well even when the sample size is small (Tabachnick & Fidell, 2007). The recommended model fit cut-off criteria for CFI are the following: CFI >0.95 is a good fit; >0.90 is an acceptable fit (Gaskin, 2016; Gaskin & Lim, 2016; Hair et al., 2014; Hu & Bentler, 1999). The CFI is the most popularly reported fit index due to being one of the measures least affected by sample size (Chen, 2007; Fan et al., 1999; Hu & Bentler, 1998).

- *Root mean square error of approximation (RMSEA):* RMSEA is an "error of approximation index because it assesses the extent to which a model fits reasonably well in the population" (Brown, 2006:83). The recommended model fit cut-off criteria for RMSEA are the following: RMSEA <0.05 is a good fit; between 0.05 and 1.0 is a moderate fit; >0.10 is a bad/poor fit (Browne & Cudeck, 1993; Gaskin, 2016; Gaskin & Lim, 2016; Hair et al., 2014; Hu & Bentler, 1999). However, RMSEA produces a better quality of estimation when the sample size is large compared to a smaller sample size (Brown, 2006; Hu & Bentler, 1999).

According to the model fit cut-off criteria, the analysis of the initial structural model resulted in a poor model fit with CMIN/DF= 2.262, CFI = 0.868 and RMSEA = 0.103. In order to improve the model goodness-of-fit, the observed variables with regression weightings less than 0.7 (Hair et al, 2014) were removed one after the other and the analysis was re-run. Thus, the analysis was re-run seven times (as shown in Appendix G) to remove all the observed variables with regression weightings of less than 0.7. The removed observed variables were PSAR3_Q, PIR10_Q, PIR8_Q, PIR11_Q, PIR2_Q, PMPR4_Q and PIR9_Q. After removing the last observed variable (PIR9_Q), the final structural model was generated (as shown in figure 10-2) with model fit values as CMIN/DF= 2.090, CFI = 0.928, RMSEA = 0.095.

This result implies that the conceptual framework fits the observed data for the level of quality implementation of the IT project assurance processes.

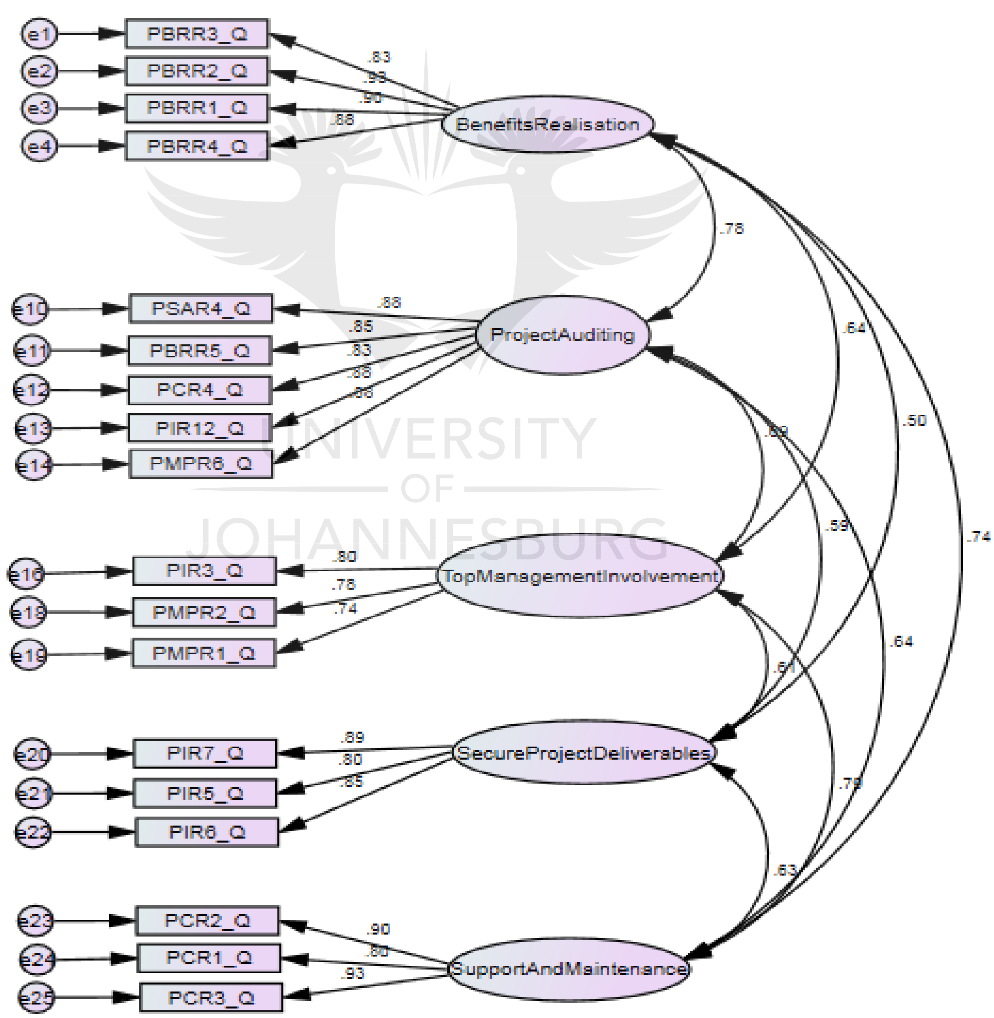

Figure 10-2 : Final structured model for level of quality implementation of the IT project assurance processes

The final structural model (shown in figure 10-2) has five factors, namely benefits realisation, project auditing, top management involvement, secure project deliverables, and support and maintenance. The observed variables PBRR3_Q, PBBR2_Q, PBRR1_Q and PBRR4_Q are the predictors of benefits realisation with regression weightings 0.83, 0.93, 0.90 and 0.88 respectively. The observed variables PSAR4_Q, PBRR5_Q, PCR4_Q, PIR12_Q and PMPR6_Q are the predictors of project auditing with regression weightings 0.88, 0.85, 0.83, 0.88 and 0.88 respectively. The observed variables PIR3_Q, PMPR2_Q and PMPR1_Q are the predictors of top management involvement with regression weightings 0.80, 0.78 and 0.74 respectively. The observed variables PIR7_Q, PIR5_Q and PIR6_Q are the predictors of secure project deliverables with regression weightings 0.89, 0.80 and 0.85 respectively. The observed variables PCR2_Q, PCR1_Q and PCR3_Q are the predictors of support and maintenance with regression weightings 0.90, 0.80 and 0.93 respectively.

The next section discusses the exploratory factor analysis for the importance level of the IT project assurance processes.

10.5 EFA FOR THE IMPORTANCE LEVEL OF THE IT PROJECT ASSURANCE PROCESSES

An EFA was conducted for the importance level of the IT project assurance processes which involved the following stages: (i) factor extraction, (ii) factor rotation, (iii) the data adequacy test, (iv) the convergent validity test, (v) the reliability test, and (vi) the discriminant validity test. These stages are discussed in the following sections.

10.5.1 Factor Extraction

The maximum likelihood was used as a factor extraction method because it provides a model fit estimate and has been used in AMOS for CFA and structural equation modelling (Brown, 2006; Gaskin, 2016).

10.5.2 Factor Rotation

The various types of factor rotation were discussed in section 10.3.2. The promax rotation method was also applied in the importance level of the IT project assurance processes.

10.5.3 EFA Data Adequacy

The EFA data adequacy was first tested by using the Kaiser-Meyer-Olkin (KMO) test which measures the sampling adequacy (Kaiser 1974; Pallant, 2013). As table 10-9 illustrates, the KMO value was 0.867. This means that the KMO value is acceptable and the data are adequate.

Table 10-9: KMO and Bartlett's Test result for importance level

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.867
Bartlett's Test of Sphericity	Approx. Chi-Square	2112.672
	df	496
	Sig.	.000

The second test of data adequacy assessed the Bartlett test of sphericity. The result in table 10-9 indicates that a significant value is less than 0.05 which implies that the data are adequate.

The third test of adequacy for an exploratory factor analysis assessed the extraction values in the communalities table. As shown in table 10-10, all the extracted communalities had values greater than 0.3. This means that the data are adequate.

Table 10-10: Communalities for the importance level of the IT project assurance processes

Communalities[a]		
Observed variable	**Initial**	**Extraction**
PSAR1_I	.618	.519
PSAR2_I	.571	.394
PSAR3_I	.551	.550
PSAR4_I	.710	.728
PSAR5_I	.712	.748
PMPR1_I	.539	.424
PMPR2_I	.717	.999
PMPR3_I	.632	.627
PMPR4_I	.663	.650
PMPR5_I	.743	.673
PMPR6_I	.747	.788
PIR1_I	.650	.578
PIR2_I	.608	.487
PIR3_1	.666	.616
PIR4_I	.728	.788
PIR5_I	.758	.807
PIR6_I	.626	.577
PIR7_I	.718	.635
PIR8_I	.615	.494
PIR9_I	.673	.773
PIR10_I	.635	.512
PIR11_I	.482	.331

Communalities[a]		
Observed variable	Initial	Extraction
PIR12_I	.609	.553
PCR1_I	.767	.727
PCR2_I	.757	.923
PCR3_I	.592	.551
PCR4_I	.696	.646
PBRR1_I	.799	.772
PBRR2_I	.729	.795
PBRR3_I	.744	.655
PBRR4_I	.722	.667
PBRR5_I	.829	.990
Extraction Method: Maximum Likelihood		

The fourth test of adequacy for the exploratory factor analysis assessed the total variance explained to determine the number of significant factors. As table 10-11 illustrates, four factors have been identified. It implies that four factors account for 60.622% of the variance. The EFA test result is acceptable because these four factors each has an eigenvalue greater than 1.0 which is a common criterion for a factor to be useful (Pallant, 2013:190). This result means that the data are adequate.

Table 10-11: Total variance explained for the importance level of the IT project assurance processes

Factor	Eigenvalues	Extraction Sums of Squared Loadings		
	Total	Total	% of Variance	Cumulative %
1	6.034	5.616	40.118	40.118
2	1.661	1.338	9.560	49.678
3	1.190	.829	5.924	55.602
4	1.046	.703	5.020	**60.622**

Extraction Method: Maximum Likelihood

The fifth test of adequacy for exploratory factor analysis assessed the goodness-of-fit result. As shown in table 10-12, the goodness-of-fit result indicates that the significant value is less than 0.05 which means that the data are adequate.

Table 10-12: Goodness-of-fit result

Goodness-of-fit Test		
Chi-Square	df	Sig.
292.103	244	.019

10.5.4 EFA Convergent Validity

Convergent validity was determined by assessing the factor loadings in the pattern matrix. The maximum likelihood analysis was re-run 18 times (as shown in Appendix H) and the items with factor loadings less than 0.5 were removed. The removed items were PMPR1_I, PMPR5_I, PIR11_I, PIR10_I, PSAR2_I, PSAR3_I, PCR3_I, PIR12_I, PSAR4_I, PIR1_I, PIR8_I, PIR2_I, PCR1_I, PMPR4_I, PMPR2_I, PSAR1_I, PSAR5_I and PBRR3_I. The observed variables with factor loadings greater than 0.5 are shown in table 10-13.

Table 10-13: Pattern matrix for importance level

Pattern Matrix[a]				
	Factor			
Observed variable	1	2	3	4
PIR5_I	**.887**			
PIR6_I	**.703**			
PIR3_I	**.678**	.348		
PIR7_I	**.538**			
PBRR1_I		**.877**		
PBRR2_I		**.760**		
PCR2_I		**.688**		
PBRR5_I			**.973**	
PBRR4_I			**.643**	
PCR4_I			**.626**	
PMPR6_I			**.622**	
PMPR3_I				**.770**
PIR4_I	.379			**.640**
Extraction Method: Maximum Likelihood Rotation Method: Promax with Kaiser Normalization[a]				
a. Rotation converged in 7 iterations				

10.5.5 EFA Reliability Test

The reliability test was conducted for the importance level of the IT project assurance processes. The Cronbach's alpha coefficient was used to test the reliability of the exploratory factor analysis. A Cronbach's alpha coefficient of 0.7 and above is accepted as representing good reliability.

Table 10-14: Cronbach's alpha reliability test result for the importance level of the IT project assurance processes

Factors	Factor name	Cronbach's alpha coefficient
Factor 1 (PIR5_I, PIR6_I, PIR3_I, PIR7_I)	Secure project deliverables	0.836
Factor 2 (PBRR1_I, PBRR2_I, PCR2_I)	Benefits realisation	0.867
Factor 3 (PBRR5_I, PBRR4_I, PCR4_I, PMPR6_I)	Project auditing	0.839
Factor 4 (PMPR3_I, PIR4_I)	Project management methodology adherence	0.720

As shown in table 10-14, the Cronbach's alpha coefficient is above 0.7 for all the factors. This result indicates that the EFA reliability test is valid for the importance level of the IT project assurance processes.

10.5.6 EFA Discriminant Validity

In the importance level of the IT project assurance processes, the EFA discriminant validity was examined by using two methods. The first method examined the pattern matrix (shown in table 10-13) in which cross-loadings exist in the observed variables PIR3_I and PIR4_I with cross-loadings differences 0.330 and 0.261 respectively. These cross-loading differences differ by more than 0.2 which indicates good discriminant validity (Gaskin, 2016).

The second method examined the factor correlation matrix as shown in table 10-15. The result indicates that factors 1, 2, 3 and 4 are correlated statistically.

Table 10-15: Factor correlation matrix

Factor Correlation Matrix				
Factor	**1**	**2**	**3**	**4**
1	1.000	.368	.519	.486
2	.368	1.000	.576	.421
3	.519	.576	1.000	.511
4	.486	.421	.511	1.000
Extraction Method: Maximum Likelihood				
Rotation Method: Promax with Kaiser Normalization				

The following section discusses the confirmatory factor analysis for the importance level of the IT project assurance processes.

10.6 CFA FOR THE IMPORTANCE LEVEL OF THE IT PROJECT ASSURANCE PROCESSES

The EFA pattern matrix (shown in table 10-13) was imported into the AMOS 24.0 software package by using the pattern matrix model builder plugin. The initial structural model was then generated (shown in figure 10-3) with four factors, namely secure project deliverables, benefits realisation, project auditing and project management methodology adherence.

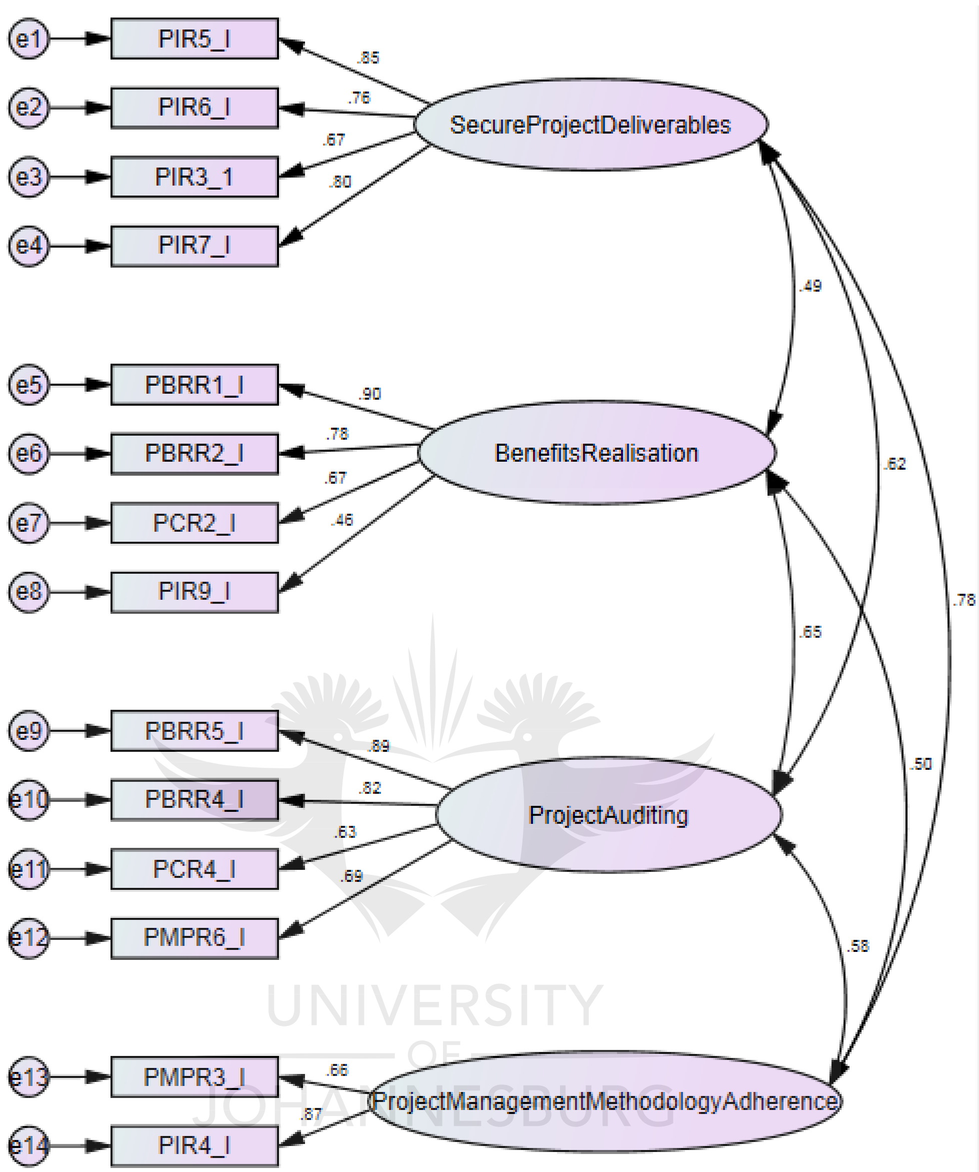

Figure 10-3 : Initial structural model for the importance level the IT project assurance processes

Figure 10-3 illustrates that the observed variables PIR5_I, PIR6_I, PIR3_I and PIR7_I are the predictors of secure project deliverables with regression weightings of 0.85, 0.76, 0.67 and 0.80 respectively. The observed variables PBRR1_I, PBRR2_I, PCR1_I and PIR9_I are the predictors of benefits realisation with regression weightings of 0.90, 0.78, 0.67 and 0.46 respectively. The observed variables PBRR5_Q, PBRR4_I, PCR4_Q, and PMPR6_Q are the predictors of project auditing with regression weightings of 0.89, 0.82, 0.63 and 0.69 respectively. The observed variables PMPR3_I and PIR4_I are the predictors of project management methodology adherence with regression weightings of 0.66 and 0.87 respectively.

According to the model fit cut-off criteria (discussed in section 10.4), the analysis of the initial structural model resulted in a poor model fit with CMIN/DF= 2.180, CFI = 0.884, RMSEA = 0.099. In order to improve the model goodness-of-fit, the SEM analysis was re-run four times (shown in Appendix I) to remove the observed variables with regression weightings of less than 0.7. The removed observed variables were PIR9_I, PCR2_I, PIR3_I and PBRR4_I. After removing the last observed variable (PBRR4_I), the final structural model was generated (shown in figure 10-4) with four factors, namely secure project deliverables, benefits realisation, project auditing and project management methodology adherence.

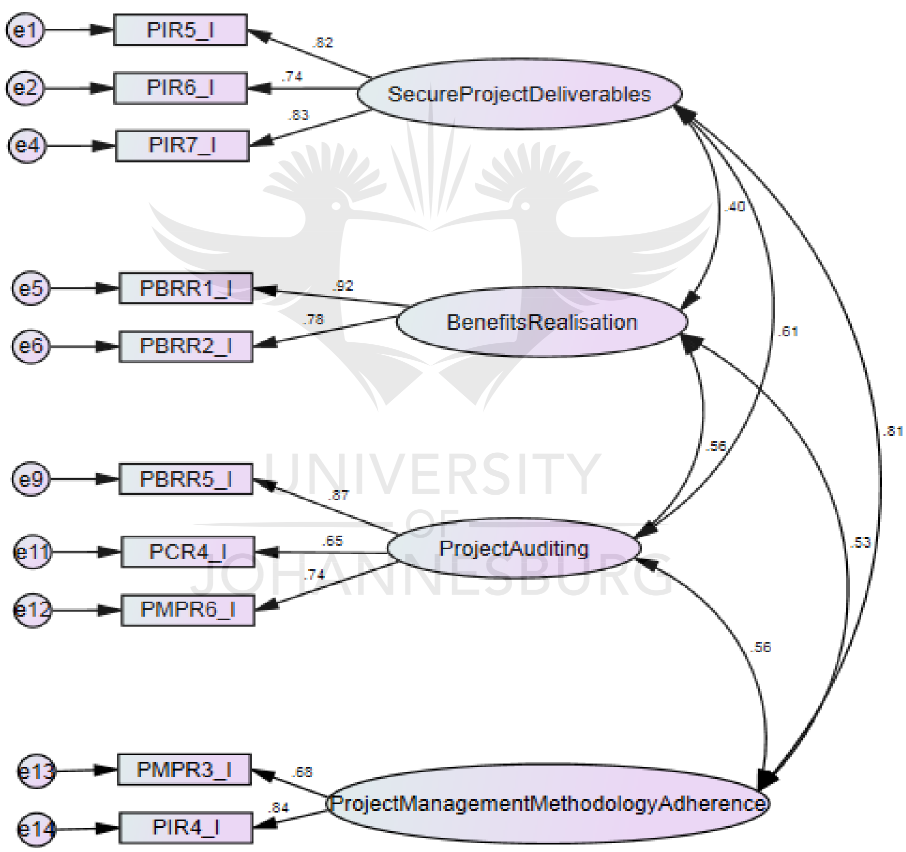

Figure 10-4 : Final structured model for importance level of the IT project assurance processes

Figure 10-4 illustrates that the observed variables PIR5_I, PIR6_I, PIR3_I and PIR7_I are the predictors of secure project deliverables with regression weightings of 0.82, 0.74 and 0.83 respectively. The observed variables PBRR1_I and PBRR2_I are the predictors of benefits realisation with regression weightings of 0.92 and 0.78 respectively. The observed variables PBRR5_Q, PCR4_Q, and PMPR6_Q are the predictors of project auditing with regression weightings of 0.87, 0.65 and 0.74 respectively. The observed variables PMPR3_I and PIR4_I are the predictors of project management methodology adherence with regression weightings of 0.68 and 0.84 respectively.

According to the model fit cut-off criteria (discussed in section 10.4), the analysis of the final structural model resulted in a good model fit with CMIN/DF= 2.030, CFI = 0.936, RMSEA = 0.093. This result implies that the conceptual framework fits the observed data for the importance level of the IT project assurance processes.

10.7 FINAL CONCEPTUAL FRAMEWORK

The original conceptual framework (shown in figure 10-5) was developed and discussed in chapter 4 and chapter 5. The results of the final SEM analysis revealed the final conceptual framework as shown in figure 10-6. In both the original and final conceptual framework Level 1: IT Project Life Cycle, Level 2: IT Project Deliverables, Level 3: IT Project Auditing, Project Governance and IT Project Success, components remained as they were. In Level 4: IT Project Assurance, the final conceptual framework had fewer IT project assurance processes than the original conceptual framework.

The identified factors in the final conceptual framework have IT project assurance processes which can be tailored to increase the chances of delivering a successful IT project in the organisation. This is evidenced by Tilk (2002), Berg (2013) and PWC (2015) that the utilisation of project assurance can increase the success rate of IT projects. The six factors identified in the final conceptual framework are discussed below.

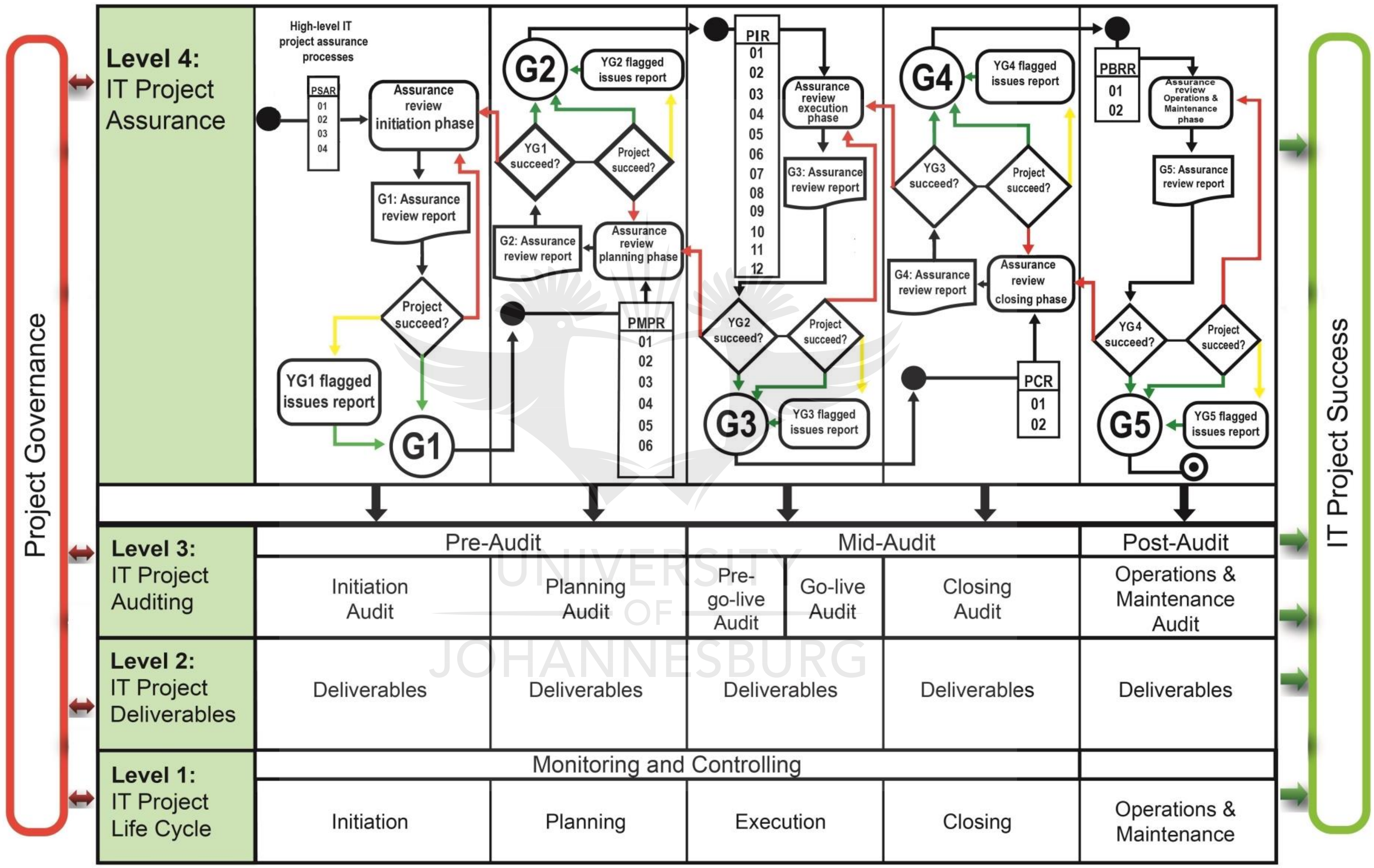

Figure 10-5 : Original Conceptual Information Technology Project Management Assurance Framework (Mkoba & Marnewick, 2016)

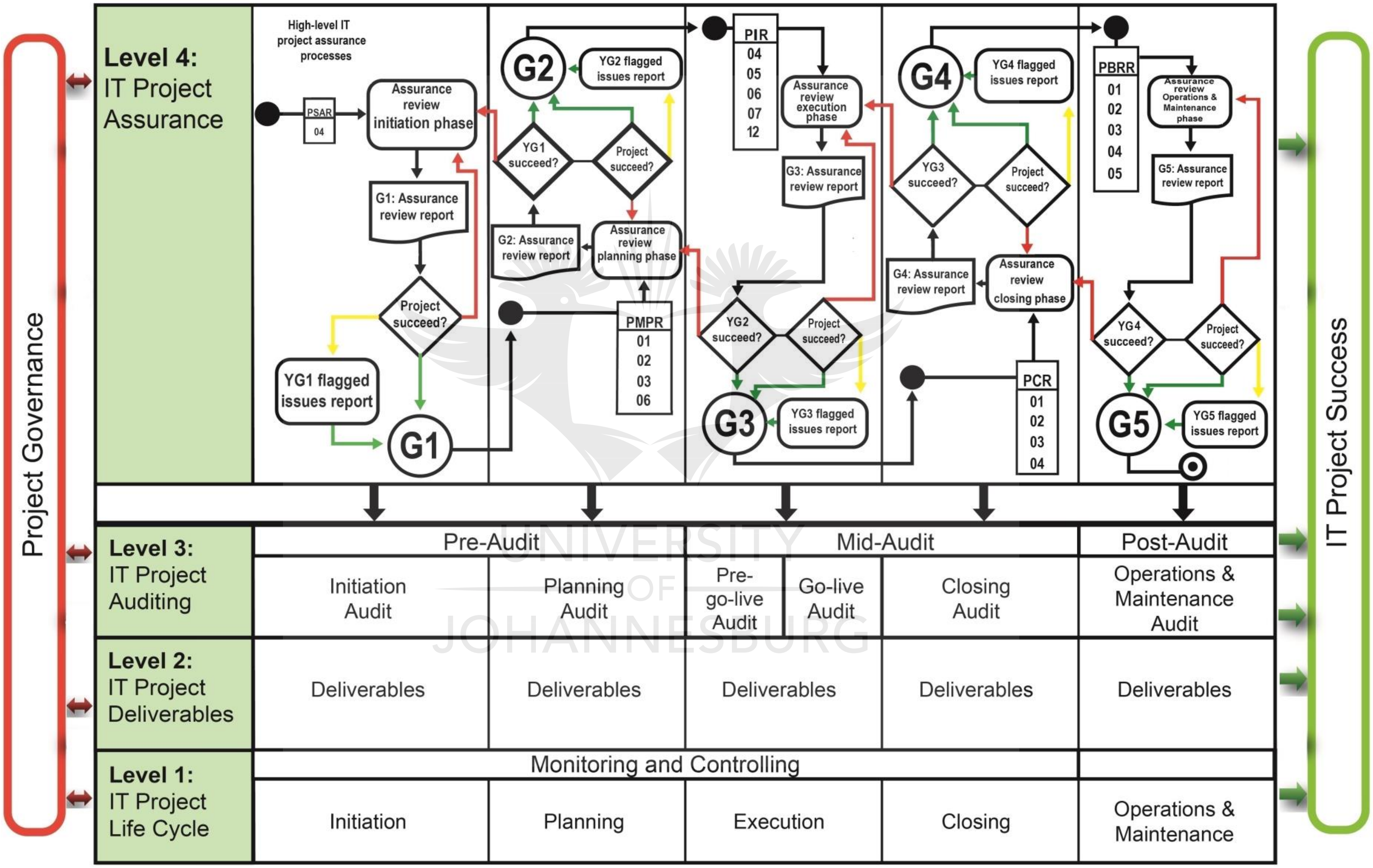

Figure 10-6 : Final Conceptual Information Technology Project Management Assurance Framework

10.7.1 Project Auditing

The final conceptual framework shows that performing a project audit in the initiation phase (PSAR4), a project audit in the planning phase (PMPR6), a project audit in the execution phase (P1R12), a project audit in the closing phase (PCR4) and a project audit in the operations and maintenance phase (PBRR5) are the predictors of project auditing. This research has found that these observed variables for project auditing have cut across all the phases of the IT project life cycle.

The literature review established that auditing a project throughout the project life cycle helps to identify project risks earlier and trigger timely corrective actions as well as improve project performance which increases the likelihood of the successful completion of the project and delivery of the product (Marnewick & Erasmus, 2014; Meredith & Mantel, 2009; Simon, 2011). According to Hill (2013), auditing within the project management environment measures results and identifies the contributing causes of those results. The majority of project audits are based on ad hoc management requests rather than systematic auditing processes throughout the project life cycle (Huibers et al., 2015). The organisations can turn to project auditing throughout the life cycle in order to mitigate the high risk of project failure (PWC, 2013). Huemann (2004:7) suggests that a “modern project management approach should be the basis of project auditing and should be done regularly to provide a learning chance and contributes to project success”.

The research findings support the established literature review on project auditing for IT project success. Therefore, the final conceptual framework empirically validates the importance of IT project auditing throughout the project life cycle to ensure successful delivery of an IT project in the organisation.

10.7.2 Involvement of Top Management

The final conceptual framework indicates that involving top management and project stakeholders in developing project plans (PMPR1) ensures that project plans are developed, updated and realistic in achieving IT project outcomes (PMPR2). Involved top management and project stakeholders during the execution phase of the IT project activities (PIR3) are the predictors of top management involvement.

The literature review established that top management involvement throughout the IT project life cycle was among the critical success factors that influenced project success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013, 2014; Baccarini & Collins, 2003; Belassi & Tukel, 1996; Belassi

& Tukel, 1999; Chow & Cao, 2008; Kerzner, 1987; Marnewick, 2013; Pinto & Slevin, 1987; Standish Group, 2016; Sudhakar, 2012). For example, in P2M, Ohara (2005) states that top management provides the vision and specifies the mission of the project which provide strategic direction to the project and have an impact on project success (Ahimbisibwe et al., 2015; Pinto & Slevin, 1987). Top management provides a decision-making framework throughout the implementation of the IT project activities. According to Zwikael and Globerson (2006), top management develops and puts in place critical success processes which contribute to the project success. The commitment of top management ensures close monitoring and controlling of project progress until its successful completion.

The research findings support the established literature review on top management involvement for IT project success. Therefore, the final conceptual framework empirically validates the importance of top management involvement in the successful delivery of an IT project in the organisation.

10.7.3 Project Management Methodology Adherence

The final conceptual framework indicates that aligned IT project management with project management methodology and standards (PMPR3) and ensured adherence to project management methodology (PIR4) are the predictors of project management methodology adherence.

The literature review establishes that adhering to a project management methodology increases the likelihood of successful projects (Joslin & Müller, 2014; Standish Group, 2016). Project management methodologies have been developed to support project managers in achieving more project success rates. For example, the commonly used IT project management methodologies are the PRINCE2 and the Agile software development methodology. Project Management Body of Knowledge (PMI, 2017) is a body of knowledge and not a methodology which has been used as a project management framework in the organisations (shown in the qualitative data analysis results in chapter 7).

The research findings support the established literature review on project management methodology adherence for IT project success. Therefore, the final conceptual framework empirically validates the importance of project management methodology adherence in the successful delivery of an IT project in the organisation.

10.7.4 Secure Project Deliverables

The final conceptual framework indicates that prevented IT project fraud and corruption (PIR5), provided IT project conflict management (PIR6) and assessed IT security management to the IT project deliverables (PIR7) are the predictors of secure project deliverables.

The literature review establishes that corruption on projects may occur in the form of bribery, fraud or collusion and at any level of the contractual structure (Transparency International UK, 2008; World Bank Washington D.C., 2000). Corruption may "involve any one or more of the government, project owner, funders, consultants, contractors, subcontractors, suppliers, joint venture partners, and agents"(Transparency International UK, 2008:2). According to Kwak (2002), the corruption factor affects project success. The organisation should incorporate effective an anti-corruption policy and raise awareness among project team members by providing anti-corruption training to prevent fraud and corruption during the IT project life cycle. The project governance, project team members and other project stakeholders can sign and comply with the anti-corruption agreement. The project manager should make sure any suspected corruption during the implementation of the IT project is reported and enforcement action taken.

The literature review also indicates that conflict in project management is inevitable because it involves individuals from different backgrounds who are working together to complete the assigned task. The conflict management process identifies and addresses differences which, if unmanaged, will affect the project objectives and can delay the project to meet its goals (APMBOK, 2012; PMI, 2017). For example, in P2M, Ohara (2005:92) mentions that the effective resolution of conflicts and fostering a team spirit lead to project success.

Furthermore, information security ensures the confidentiality, availability and integrity of information (ISO/IEC 27001, 2016). Information security includes the application and management of proper controls with the aim of ensuring sustained business success and continuity, and minimising consequences of information security incidents. Thus, the IT project deliverables should have sufficient information security and controls before it goes live. Awareness of information security policy (ISO/IEC 27001, 2016) to top management and other project stakeholders ensure that information security in the IT project deliverables is addressed and managed properly.

The research findings support the established literature review on secure project deliverables for IT project success. Therefore, the final conceptual framework empirically validates the importance of secure project deliverables in the successful delivery of an IT project in the organisation.

10.7.5 Support and Maintenance

The final conceptual framework confirmed that the organisation has the capacity to support and maintain the IT product (PCR2), confirmed that the IT project is ready for closure (PCR1) and confirmed that the environment is still conducive to provide IT services (PCR3) are the predictors of support and maintenance.

The literature review established that support and maintenance of the IT product ensures availability of data and application to maintain business functions in the organisation. Support and maintenance of the IT product also increase performance to achieve maximum productivity, increase operational efficiency to reduce costs and increase organisational effectiveness as well as allow organisation to be competitive in achieving business success. IT project readiness for closure confirms that organisation has the capability to support and maintain IT product and services, lessons learned from the project are documented, end-users are trained, the quality assurance of the product is accepted by the project governance and the project stakeholders, environment is still conducive to provide IT services, there is a plan for post-implementation review and all the project objectives are met (PMI, 2017).

The research findings support the established literature review on support and maintenance of IT product for IT project success. Therefore, the final conceptual framework empirically validates the importance of support and maintenance of IT product to deliver a successful IT project in the organisation.

10.7.6 Benefits Realisation

The final conceptual framework confirmed that the planned benefits are realised from the IT project (PBRR1) and the benefits register is updated (PBRR4), ensured that organisational benefits realisation is sustained (PBRR2) and identified what has caused some of the planned benefits not to be delivered (PBRR3). These are the predictors of benefits realisation.

The literature review establishes that benefits realisation management aims at ensuring the alignment between project outcomes and business strategies. It has been shown to increase project success across different countries and industries (Serra & Kunc, 2014). Thus, organisations should ensure that the potential benefits arising from the use of IS/IT are realised

(Badewi, 2016). The processes of benefits realisation management involve benefits identification, benefits planning, benefits delivery, benefits review and benefits sustainment (Ashurst, 2012; Bradley, 2010; Ward & Daniel, 2012).

The benefits review and evaluate results, and determine and confirm which planned benefits have been achieved (Ward & Daniel, 2012). The reviews also identify which expected benefits have not been achieved and decide on the remedial actions to be taken to obtain the benefits. The benefits register collects and lists the planned benefits used to measure and communicate the delivery of benefits, and is used to track and update any changes that can affect the project-defined benefits (Mossalam & Arafa, 2016). According to Atkinson (1999), benefits realisation of the project product to an organisation can be measured by improved efficiency, effectiveness, increased profits, achieving the organisation's strategic goals and organisational learning. Benefits of the project to the stakeholder community can be measured by the satisfaction of the users, their social and environmental impact, personal development, contractors' profits, capital suppliers as well as the economic impact to the surrounding community.

The research findings support the established literature review on benefits realisation from the IT product. Therefore, the final framework empirically validated the importance of benefits realisation management for the successful delivery of an IT project in the organisation.

10.8 CONCLUSION

This chapter conducted a factor analysis to determine the correlations among variables and factors as well as how the conceptual framework fits the data.

The exploratory factor analysis (EFA) for the level of quality implementation of the IT project assurance processes was done using the maximum likelihood method. The exploratory factor analysis data adequacy was tested by assessing the results of the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity, extraction values in the communalities table, total variance explained to determine the number of significant factors and the goodness-of-fit result. These assessment results mean that data are adequate.

The EFA convergent validity assessed the factor loadings in the pattern matrix and revealed that the variables were correlated. The EFA reliability test results indicated that all factors had a Cronbach's alpha coefficient of above 0.7. The results implied that the EFA reliability test was valid for the level of quality implementation of the IT project assurance processes. The discriminant validity test result indicated that the variables were related more strongly to their own factor and were statistically correlated.

The chapter also conducted the confirmatory factor analysis (CFA) to determine how the conceptual framework fitted the data for the level of quality implementation of the IT project assurance processes. The final result of the structural equation modelling (SEM) analysis indicated that the conceptual framework fitted the data. The five factors were identified as benefits realisation, project auditing, top management involvement, secure project deliverables, and support and maintenance.

Furthermore, the EFA for the importance level of the IT project assurance processes was also done by using the maximum likelihood method. The EFA data adequacy was also tested by assessing the results of the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity, extraction values in the communalities table, the total variance explained to determine the number of significant factors and the goodness-of-fit result. These assessment results meant that the data were adequate.

The EFA convergent validity assessed the factor loadings in the pattern matrix and revealed that the variables were correlated. The EFA reliability test results showed that all factors had a Cronbach's alpha coefficient of above 0.7. The result implied that the EFA reliability test was valid for the importance level of the IT project assurance processes. The discriminant validity test result indicated that the variables were related more strongly to their own factor and statistically correlated.

The confirmatory factor analysis (CFA) was conducted to determine how the conceptual framework fitted the data for the importance level of the IT project assurance processes. The final result of the SEM analysis indicated that the conceptual framework fitted the data. The four factors were identified as benefits realisation, project auditing, secure project deliverables and project management methodology adherence.

The chapter also compared the final SEM analysis results between the level of quality implementation and the importance level of the IT project assurance processes. The overall SEM analysis results indicated that the six factors were identified as project auditing, top management involvement, secure project deliverables, project management methodology adherence, support and maintenance, and benefits realisation. These factors had project assurance processes which could be tailored to ensure successful delivery of the IT project in the organisation.

The chapter also discussed the six factors identified in the final conceptual framework and found that the research findings supported the established literature review. The final conceptual framework empirically validated the importance of the identified factors in delivering a successful IT project in the organisation.

The next chapter discusses the research conclusion, research contributions, limitations and future research.

CHAPTER 11: RESEARCH CONCLUSIONS

11.1 INTRODUCTION

This is the last chapter that concludes the thesis. The research problem was resolved. The goal of this chapter is to determine whether the research goal has been achieved. The following are the objectives to achieve the goal of this chapter:

- To determine whether the research objectives, problem and question have been achieved
- To summarise and conclude the key research findings
- To summarise contributions of the research study
- To describe the research limitations
- To suggest future research

The following section discusses the response to the research problem and research question.

11.2 RESPONSE TO RESEARCH PROBLEM AND QUESTION

The research problem was stated in chapter 1 as:

There is a lack of research studies on how project assurance can be effectively utilised to mitigate IT project failure and there is no IT project management assurance framework for the successful delivery of IT projects.

The literature revealed that there was a lack of IT project auditing processes throughout the IT project life cycle (Huibers et al., 2015; Labuschagne & Marnewick, 2008; Marnewick & Erasmus, 2014; Lehtinen at al., 2014; PMI Brazil survey, 2013; PMI India, 2014; Ramos & Mota, 2014; Simon, 2011).

The research question was also stated in chapter 1:

How can IT projects be continuously audited to increase the number of successful IT projects?

The research question and research problem were resolved by the development of a conceptual information technology project management assurance framework. This framework contained IT project assurance processes which could be tailored to increase the chances of delivering a successful IT project in the organisation.

The following section discusses and summarises the research objectives.

11.3 SUMMARY OF THE RESEARCH FINDINGS

11.3.1 Project Success and Factors Influencing Project Success

The first research objective was to explore literature on project success and to determine the factors influencing project success. This objective was achieved through exploring the literature on project success and determining factors influencing project success. The research found that project success had been perceived differently since its evolution. The definition of 'project success' used in this study was adapted from Bannerman (2008) where the project success view moved from an organisation's tactical level to the strategic level. Project success includes process success, project management success, project product (deliverables) success, an organisation's business success and strategic success (organisational impact), programme success and portfolio success (Ahimbisibwe et al., 2015; Almajed & Mayhew, 2013, 2014; Bannerman, 2008; Cooke-Davies, 2002; Davis, 2014; Marnewick, 2013; Mistra et al., 2009; Müller and Jugdev, 2012; Standish Group, 2016; Turner, 2004).

The key research findings are that the following are identified factors which influence project success: top management support, project vision and mission, good leadership, auditing of processes, organisational culture, monitoring and controlling, change management, adequate project funding and effective anti-corruption policy. Other identified factors are project team commitment, competence and effective communication between the project team members, project team motivation, project size, end-users involvement and training, project management knowledge and project management maturity level. These factors are discussed in section 3.3. The research also determines that a conducive external environment influences project success as discussed in section 3.3.6.

11.3.2 Relationship between Auditing and Project Success

The second research objective was to investigate the existence of a relationship between auditing and project success. This objective was achieved through investigating the existence of a relationship between auditing and project success through various research studies.

Auditing an IT project throughout its life cycle identifies project risks earlier, triggers timely corrective actions, improves project performance and increases the chances of delivering a successful IT project in the organisation (Huemann, 2004; Marnewick & Erasmus, 2014; Meredith & Mantel, 2009). The key research findings are that a positive relationship between IT project auditing and project success exists. For example, Sonnekus and Labuschagne (2003) have found that the auditing of processes contributes to 50.2% of IT project success in South Africa.

Marnewick and Labuschagne (2009) have also found that the auditing of processes is among the factors that influence the outcomes of IT projects in South Africa. Simon (2011) proposes three phases of project auditing to ensure IT project success: pre-audit, mid-audit and post-audit. Pre-audit validates project readiness, mid-audit evaluates the progress of the execution of project activities against the plans, and post-audit confirms project readiness for closure.

11.3.3 Concept of Auditing

The third research objective was to explore literature and gain an understanding of the concept of auditing. This objective was achieved through exploring literature and analysing various auditing definitions to determine whether there were areas of common understanding in the literature.

The key research findings on the concept of auditing are that general auditing (referred to as financial audit) and continuous auditing are the types of auditing. General auditing is always done once a year as required by the regulatory agency. Continuous auditing is done throughout the year and has more advantages than general auditing. These include early detection of errors and fraud, an increased ability to mitigate risks, early presentation of the final accounts at the end of the year and increased efficiency in achieving the organisation's goals and strategic objectives (Coderre et al., 2005; Kanavaris, 2013; Spicer & Pegler, 1985).

The other key research finding is that auditing is a systematic process of examining accounts or business records, of collecting and evaluating evidence regarding the organisation assertions in complying with laws and regulations so as to give a true and fair view of state affairs, and communicating results to intended users.

11.3.4 Information Technology and Its Link to Auditing

The fourth research objective was to examine literature on auditing in information technology (IT) and establish its link to auditing. This objective was achieved through examining literature and analysing various IT auditing definitions to determine whether there were areas of common understanding in the literature. A link between IT auditing and auditing was established.

An IT audit evaluates a computerised information system to ascertain whether it produces timely, accurate, complete and reliable information outputs (ASOSAI, 2003). The IT audit ensures the confidentiality, integrity and availability of data as well as compliance with legal and regulatory requirements. IT audits have changed due to advances in technology and the alignment of IT with business strategies to achieve organisational strategic objectives and goals (Ghiran et al., 2011).

The key research findings are that an IT audit is a process of obtaining and evaluating evidence to determine if the information system protects information assets, maintains data integrity, and manages risks and controls in accordance with applicable laws and regulations which result in using resources effectively to achieve organisational strategic objectives and goals. This definition of an IT audit has similar characteristics with auditing (as discussed in chapter 2); thus, there is a link between IT audit and auditing.

11.3.5 Project and Its Link to Auditing

The fifth research objective was to examine literature on project auditing and establish its link to auditing. This objective was achieved through examining literature and analysing various project auditing definitions to determine whether there were areas of common understanding in the literature.

The key research finding is that project auditing is a part of the project management process in ensuring business and technical processes are in place to result in a successful project (McDonald, 2002). Projects are audited with regard to their implemented project management plans, compliance with statutory as well as regulatory and corporate guidelines (Reusch, 2011).

The research found that none of the project management standards had given guidance for project auditing, or for that matter, IT project auditing as discussed in section 2.7. The other key research finding was that IT project auditing was defined as a systematic process of continuous examining management of a project, collecting and evaluating evidence to determine whether the project management complies with best practice and standards and established project management criteria in order to give a true and fair view of the state of a project and communicating the results to intended users. This definition was used throughout the research. The definition of IT project auditing shared similar characteristics with auditing (as discussed in chapter 2); thus, there is a link between project auditing and auditing.

11.3.6 Development of a Conceptual Framework and the IT Project Assurance Processes

The sixth research objective was to explore literature on project assurance and develop a conceptual information technology project management assurance framework, and IT project assurance processes. This objective was achieved through exploring literature on project assurance, and developing a conceptual information technology project management assurance framework and IT project assurance processes. Project assurance focuses on project delivery performance; that is, whether the project can be delivery successful and what can be done to ensure its successful delivery.

The key research findings are that the utilisation of project assurance in IT projects can increase the chances of delivering a successful IT project in the organisation (Berg, 2013; PWC, 2015; Tilk, 2002). A deductive content analysis (Mayring, 2000) was used to develop the components of a conceptual framework from the comprehensive literature review (as discussed in chapter 4). The high-level IT project assurance processes were developed and discussed in chapter 4. These IT project assurance processes might be tailored to deliver a successful IT project in the organisation. The research findings also provide the flow charts to guide the IT project assurance reviews in each phase of the IT project life cycle as discussed in section 5.3.

The conceptual framework was developed as shown in figure 5-7. This conceptual framework was also validated to derive the final conceptual framework.

11.3.7 Research Methodology

The seventh research objective was to investigate and select appropriate research methodology and methods. This objective was achieved through investigating and selecting an appropriate research methodology and research methods to validate the conceptual framework.

The research methodology described how the research was carried out. The literature review on research philosophies in chapter 6 found that the common philosophical assumptions applied in research are positivism, interpretivism and critical realism (Hirschheim et al., 1995; Mingers & Stowell, 1997; Mumford et al., 1985; Myers & Klein, 2011; Orlikowski & Baroudi, 1991; Walsham, 1993, 1995a, 2006; Winder et al., 1997).

The interpretivist and positivist research philosophies were adopted in this research study. The interpretivist philosophy was adopted because the research study aimed at validating the conceptual framework through focus group interviews and collecting qualitative data. The positivist philosophy was adopted because the research study intended to validate the conceptual framework into the large sample and to collect quantitative data. Thus, the exploratory sequential mixed methods design (which includes both the qualitative and quantitative research methods) was adopted as discussed in section 6.4. A focus group was used as a qualitative research method where participants were selected and brought together to explore, discuss and validate the conceptual framework (Krueger, 1994; Krueger & Casey, 2009; Morgan 1988; Stewart, Shamdasani & Rook, 2007). Structured questionnaires were used to collect quantitative data (Descombe, 1998; Newsted, Huff & Munro, 1998; Pinsonneault & Kraemer, 1993).

The units of analysis in this research were IT project managers who are involved in the managing and implementing of IT projects in their organisations.

11.3.8 Data Collection, Data Analysis and Interpretation of Results

The eighth research objective was to design data collection instrument, collect and analyse data, and interpret results.

Firstly, the objective was achieved through designing a focus group interview guide to collect qualitative data and three survey questionnaires to collect quantitative data.

- **Qualitative research method**

The qualitative research method used the focus group discussion to validate the conceptual framework as discussed in chapter 7. The participants of the focus group were recruited using the purposive sampling strategy to select information-rich participants related to the purpose of the research study. IT project managers and project management office (PMO) managers from financial institutions and public sector organisations located in South Africa were the participants of the focus group discussion. The focus group interview guide with ten open-ended questions was developed as shown in Appendix C. The focus group discussion was facilitated by a moderator (researcher) through the focus group interview guide.

- **Quantitative research method**

The quantitative research method used survey questionnaires to validate the conceptual framework as discussed in chapter 9. The simple random sampling method was adopted to select the study samples because it provided results which were highly generalisable as a representative view of the entire population and they were relatively unbiased as well (Fink, 2003; Kumar, 2011).

The three types of structured questionnaires using closed-ended questions were designed as shown in Appendix D. The first questionnaire was on successful IT projects. This questionnaire aimed at answering the questions in relation to the most recent successful IT project that had been managed in the organisation. The second questionnaire was on challenged IT projects. This questionnaire aimed at answering the questions in relation to the most recent challenged IT project that had been managed in the organisation. The third questionnaire was on failed IT projects. This questionnaire aimed at answering the questions in relation to the most recent failed IT project that had been managed in the organisation.

These questionnaires were pilot-tested with experts from financial institutions and public sector organisations. The pilot-tested comments were incorporated into the final questionnaires. The final questionnaires were distributed by using emails from the researcher's established database of 169 IT project managers.

Secondly, the objective was achieved through collecting qualitative data from the focus group discussion which was recorded digitally. The quantitative data were collected, using the survey questionnaires to which 121 IT project managers responded.

Thirdly, the objective was achieved through analysing qualitative data and quantitative data. The data analysis was conducted using the qualitative data. The qualitative data analysis results were then used to build an instrument to collect the quantitative data.

- **Qualitative data analysis**

The digitally recorded focus group discussion was transcribed as discussed in chapter 7. The transcriptions were coded using the ATLAS.ti 7.0 software package. An inductive thematic analysis was used to analyse the qualitative data. The coded data were analysed and patterns discovered, and themes emerged from the patterns. The emerged themes in each phase of the IT project life cycle were discussed in section 7.4.

The key research findings are that the original project assurance framework has been updated by including a new project assurance process in the initiation phase, namely "Align IT project with existing programme". The rest of the components of the conceptual framework have remained the same. The updated conceptual framework is discussed in section 7.5. The results of the qualitative data analysis were used to build an instrument to collect data in the follow-up quantitative research.

- **Quantitative data analysis**

The quantitative data were analysed using descriptive analysis, analysis of variance (ANOVA) and factor analysis.

(a) Descriptive data analysis

The descriptive analysis, using SPSS 24.0, was based on (i) how well the IT project assurance processes had been implemented when a particular IT project outcome was achieved in the organisations and (ii) how important the IT project assurance processes were in achieving a successful IT project outcome (discussed in chapter 9).

The key research findings for successful, challenged and failed IT projects are that most of the IT project assurance processes have been implemented better in successful IT projects than in challenged and failed IT projects. With respect to how important the IT project assurance processes are in achieving a successful IT project outcome, the research finding is that most of the successful, challenged and failed IT projects perceive that all the IT project assurance processes in each phase of the IT project are important in achieving a successful IT project outcome.

(b) Analysis of variance (ANOVA)

The ANOVA F-test was conducted using SPSS 24.0 to determine whether there was a significant difference between the level of quality implementation and the importance level of project assurance processes across the successful, challenged and failed IT projects (discussed in chapter 9).

The key research findings are that there is a significant difference in the level of quality implementation across successful, challenged and failed IT projects. This finding is also revealed in the descriptive analysis where the IT project assurance processes are implemented better in the successful IT projects than in the challenged and failed IT projects.

The research has also found that there is no significant difference in the importance level across successful, challenged and failed IT projects. This implies that successful, challenged and failed IT projects perceive that all project assurance processes are important throughout the IT project life cycle to deliver a successful IT project outcome.

These key research findings mean that organisations should utilise the IT project assurance processes throughout the IT project life cycle to increase the chances of delivering a successful IT project.

(c) Factor analysis

A factor analysis was conducted to determine possible correlations among the variables and factors as well as to determine how the conceptual information technology project management assurance framework fitted the data. The exploratory factor analysis (EFA) used the maximum likelihood method which revealed that data were adequate as discussed in section 10.3.3. The research findings in the EFA convergent validity test showed that variables were highly correlated for levels of quality implementation and importance of IT project assurance processes. The EFA reliability test was conducted for both the level of quality implementation and the importance level of IT project assurance processes.

The key research findings were that the Cronbach's alpha coefficient was above 0.7 for all factors (shown in table 10-7 and table 10-14). The research findings in the EFA discriminant validity test were that the factors were statistically correlated for the level of quality implementation and the importance level of IT project assurance processes.

The confirmatory factor analysis used AMOS 24.0 to determine how the conceptual information technology project management assurance framework fitted the data. The key research findings were that the conceptual information technology project management assurance framework fitted the observed data for the level of quality implementation (discussed in section 10.4) and the importance level of IT project assurance processes (discussed in section 10.7).

11.3.9 Final Conceptual Framework

The ninth research objective was to develop a final conceptual information technology project management assurance framework. This objective was achieved when a final conceptual framework was developed.

The original conceptual information technology project management assurance framework (shown in figure 10-5) was developed and discussed in chapter 4 and chapter 5. The final SEM analysis results revealed the final conceptual framework as shown in figure 10-6. In both the original and the final conceptual framework, the following framework components remained as they were: Level 1: IT Project Life Cycle, Level 2: IT Project Deliverables, Level 3: IT Project Auditing, Project Governance and IT Project Success.

The key research findings are that, in Level 4: IT Project Assurance, the final conceptual framework had a few more IT project assurance processes than the original conceptual framework. The six factors which were identified in the final conceptual framework were project auditing, top management involvement, project management methodology adherence, secure project deliverables, support and maintenance, and benefits realisation. These factors had IT project assurance processes which could be tailored to increase the chances of delivering a successful IT project in the organisation (Berg, 2013; PWC, 2015; Tilk, 2002).

11.4 RESEARCH CONTRIBUTIONS

11.4.1 Theoretical Contributions

The theoretical contributions of this research is firstly, it provides a conceptual information technology project management assurance framework. The framework introduces IT project assurance processes which have not been used widely in IT project management. In literature, there are a few studies on IT project success through project assurance thus, IT project assurance has not been fully explained. Secondly, this research contributes by filling the gaps in existing research studies on IT project success through project assurance. Furthermore, none of the project management best practices and standards have provided guidance on project auditing and assurance. Thirdly, this research has contribution to the body of knowledge with regards to project auditing and assurance. Fourthly, this research also contributes knowledge to the project management curriculum of the education and training institutions. These institutions can incorporate the concept of IT project assurance in their project management curriculum to create competent project assurance experts in the IT industry.

This research may become a suitable reference for researchers who are interested in IT project success through project assurance.

11.4.2 Practical Contributions

Over the last decade, information technology (IT) projects have continued to fail at an alarming rate. Project managers are still battling to manage and deliver successful IT projects in organisations. This research contributes firstly to project management practitioners by providing them with a tool to deliver successful IT projects in their organisations.

Secondly, project governance board can use the conceptual information technology project management assurance framework as a guide to conduct project assurance reviews. The framework has IT project assurance processes which can assist the project governance board to assess whether organisations are doing things right in order to deliver successful IT projects.

Thirdly, the research contributes to organisation's realising return on IT investment. Failed IT projects cause organisations to waste huge amounts of money. The effective utilisation of the conceptual information technology project management assurance framework can assist organisations to implement successful IT projects. Successful IT projects enable organisations to achieve their strategic objectives and goals, create business value, increase performance and productivity, improve service delivery, create competitive advantage and realise return on investment (ROI). Furthermore, project assurance reviews build organisational learning by (i) providing a room for project managers and project teams to reflect their experience and learn, (ii) creating reference models which document the lessons learned from the IT projects that can be used in future projects and project assurance reviews, and (iii) building skills of project teams. The organisations benefit from the project assurance team mentoring project teams, general level of project assurance skills within the organisation is raised and increased overall organisational effectiveness in managing IT projects.

The next section discusses the research limitations.

11.5 LIMITATIONS OF THE RESEARCH

The following are the limitations of this research:

First, this research is limited because of the small sample size (121 units of analysis) drawn from Africa. Further research is needed to validate the conceptual information technology project management assurance framework in a larger sample size.

Second, the final conceptual framework is limited to the project life cycle which includes its initiation, planning, execution, closing, and operations and maintenance project phases (Kay, 2014; Ohara, 2005; PMI, 2017). Further research is required to integrate the conceptual framework with project hybrid methodologies and agile approaches.

Third, the conceptual framework cannot be generalised to other industries, including construction and manufacturing, because this research study has focused on IT project management in public and private sector organisations only.

Fourth, the structural equation modelling (SEM) has been used to construct the conceptual information technology project management assurance framework. Further research is required to apply other modelling techniques to construct the framework.

The next section suggests future research.

11.6 SUGGESTIONS FOR FUTURE RESEARCH

The findings and limitations of this research provide opportunities and direction for future research.

11.6.1 Future Validation of the Conceptual Framework

Although Africa share some similarities with other continents, further research is needed to validate the conceptual framework in a larger sample size.

11.6.2 Organisational Impact Assessment

Longitudinal research studies are needed to assess the impact of utilising the conceptual framework in IT projects in other countries. The longitudinal studies will investigate and find out if the utilisation of the framework has increased the rate of successful IT projects in both public and private sector organisations.

Research is also needed to compare the utilisation and impact of the conceptual framework among the organisations of developed and developing countries. This research can explore and improve the conceptual framework even more.

11.6.3 Integration into other Project Management Methodologies

Most organisations worldwide are using project management frameworks such as the PMBOK® Guide, project management methodologies such as PRINCE2 as well as Agile and hybrid methodologies to manage and implement IT projects. Further research is required to integrate the conceptual information technology project management assurance framework with project hybrid methodologies and Agile approaches.

11.6.4 Modelling Techniques to Construct the Framework

This research used the structural equation modelling (SEM) to construct the conceptual framework. SEM is not the only modelling technique available to create the framework. Future research is required to apply other modelling techniques (for example, artificial neural networks and generic algorithms) to construct the framework.

The following section describes the thesis concluding remarks.

11.7 THESIS CONCLUDING REMARKS

Research is about creating new knowledge. The new knowledge is documented and shared with communities to address and solve the problems they face. With regard to research findings, the developed conceptual information technology project management assurance framework can help public and private sector organisations to implement successful IT projects. IT project success has a positive organisational impact, as it increases performance and productivity, contributes to achieve strategic objectives and goals, improves service delivery and creates competitive advantage.

The delivery of business outcomes is realized through the success of projects, and in essence that is the way that project management strategies drive organisational success.

Adrian McKnight, PMP

In conclusion, it is important for organisations to continue aligning IT project activities with their business strategies and ensure they implement successful IT projects for assuring effective socio-economic development in a nation.

APPENDIX A: PROJECT GOVERNANCE INTERACTION WITH LEVELS OF THE CONCEPTUAL FRAMEWORK

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
Initiation phase	• Review and approve business case • Review and approve feasibility study report • Review and approve project charter • Review and approve project stakeholders register (including project team) • Approved resources to project activities • Authorise to start a project Decision making for a project to continue to the next phase	• Developed business case • Feasibility study report • Developed project charter • Identified stakeholders list • Project estimate budget • Human resources • Physical resources • Approved project charter • Approved business case • Approved feasibility study	• Approved business case • Approved feasibility study report • Approved project charter • Approved stakeholders register • Approved resources • Obtained an authorization to start a project	• Examine the existence and contents of business case, feasibility study report, project charter, stakeholders register, approved resources for project activities, Project Management Office.	**<u>Validation assumptions</u>** i. Business case fits to business strategy and objectives ii. Business case delivers expected outcomes iii. Business case guides investment decision iv. Business case outlines high level risks v. Feasibility study reveals that project is feasible vi. Project charter aligns project vision and mission with organisation vision and mission vii. Ensure adequate project funding throughout the project life cycle viii. Ensure involvement of Project and other Stakeholders. ix. IT project sustainability x. Requirements meet the business

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
		report • Approved project charter • Approved stakeholders register • Approved resources			need xi. Project Management Office in place, equipped and operational xii. IT project initial scope is defined xiii. Stakeholders' expectations are aligned with the IT project purpose xiv. Ensure stakeholders' realistic expectations are achieved xv. Competence of the Project Manager to apply organisational resources to project activities xvi. Ensure dissemination of information on project progress to stakeholders **<u>Project Success</u>** i. Project governance structure leads to IT project success ii. Organisational culture influences project success iii. External environment assure IT project success

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
					iv. Business case, feasibility study project stakeholders, project charter assure IT project success v. Project charter assures IT project success vi. Stakeholders involvement leads to project success vii. Availability of adequate resources contribute in achieving project success viii. Success criteria stated in the project charter assure IT project success ix. Project sponsor, stakeholders and customers have common understanding on project success criteria **Benefits realisation** i. Benefits stated in the Business case are achieved ii. Stakeholders satisfaction iii. Customer satisfaction iv. Top management satisfaction

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
					v. Project governance Board satisfaction vi. IT project objectives satisfy project requirements definition
Planning Phase	• Review and approve project management plans • Review and approve project documents • Review and approve project management methodology	• Project management plans • Project documents Selected project management methodology	• Approved project management plans • Approved project documents • Approved project management methodology	Examine the existence and contents of all the approved project management plans, project documents and project management methodology	<u>**Validation assumptions**</u> i. Project management plans and project documents achieve IT project objectives and goals ii. Project management plans are realistic in achieving IT project outcomes iii. Validate project team readiness to begin project work iv. Strategy and tactics are defined for successful completion of IT project v. Change requests updated in the project management plans vi. Validate project readiness to start vii. Project management competence to project team members viii. Work Based Structure are created ix. Project time frame is appropriate

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
					Benefits realisation Project management plans and project methodology delivered expected IT project outcomes **Project success** i. Viability of project management approach in delivering successful IT project ii. Project maturity level contribute in successful IT project iii. Corporate understanding of project management leads to x. project success
Execution phase	• Review and approve project deliverables • Review and approve performance of the project management plans • Review and approve end-users acceptance	• Project deliverables • Project management plans performance report • Users acceptance	• Approved project deliverables • Approved project management plans performance report	Examine the existence and contents of project deliverables, performance of the project management plan, change requests, contract performance,	**Validation assumptions** i. Complete the work defined in the project management plans ii. Project management plans satisfy the project specifications iii. Ensure coordination of project stakeholders and resources iv. Manage stakeholders expectations

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
	testing report • Review and approve project management plans updates • Review and approve project team performance report • Review and approve project documents updates • Review and approve organisational process assets updates • Review and approve project product quality assurance • Review and approve contractors/vendors awards • Review project contract performance	testing report • Project management updates • Project team performance report • Project documents updates • Organisational process assets updates Project product quality assurance report • Contractors /vendors awards • Project contract performance	• Approved users acceptance testing report • Approved project management updates • Approved project team performance report • Approved project documents updates • Approved organisational process assets updates • Approved project product quality	project management plans updates, acceptance test report, project team performance report, organisational process assets updates, project documents updates	v. Assess and manage risks vi. Security risk assessment vii. Change requests updated in the project management plans viii. User acceptance testing ix. Manage changes to project deliverables x. Assess contract performance xi. Ensure vendors management xii. Ensure conflicts resolution xiii. Fraud and corruption management xiv. Clear requirements definition xv. Clear business objectives xvi. Educate and train users xvii. Project team performance xviii. Product quality assurance xix. Organisational readiness for a project product

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
			assurance • Approved Contractors /vendors awards • Reviewed project contract performance		**Benefits realisation** i. Quality project product delivered ii. Increased organisational efficiency **Project success** i. Positive Top management support ii. Good leadership of a Project Manager iii. Correct auditing of processes iv. Frequent user involvement v. Project team commitment vi. Good communication between project team members vii. Good communication between project team members and customers viii. User understanding of technology High level of collaboration between project manager and project sponsor ix. External environment is conducive for IT project success

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
Closing phase	• Review and approve final project product acceptance report • Review and approve project closeout report • Review and approve Post-implementation plan •	• Final project product acceptance report • Project closeout report • Post-implementation plan •	• Approved final project product acceptance report • Approved project closeout report • Approved Post-implementation plan •	Examine existence of final project product acceptance report, project product acceptance certificate, project closeout report, and Post-implementation plan	**Validation assumptions** i. All project activities stipulated in the project management plans are completed. ii. Final project product accepted by customers, stakeholders and Top management. iii. Provide project lessons learnt. iv. Training to end-users and transfer of technology v. Complete project records vi. Confirm project is ready for closure vii. Assess external environment viii. Quality of project product delivered **Benefits realisation** Final project product is in use and provides accuracy and reliable outputs **Project success** i. Project meeting time, cost and quality. ii. Project product meeting

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
					organisational strategic and business objectives. iii. Satisfaction of user's needs iv. Satisfaction of stakeholder's needs v. Project team satisfaction vi. Project deliverables success
Monitoring and Controlling Phase	• Review and approve project progress report • Review and approve project risks register updates • Review and approve project product quality control • Review and approve change requests	• Project progress report • Project risks register updates • Project product quality control • Change requests	• Approved project progress report • Approved project risks register updates • Approved project product quality control • Approved Change requests	Examines the existence and contents of project progress report, project risks register updates, project product quality control, change requests	**Validation assumptions** i. Monitor and control project throughout the IT project life cycle ii. Report project progress against the performance objectives defined in the project management plans iii. Communicate project progress to Top management, stakeholders and customers iv. Frequent assess and manage risks v. Monitor implementation of the change requests vi. Determine corrective and preventive actions to resolve performance issues vii. Provide forecasts to update project

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
					costs and schedule **Benefits realisation** Early and timely corrective actions taken throughout the project life cycle **Project success** i. Frequent monitor the external environment to ensure project success ii. Frequent monitor organisational process assets to ensure project success
Operations and maintenance phase	• Review and approve Service Level Agreements • Verify project product • Review and approve operations and maintenance manual • Approve incident response team • Review and approve Disaster Recovery Plan	• Service Level Agreements • Project product outputs • Operations and maintenance manual • Identified incident response team • Disaster Recovery Plan	• Approved Service Level Agreements • Verified project product outputs • Operations and maintenance manual • Approved	Examine existence and contents of Service Level Agreements, project product outputs, operation and maintenance manual, incident team and Disaster Recovery Plan	**Validation assumptions** i. Assess performance of Service Level Agreements. ii. Project product maintenance iii. Evaluate project product outputs iv. Effective use of project product v. Operations and maintenance manual are easy to use vi. Assess external environment vii. Business continuity plan/ Disaster Recovery plan tested

Level 1: IT project life cycle	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
			incident response team • Approved Disaster Recovery Plan		and can handle calamities **Benefits realisation** i. Positive organisational impact ii. Improved efficiency iii. Positive social and environmental impact iv. Positive return on investment v. Business growth vi. Competitive advantage vii. Position the organisation for future opportunities **Project success** i. Business success ii. Strategic success
Level 2: IT project deliverables	• Review and approve IT project deliverables in each phase of project life cycle	• IT project deliverables	• Approved IT project deliverables	Examine existence of project tangible and intangible deliverables	**Validation of assumptions** i. IT project deliverables meet project objectives and goals **Benefits realisation** Validate benefits realised from the IT project deliverables

Level 3: IT project auditing	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
IT project auditing	• Review and approve Pre-Audit report • Review and approve Mid-Audit report • Review and approve Post-Audit report	• Pre-Audit report • Mid-Audit report • Post-Audit report	• Approved • Pre-Audit report • Approved • Mid-Audit report • Approved Post-Audit report	Examine existence and contents of Pre-Audit report, Mid-Audit report, Post-Audit report	**<u>Validation of Assumptions</u>** i. Assess Pre-Audit report to assure project success ii. Assess Mid-Audit report to assure project success iii. Assess Post-Audit report to assure project benefit realisation iv. Availability and utilisation of Auditing of processes v. Evaluate project health throughout the project life cycle **<u>Benefits realisation</u>** Improved IT project performance **<u>Project success</u>** i. IT project audit influences project success ii. Earlier and timely corrective actions influence project success

Level 4: IT project assurance	Project Governance Responsibilities	Inputs	Outputs	IT project Audit	IT Project Assurance Assumptions
IT project assurance	• Review and approve IT project assurance plan • Review and approve Gates review reports in each project phase • Decision making for a project to continue or discontinue to the next phase	• IT project assurance plan • Gates review reports	• Approved project assurance plan • Approved Gates review reports	Examine existence and contents of project assurance plan, Gates review reports	**Validation assumptions** i. Assess business assurance (i.e. assured value for money) ii. Assess user assurance (i.e. project product meets expected requirements) iii. Assess technical assurance iv. Assess suppliers assurance v. Assess quality assurance vi. Monitor project delivery performance vii. Realisation of expected outcomes viii. Utilisation of gates review in the project life cycle **Benefits realisation** i. Successful IT projects ii. Realised organisational strategic values **Project success** IT project assurance increases project success rate

Source: Author

APPENDIX B: DETAILED IT PROJECT ASSURANCE PROCESSES

IT PROJECT LIFE CYCLE: INITIATION PHASE

IT PROJECT ASSURANCE REVIEW: GATE 1

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
1. a. Project Strategic Alignment Review **(PSAR)**	**PSAR01:** Define IT Project Vision and Mission	Develop IT project vision and mission which are understood by top management and stakeholders and that support the organisation objectives.	**PSAR01.1:** Confirm that the IT project vision and mission are defined	• Approved IT project's vision and mission
			PSAR01.2: Confirm that top management and stakeholders were involved to develop the IT project vision and mission	• Minutes of the meeting indicating top management and stakeholders participated in the development of the IT project's vision and mission
			PSAR01.3: Confirm that IT project vision and mission were aligned with organisational vision and mission	• List of IT project's vision aligned with organisational vision • List of IT project's mission aligned with organisational mission

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
	PSAR02: Define IT project objectives and goals	Develop IT project objectives and goals which are specific, measurable, achievable, realistic and timely (SMART). Ensure the IT project objectives and goals are agreed by top management and stakeholders, and contribute in achieving organisational strategic and business objectives as well as organisational goals.	**PSAR02.1:** Confirm IT project objectives and goals are defined	• List of Specific, Measurable, Achievable, Realistic, Timely (SMART) IT project objectives and goals
			PSAR02.2: Confirm that top management and stakeholders were involved to develop the IT project objectives and goals	• Minutes of the meeting indicating top management and stakeholders attending the development of the IT project objectives and goals
			PSAR02.3: Confirm that IT project objectives are aligned with organisation's strategic and business objectives	• List of IT project objectives aligned with organisation's strategic objectives • List of IT project objectives aligned with organisation's business objectives

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			PSAR02.4: Confirm that IT project goals are aligned with organisation's goals	• List of IT project goals aligned with organisation's goals
	PSAR03: Ensure sustainability of the IT project	Evaluate the sustainability of the IT project against criteria on economic, environmental and social sustainability. Sustainability needs to be considered when the decisions of the IT project investment are being made.	**PSAR03.1:** Confirm economic sustainability of the IT project	• Percentage of extra revenue generated from the IT project product or services • Percentage of reduced operational cost in the organisation • Percentage of improved efficiency in the organisation's business processes • Percentage of expected strategic value realised from the IT project
			PSAR03.2: Confirm environmental sustainability of the IT project	• Percentage of awareness on energy consumption • Percentage of IT project delivery processes to minimise energy consumption • Percentage of awareness on waste management • Percentage of IT project delivery processes to minimise waste • Percentage of managing IT project

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
				through digital communication such as teleconferencing/video conferencing) instead of travelling to the meeting location
			PSAR03.3: Confirm social sustainability of the IT project	• Percentage of awareness on labour practices • Percentage of awareness on health and safety standards and regulations • Number of health and safety incidents that occurred during the implementation of the IT project • Percentage of awareness on human rights laws and policies in the IT project • Number of child labour involved in the IT project
				• Percentage of end-users/customers who received training • Percentage of awareness on social responsibility • Number of community out-reach programs supported by the IT

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
				project • Number of bribery and corruption prevention policies in the organisation • Percentage of IT project team awareness on bribery and corruption prevention • Number of the IT project corruption cases occurred due to unethical behaviour • Percentage of awareness on procurement practices in the IT project
	PSAR04: Evaluate Pre-Audit report (Initiation phase)	Examine pre-audit report from the initiation phase of the IT project life cycle in order to determine whether the IT project auditing recommendations can assure successful delivery of the IT project.	**PSAR04.1:** Assess competence of auditors who audited IT project	• List of auditors qualified with project management experience • Number of years' auditors experienced in auditing projects
			PSAR04.2: Confirm that meetings were conducted between auditors, top management and project manager	• Number of meetings conducted (Minutes of the audit meetings) • Minutes indicating top management member attending the audit report approval meeting
				• Number of open IT project audit recommendations against the

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
				closed audits
			PSAR04.3: Confirm that audit report covered all expected basic deliverables from the initiation phase of the IT project life cycle	• Percentage of deviation between IT project audited items and expected basic deliverables from the initiation phase of the IT project life cycle
	PSAR05: Assess external environment	Evaluate the impact of political, economic, social, technological and legal requirements might have on the IT project. Ensure external environment is conducive for the successful delivery of the IT project.	**PSAR05.1:**Confirm that IT project is compliant with legal and regulatory requirements	• List of legal and regulatory requirements
			PSAR05.2: Confirm that political environment is conducive for implementing IT project activities	• List of political risks that affects the implementation of the IT project • List of political factors that affects the implementation of the IT project
			PSAR05.3: Confirm that state of economy is conducive for implementing IT project activities	• List of economic factors that affects the implementation of the IT project
			PSAR05.4: Confirm that social and cultural issues are integrated with the IT project activities	• List of social factors which affect the IT project • List of cultural factors which affect the IT project
			PSAR05.5: Confirm that there is a technology management strategy in place	• List of emerging technologies which may have impact on the IT project

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
1. b. Project Business Justification Review **(PBJR)**	**PBJR01:** Assess business case	Ensure business case meets the needs of the business, addresses the IT project objectives, estimates IT project costs, identifies project risks and benefits as well as justifies whether it is worth investing in the IT project.	**PBJR01.1:**Confirm that business case addressed the business needs, business problem(s) and objectives of the IT project	• List of the business needs defined in the business case • List of the IT project objectives addressed in the business case • List of the existing business problem(s) addressed in the business case • List of recommended options to resolve the business problem(s)
			PBJR01.2: Confirm that high-level project risks and benefits to the organisation were identified in the business case	• List of high-level identified risks to the IT project • List of identified benefits from the IT project
			PBJR01.3: Confirm that IT project deliverables were addressed in the business case	• List of IT project deliverables
			PBJR01.4: Ensure that IT project budget was established and approved	• List of top management and stakeholders involved in the preparation of the IT project budget • Minutes indicating top management member attending the approval meeting

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			PBJR01.5: Ensure that resources required to implement IT project activities were established	• List of resources required to implement IT project activities
			PBJR01.6: Confirm that the sources of the IT project funding and amounts were included in the business case	• List of identified sources of the IT project funding and amounts
	PBJR02: Assess involvement of top management and other stakeholders	Ensure that top management and stakeholders are involved to develop and approve the business case as well as using it in the IT project investment decision making.	**PBJR02.1:** Confirm that top management and stakeholders were involved during the development of the business case	• Minutes of the meeting indicating top management member and stakeholders attending the development of the business case
			PBJR02.2: Confirm that top management and stakeholders were involved in the approval of the business case	• Minutes of the meetings indicating approval • Minutes indicating top management member and stakeholder attending the approval meeting
1. c. Project Approval Review **(PAR)**	**PAR01:** Ensure that project governance structure is established	Confirm that a project governance structure is established, and that it provides the project manager and team with structure,	**PAR01.1:** Confirm that project governance structure is established	• Project governance structure diagram • Project Management Office(PMO) with defined roles and responsibilities, equipped and

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		processes, and a decision-making framework for managing the IT project, while supporting and controlling the IT project for successful delivery.		operational
			PAR01.2: Confirm that competent project manager was appointed	• Minutes indicating top management member attending the appointment meeting of a project manager • List of qualifications in project management discipline • Number of years' project manager experienced in managing projects • Competence level of a project manager
	PAR02: Assess authorisation of IT project to start	Evaluate how the IT project obtained authorisation to start. Top management and project stakeholders determine whether there is sufficient justification for the	**PAR02.1:**Confirm that approved project documents were distributed to the members of project governance board prior to the meeting to authorise the IT project to start	• Distribution list of the project documents to the members of project governance board • List of project documents

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		organisation to undertake the IT project.	**PAR02.2:**Confirm that project governance board approved IT project to start	• Minutes indicating project governance board member attending the approval meeting • List of all documents used to authorise IT project to start

IT PROJECT LIFE CYCLE: PLANNING PHASE

IT PROJECT ASSURANCE REVIEW: GATE 2

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
2. Project Management Plans Review **(PMPR)**	**PMPR01:** Develop IT project management plans	Ensure that IT project management plans are developed, and are realistic in achieving the IT project outcomes. IT project management plans describe the management of project scope, time, cost, quality, communications, human resources, risks, procurements, integration, stakeholder engagement, social responsibilities, user acceptance test, project fraud and corruption prevention, benefits realisation, conflict management, and other relevant specific plans.	**PMPR01.1:**Confirm that IT project scope management plan is developed	• Confirmation of collected stakeholder needs and requirements • Statement of the IT project scope • Work breakdown structure (WBS)
			PMPR01.2: Confirm that IT project time management plan is developed	• Developed schedule for the IT project
			PMPR01.3: Confirm that IT project cost management plan is developed	• Estimated IT project costs • Determined IT project budget
			PMPR01.4: Confirm that quality is managed in the IT project	• Defined quality standards • IT Project quality management plan • Quality assurance plan • Quality control measurements to ensure that IT project deliverables complied with quality standards
			PMPR01.5: Confirm that IT project human resources management plan is developed	• Identified IT project roles, responsibilities and required skills • Mapping of acquired IT project

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
				team with roles and responsibilities, qualifications and years of experience in
				project activities to the identified required roles and responsibilities • Staffing management plan • Percentage of awareness on professional and ethical behaviour of the project team members
			PMPR01.6: Ensure effective communication between internal and external stakeholders throughout the IT project life cycle	• IT project communications management plan
			PMPR01.7: Confirm that there is a process to conduct risk management activities for the IT project	• IT project risk management plan
			PMPR01.8: Confirm that project risk register is regularly reviewed and updated	• Identified new risks • Updated risk register
			PMPR01.9: Confirm that correct project procurement processes are followed	• IT project procurement management plan • IT project procurement strategy is complying with procurement Act and rules

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			PMPR01.10: Confirm that there are management strategies to engage and managed stakeholders throughout the IT project life cycle	• IT Project stakeholder management plan
			PMPR01.11: Ensure that project activities are coordinated throughout the IT project life cycle	• IT project integration plan
			PMPR01.12: Confirm that user acceptance testing is done to the end-user's satisfaction	• Acceptance criteria • User acceptance test plan
			PMPR01.13: Confirm that unethical behaviour are identified and managed throughout the IT project life cycle	• Project fraud and corruption prevention plan
			PMPR01.14: Confirm that social responsibilities have been addressed in the IT project	• Project social responsibility plan
			PMPR01.15: Confirm that project benefits are identified, managed and can be realised	• Benefits realisation management plan
			PMPR01.16: Ensure resolution of	• Project conflict management plan

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			conflicts throughout the IT project life cycle	
			PMPR01.17: Confirm how the IT project management plans are monitored and controlled	• Process to monitor and control IT project management plans
	PMPR02: Align IT project management with project management methodology and/or standard.	Ensure that IT project management is aligned with project management methodology and standards such as PRINCE2, PMBOK, P2M, APMBOK etc.	**PMPR02.1:**Confirm that IT project management is aligned with project management methodology and/or standard	• The selected project management methodology or standard
	PMPR03: Assess involvement of top management and key stakeholders	Ensure that top management and key stakeholders understood and approve the IT project management plans.	**PMPR03.1:**Confirm that top management is involved in the approval of the IT project management plans	• Minutes of meetings indicating approval • Minutes indicating top management member attending the approval meeting
	PMPR04: Evaluate pre-audit report (planning phase audit)	Examine pre-audit report from the planning phase of the IT project life cycle in order to determine whether the IT	**PMPR04.1:**Confirm that audit report covered all expected basic deliverables from the planning phase of the IT project life cycle	• Percentage of deviation between IT project audited items and expected basic deliverables from the planning phase

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		project auditing recommendations can assure successful delivery of the IT project.	**PMPR04.2:**Confirm that meetings are conducted between auditors, top management and project manager to review and approve planning phase audit report	• Minutes of the audit meetings • Minutes indicating top management member attending audit report (of the planning phase) approval meeting
	PMPR05: Validate business case against the original requirements	Confirm that business case is still valid before starting to implement IT project. Evaluate the business case to check if it is unaffected by internal and external events or changes.	**PMPR05.1:**Confirm that business case is still valid	• Percentage of deviation between the original business case and the current environment • Updated business case
	PMPR06: Update IT project management plans	Monitor and control the ongoing project activities against IT project management plans to identify areas in which changes to the plans are required.	**PMPR06.1:**Confirm the areas required to be updated in the IT project management plans, and the reasons of updating them	• Identified areas to be updated • Reasons for IT project management plans updates • Updated project management plans
			PMPR06.2: Confirm that IT project management plans changes are monitored, updated and managed	• Change management processes
	PMPR07: Validate organisation	Assess organisational readiness to start executing IT	**PMPR07.1:**Confirm that project governance structure is in place	• Approved composition of project governance structure

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
	readiness to execute IT project	project.	**PMPR07.2:**Confirm that project manager is appointed	• Appointed project manager
			PMPR07.3: Confirm that project team is in place and ready to implement the IT project	• Approved project team members
			PMPR07.4: Confirm that Project Management Office (PMO) is equipped	• PMO in place and ready to operate
			PMPR07.5: Confirm that top management, project manager, project team and stakeholders are committed to the implementation of the IT project	• Signed binding agreement
			PMPR07.6: Confirm that all required resources are in place to start implementing IT project	• Approved budget • Approved physical resources • Approved human resources
			PMPR07.7: Confirm that project management plans and project documents are in place to start implementing IT project	• Approved IT project management plans • Approved project documents

IT PROJECT LIFE CYCLE: EXECUTION PHASE

IT PROJECT ASSURANCE REVIEW: GATE 3

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
3. Project Implementation Review **(PIR)**	**PIR01:** Ensure involvement of top management and other stakeholders	Confirm that top management and key stakeholders are involved to review and approve progress reports during the implementation of the IT project	**PIR01.1:**Confirm that project manager meets regularly with project team members to review progress of the IT project activities	• Process to review progress of the IT project
			PIR01.2: Confirm that project manager has prepared IT project progress report to submit to the top management	• IT project progress reports
			PIR01.3: Confirm that top management and project manager meet to review and approve IT project progress report	• Minutes indicating top management members and project manager attending meeting to review and approve project progress report • Approved project progress report
			PIR01.4: Ensure that project team members are continuous involved to implement IT project activities	• Process to review performance of the project team members

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
	PIR02: Evaluate organisation readiness for service	Assess to determine whether the organisation is ready to implement the business changes, and IT project product is robust before delivery.	**PIR02.1:**Confirm that organisation is ready to implement the business change	• Change management plan is in place • Capability assessment report for operating and maintaining the IT project product • Migration plan • IT security policy and strategy documents • Business continuity plan • Disaster recovery plan • Manuals for how to operate the IT project product
			PIR02.2: Confirm that IT project product is adhering to specifications and requirements	• Process to review that IT project product complies with specifications and requirements
	PIR03. Monitor and control implementation of the IT project activities	Ensure continuous monitoring and controlling of the IT project activities against the project management plans. Monitoring and controlling track the project progress, identify variances from the IT project management plans and	**PIR03.1:**Confirm that IT project activities are monitored and controlled	• Identified variances from the IT project management plans • IT project progress report • Change requests • IT project management plans updates
			PIR03.2: Confirm that integrated change controls are performed	• Change log

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		recommend corrective or preventive action to be taken.	**PIR03.3:** Ensure that the project scope is validated	• Approved change requests • Updated IT project scope
			PIR03.4: Confirm that project schedule is controlled, changes are managed and updated	• Updated IT project time management plan • Updated project schedule
			PIR03.5: Confirm that project costs baseline is controlled, changes are managed and updated	• Project costs approved change requests • Updated IT project cost management plan • Update IT project budget
			PIR03.6: Confirm that IT project product quality is monitored, controlled, changes are managed and updated	• Approved change requests • Updated IT project quality management plan
			PIR03.7: Confirm that project risks are monitored and controlled throughout the entire IT project life cycle	• Approved change requests • Updated risk register • Updated IT project risks management plan
			PIR03.8: Confirm that procurements are controlled by managing procurements relationship, monitor contract performance and manage	• Process to manage procurements relationship • Contract performance report • Approved change requests • Updated IT project procurement

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			changes in the contracts	management plan • Contracts updates
			PIR03.9: Confirm that communication between project stakeholders is controlled and changes are managed throughout the IT project life cycle	• Approved change requests • Updated IT project communication plan • Process to communicate changes to project schedule, costs, scope, procurements, stakeholder engagement and resources
			PIR03.10: Ensure that external environment is still conducive to continue implementing the IT project activities	• External environment assessment report
	PIR04: Ensure adequate project funding	Ensure that sufficient project funds are available to implement IT project activities throughout the IT project life cycle.	**PIR04.1:**Confirm that there are still sufficient funds to continue implementing IT project activities.	• Project fund management guidelines • Project funds income and expenditure report • Project funds mobilisation strategy
	PIR05: Evaluate IT project fraud and corruption management	Assess management of project fraud and corruption during the implementation of the IT project activities.	**PIR05.1:**Confirm that IT project management is adhering to the anticorruption policy	• Project stakeholders trained on project anticorruption • Anticorruption agreement signed by top management, project

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
				manager, project team members, vendors/contractors, and other stakeholders
			PIR05.2: Confirm that the project fraud and corruption cases are managed	• Identified fraud and corruption cases • Number of identified cases referred for disciplinary action • Fraud and corruption cases management plan
	PIR06: Evaluate conflict management	Assess how conflicts are managed during the implementation of the IT project activities.	**PIR06.1:** Confirm that conflicts are resolved during the implementation of the IT project activities	• Conflict management plan • Resolved conflicts
	PIR07: Evaluate existence of reward or motivation scheme provided to the IT project team members	Assess to determine whether there is reward or motivation scheme provided to the project team members. Motivating project team enhances their productivity throughout the IT project life cycle.	**PIR07.1:** Confirm that project team members are motivated or rewarded according to their performance	• Interventions when project team members are not motivated
	PIR08: Adhere to project management methodology	Evaluate to determine whether the implementation of the IT project activities is adhering to the selected project management methodology	**PIR08.1:** Confirm that IT project management is adhering to project management methodology and/or standard	• Process to monitor the utilisation of the selected project management methodology

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		and/or standard.		
	PIR09: Evaluate IT project product security management	Assess to ensure that the information security is addressed and managed in the IT project product.	**PIR09.1:**Confirm that information security is addressed and managed in the IT project product	• Percentage of awareness on the information security to top management, end-users and other project stakeholders • IT security policy and strategy documents in place
	PIR10: Evaluate mid-audit report from the execution phase	Examine mid-audit reports from the pre-go live and go-live audits in the execution phase of the IT project life cycle, in order to determine whether the IT project auditing recommendations can assure successful delivery of the IT project.	**PIR10.1:**Confirm that meetings are conducted between auditors, top management and project manager	• Minutes of the audit meetings • Minutes indicating top management member attending the audit report approval meeting
			PIR10.2: Confirm that audit report covered all expected basic deliverables from the execution phase of the IT project life cycle	• Percentage of deviation between IT project audited items and expected basic deliverables from the execution phase of the IT project life cycle
	PIR11: Validate business case against the original requirements	Confirm that business case is still valid during the implementation of the IT project activities. Evaluate the business case to check if it is unaffected by internal and external events or changes	**PIR11.1:**Confirm that business case is still valid	• Percentage of deviation between the original business case and the current environment • Updated business case

IT PROJECT LIFE CYCLE: CLOSING PHASE

IT PROJECT ASSURANCE REVIEW: GATE 4

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
4. Project Closing Review **(PCR)**	**PCR01:** Evaluate project readiness for closure	Assess to determine whether the IT project is ready for closure, organisation is ready to implement business change and manage service delivery as well as the project benefits are expected to be realised.	**PCR01.1:**Confirm that the project benefits are likely to be realised	• Benefits review plan in place • Benefits management plan in place
			PCR01.2: Confirm that the organisation is ready to implement business changes	• Organisational business change management plan in place
			PCR01.3: Ensure that organisation is ready to implement IT service	• IT service management plan in place which is aligned with best practices such as • ISO/IEC20000 standard, Information Technology Infrastructure Library (ITIL) framework • Integration of IT service management and benefit management for continued benefits realisation
			PCR01.4: Ensure that organisation has capability to support and maintain the final product	• Capability assessment report which determines if the organisation has internal competences and capability to support and maintain the final product

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			PCR01.5: Confirm that external environment is still conducive to operate IT project product and provide services	• External environment assessment report
	PCR02: Evaluate mid-audit report (closing phase audit)	Examine mid-audit report from the closing phase of the IT project life cycle in order to determine whether the final IT project product is delivered successful.	**PCR02.1:**Confirm that audit report covered all expected basic deliverables from the closing phase of the IT project life cycle	• Percentage of deviation between IT project audited items and expected basic deliverables from the closing phase of the IT project life cycle • Reasons for the deviation
			PCR02.2: Confirm that closing phase audit report assured that the successful final project product is delivered	• Audit recommendations
			PCR02.3: Confirm that meetings are conducted between auditors, top management and project manager to review and approve project closing phase audit report	• Minutes of the audit meetings • Minutes indicating top management member attending audit report approval meeting

IT PROJECT LIFE CYCLE: OPERATIONS AND MAINTENANCE PHASE

IT PROJECT ASSURANCE REVIEW: GATE 5

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
5. Project Benefits Realisation Review **(PBRR)**	**PBRR01:** Assess benefits identification	Ensure that the appropriate benefits are identified and quantified with business stakeholders. Assess to determine whether the project's benefits are linked with the organisation's strategic and business objectives.	**PBRR01.1**:Confirm that the project's benefits are linked with the IT project's strategic objectives	• Defined SMART project objectives aligned with organisational strategic objectives • Benefits map linking project's benefits with the project's objectives
			PBRR01.2:Confirm that the expected project benefits are included in the business case	• Business case approved by the project governance board • Benefits register established
			PBRR01.3:Confirm that identified benefits are endorsed by the top management	• Minutes of the meeting indicating top management members endorsed identified project's benefits
	PBRR02: Assess benefits planning	Ensure that the identified benefits satisfy both the organisation and all its stakeholders. Benefits planning involve the development of: (i) benefits realisation plan, (ii) measures and Key	**PBRR02.1:**Assure that the benefits realisation plan can deliver on the identified benefits	• Expected benefits linking with IT project's objectives • Potential impact assessment of the project's benefits to the organisation
			PBRR02.2: Confirm that the benefits realisation plan is endorsed by the top management	• Minutes of the meeting indicating top management members

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		Performance Indicators (KPIs) to assess the performance of the benefits realisation plan, and		endorsed the benefits realisation plan
			PBRR02.3: Confirm that the risks associated with benefits realisation are identified	• Risk register • Risk assessment and mitigation plan
		(iii) the framework for monitoring, controlling and communicating the benefits realised.	**PBRR02.4:**Ensure continuous monitoring of business changes and benefits realisation throughout the IT project life cycle	• Governance framework in place to oversight and monitor business changes and benefits realisation • Processes to track, review the progress and performance of benefits realisation
			PBRR02.5:Ensure there are measures for benefit performance	• Key performance indicators and measurements methods in place to measure the benefits performance
	PBRR03: Assess benefits delivery	Ensure the implementation of the IT project brings organisational business changes and the planned project's benefits are delivered.	**PBRR03.1:**Confirm that the planned project's benefits are delivered	• Percentage of deviation between the planned project benefits in the benefits realisation plan and the actual delivered project's benefits • Reasons for deviation • Updated benefits register

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
			PBRR03.2: Confirm what causes some of the planned benefits not to be delivered	• Reasons for not undelivered planned benefits • Benefits' actions plan established
			PBRR03.3: Confirm that the disbenefits are monitored and managed	• Reasons for disbenefits • Remedial actions are in place for the disbenefits • Updated disbenefits register
			PBRR03.4: Ensure that top management and other stakeholders are committed to deliver project's benefits	• Minutes indicating top management endorsement of benefits delivered Involvement of other stakeholders to develop departmental benefits management framework
			PBRR03.5: Assure that the organisation can manage and deliver the planned benefits	• Organisation's capacity and capability assessment report
			PBRR03.6: Confirm that benefits are transferred and embedded into the operations function	• KPIs to measure performance of the benefits transition plan • Established ownership of benefits realisation and transition

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
	PBRR04:Assess benefits review	Assess the success of the IT project in terms of the potential benefits, the delivered benefits, and the identification of the ways by which opportunities for further benefits are realised.	**PBRR04.1:**Confirm that expected organisational business benefits are realised	• Magnitude of the business value delivered to the organisation and its beneficiaries • Realised business benefits are reflected in the up-to-date approved business case
			PBRR04.2: Confirm what has contributed to the benefits realisation	• Factors contributed to the benefits realisation • Lessons learned document in place
			PBRR04.3: Ensure that the organisation capacity to successfully realise benefits from the IT project is continuously enhanced	• Application of the lessons learned • KPIs to measure performance of the benefits realisation capacity building plan
	PBRR05: Assess benefits sustainment	Ensure benefits are sustained throughout the lifecycle of the change initiative. Benefits monitoring, controlling, taking corrective actions and developing benefits realisation capability are significant in the	**PBRR05.1:**Ensure that organisational benefits realisation is sustained	• KPIs to measure the performance of the benefits sustainment plan • KPIs to measure the performance of the benefits realisation capacity building plan • Integration of IT service management and benefits

IT PROJECT ASSURANCE REVIEW AREAS	HIGH - LEVEL IT PROJECT ASSURANCE PROCESSES	PROCESS DESCRIPTION	IT PROJECT ASSURANCE PROCESSES	KEY IT PROJECT ASSURANCE INDICATORS
		organisation.		management
			PBRR05.2: Ensure continuous monitoring of performance of the product, IT service, and capability of the organisation	• Comparison of actual performance to the planned performance • Reasons for deviations between the actual performance and the planned performance
			PBRR05.3: Ensure that emerging benefits are documented and reported	• Updated benefits register • Emerging benefits action plan in place
			PBRR05.4: Assure that support and maintenance can sustain the product and IT service	• Performance of the Service Level Agreement • Customer and stakeholder satisfaction experiences are continuously assessed
			PBRR05.5: Ensure that there is a strategy for the product disposal or phase out from the organisation	• Reasons for product phase out • Product disposal plan

APPENDIX C: FOCUS GROUP INTERVIEW GUIDE

Section A: Opening question

1. Provide me your name and one successful IT project you managed or be involved in the last year?

Section B: Introductory question

2. Which controls do you have in place to ensure that IT projects are delivered successfully in your organisation?

Section C: Transition question

3. Could you briefly tell me, what are some of the reasons why your organisation audit projects during their implementation?

Section D: Key questions

4. Initiation phase

IT project assurance processes which assess:

(i) Strategic alignment of IT project with organisational strategy and business objectives

(ii) Business justification to invest in the IT project

(iii) Approval to start IT project

(iv) Audit report from the initiation phase

What are your views and suggestions to improve the proposed IT project assurance processes in the initiation phase?

5. Planning phase

IT project assurance processes which assess:

(i) IT project plans are developed, updated and realistic in achieving the IT projects outcomes

(ii) IT project management is aligned with project management methodology standards and best practice

(iii) Validate business case

(iv) Organisational readiness to start executing IT project

(v) Audit report from the planning phase

What are your views and suggestions to improve the proposed IT project assurance processes in the planning phase?

6. **Execution phase**

IT project assurance processes which assess:

(i) Performance of the implemented IT project activities against the planned activities in the project management plans

(ii) Ensure adequate project funding

(iii) Involvement of top management and project stakeholders

(iv) Adherence to project management methodology

(v) Assess IT project fraud and corruption management

(vi) Assess IT project conflict management

(vii) Assess IT security management to the IT project deliverables

(viii) Assess existence of motivation scheme to the project team members

(ix) Validate business case

(x) Environmental assessment

(xi) Assess organisational readiness for change

(xii) Audit report from the execution phase

What are your views and suggestions to improve the proposed IT project assurance processes in the execution phase?

7. **Closing phase**

IT project assurance processes which assess:

(i) IT project readiness for closure

(ii) Audit report from the closing phase

What are your views and suggestions to improve the proposed IT project assurance processes in the closing phase?

8. **Operations and maintenance phase**

IT project assurance processes which assess:

(i) Benefits realisation

(ii) Audit report from the operations and maintenance phase

What are your views and suggestions to improve the proposed IT project assurance processes in the operations and maintenance phase?

Section E: Concluding questions

9. (a) Do you think this framework for IT project assurance can be used in your organisation?

(b) What would be the benefits of using this framework?

Section F: Final question

10. Is there anything that we missed in our conversation?

*****************End ******************

APPENDIX D: SURVEY QUESTIONNAIRES

QUESTIONNAIRE FOR A SUCCESSFUL INFORMATION TECHNOLOGY PROJECT

UNIVERSITY OF JOHANNESBURG

Dear Survey Participant,

Organisations worldwide continue to invest in Information Technology (IT) projects by aligning IT project activities with their business strategy to achieve strategic goals and create business value for the organisation. However, IT projects still fail at an alarming high rate.

The purpose of this study is to examine how well specific processes are implemented when a particular project outcome is achieved and how important you believe these processes are to achieve a successful project outcome. I am inviting you to participate in this survey which should only take about 10-15 minutes of your time. Your answers will be kept confidential in a secured database.

If you have any queries or concerns in the study, please do not hesitate to contact me through my email: emkoba72@yahoo.com. You may also contact my supervisor, **Prof. Carl Marnewick**, email: cmarnewick@uj.ac.za and on Tel: 011-559 1316.

Thank you for taking the time to help further our understanding of the relationship between IT project processes and project outcomes. **Note: The deadline to receive your response is 27th July, 2017, please take a note in your diary.**

Yours faithfully,

Elizabeth Mkoba.

PhD Student in Information Technology Management,

University of Johannesburg.

QUESTIONNAIRE FOR A SUCCESSFUL INFORMATION TECHNOLOGY PROJECT

When answering this questionnaire I would like you to answer the questions in relation to the most recent project your organisation managed that was *successful*. A successful IT project is one where the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives.

SECTION A: DEMOGRAPHIC DATA

a) Please tell us about yourself. Please answer by putting a cross (x) in the appropriate box

1. Gender

Male [ ]

Female [ ]

2. Organisation type

Public sector [ ]

Private sector [ ]

Other (Please specify) ………………………………………………………

3. Please indicate the relevant project management certification(s) you possess?

Certified Associate in Project Management (CAPM) [ ]

Project Management Professional (PMP) [ ]

PMI Agile Certified Practitioner (PMI-ACP) [ ]

PMI Risk Management Professional (PMI-RMP) [ ]

PMI Scheduling Professional (PMI-SP) [ ]

Advanced Project Management Certification (APMC) [ ]

CompTIA IT Project+ [ ]

Certificated Project Management Associate (IPMA Level D) [ ]

Certificated Project Manager (IPMA Level C) [ ]

Certificated Senior Project Manager (IPMA Level B) [ ]

Certificated Projects Director (IPMA Level A) [ ]

PRINCE2 Foundation [ ]

PRINCE2 Practitioner [ ]

PRINCE2 Professional [ ]

Other (Please specify) ……………………………………………………………..

4. How many IT projects do you currently manage in your organisation?

Please write down the number of IT projects you currently manage [ ]

5. How many years of experience do you have in managing projects?

Less than 5 years [ ]

Between 5 years and 10 years [ ]

More than 10 years [ ]

SECTION B: PROJECT ASSURANCE PROCESSES IN THE INITIATION PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that was successful (the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives).

b) Below is a list of project assurance processes that could occur during the initiation phase of a project. Thinking about the most recent project your organisation managed which was *successful*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was successful. Then, in Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.

Code	Project assurance processes that could have been implemented during the **initiation phase** of the project that was successful:	**Column A: Quality of Implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PSAR1	Aligned IT project with organisational strategy and business objectives											
PSAR2	Provided business justification to invest in the IT project											
PSAR3	Provided approval to start IT project											
PSAR4	Performed a project audit											
PSAR5	Aligned IT project with the existing programme in the organisation											

SECTION C: PROJECT ASSURANCE PROCESSES IN THE PLANNING PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that was successful (the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives).

c) **Below is a list of project assurance processes that could be used in the planning phase. Thinking about the most recent project managed by your organisation which was *successful*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was successful. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **planning phase** of the project that was successful:	**Column A: Quality of Implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PMPR1	Involved top management and project stakeholders in developing project plans											
PMPR2	Ensured that project plans are developed, updated and realistic in achieving IT project outcomes											
PMPR3	Aligned IT project management with project management methodology and standards											
PMPR4	Ensured that the business case is still valid											
PMPR5	Assessed organisational readiness to execute the IT project											
PMPR6	Performed a project audit											

SECTION D: PROJECT ASSURANCE PROCESSES IN THE EXECUTION PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that was successful (the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives).

d) Below is a list of project assurance processes that could be used in the execution phase. Thinking about the most recent project managed by your organisation which was *successful*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was successful. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.

Code	Project assurance processes that could be implemented during the **execution phase** of the project that was successful:	Column A: Quality of Implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PIR1	Assessed performance of the implemented IT project activities against planned activities in the project management plans											
PIR2	Ensured adequate project funding											
PIR3	Involved top management and project stakeholders during the execution of the IT project activities											
PIR4	Ensured adherence to project management methodology											
PIR5	Prevented IT project fraud and corruption											
PIR6	Provided IT project conflict management											
PIR7	Assessed IT security management to the IT project deliverables											

Code	Project assurance processes that could be implemented during the **execution phase** of the project that was successful:	Column A: Quality of Implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PIR8	Provided a motivation scheme for the project team members											
PIR9	Confirmed that the business case is still valid											
PIR10	Evaluated the external environment to ensure that is still conducive to implement IT project activities											
PIR11	Confirmed that the organisation is ready for change											
PIR12	Performed a project audit											

SECTION E: PROJECT ASSURANCE PROCESSES IN THE CLOSING PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that was successful (the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives).

e) **Below is a list of project assurance processes that could be used in the closing phase. Thinking about the most recent project managed by your organisation which was *successful*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was successful. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **closing phase** of the project that was successful:	Column A: Quality of implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PCR1	Confirmed that the IT project is ready for closure											
PCR2	Confirmed that the organisation has the capability to support and maintain the IT product											
PCR3	Confirmed that the environment is still conducive to provide IT services											
PCR4	Performed a project audit											

SECTION F: PROJECT ASSURANCE PROCESSES IN THE OPERATIONS AND MAINTENANCE PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that was successful (the project was delivered on time, on budget, with required features and functions, met customers' satisfaction and the stakeholders' needs, and resulted in achieving organisational goals and strategic objectives).

f) Below is a list of project assurance processes that could be used in the operations and maintenance phase. Thinking about the most recent project managed by your organisation which was *successful*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was successful. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.

Code	Project assurance processes that could have been implemented in the **operations and maintenance phase** of the project that was successful:	**Column A: Quality of implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PBRR1	Confirmed that the planned benefits are realised from the IT project											
PBRR2	Ensured that organisational benefits realisation is sustained											
PBRR3	Identified what causes some of the planned benefits not to be delivered											
PBRR4	Confirmed that the benefits register is updated											
PBRR5	Performed a project audit											

****** Thank you very much for your valuable time ******

QUESTIONNAIRE FOR A CHALLENGED INFORMATION TECHNOLOGY PROJECT

Dear Survey Participant,

Organisations worldwide continue to invest in Information Technology (IT) projects by aligning IT project activities with their business strategy to achieve strategic goals and create business value for the organisation. However, IT projects still fail at an alarming high rate.

The purpose of this study is to examine how well specific processes are implemented when a particular project outcome is achieved and how important you believe these processes are to achieve a successful project outcome. I am inviting you to participate in this survey which should only take about 10-15 minutes of your time. Your answers will be kept confidential in a secured database.

If you have any queries or concerns in the study, please do not hesitate to contact me through my email: emkoba72@yahoo.com. You may also contact my supervisor, **Prof. Carl Marnewick**, email: cmarnewick@uj.ac.za and on Tel: 011-559 1316.

Thank you for taking the time to help further our understanding of the relationship between IT project processes and project outcomes. **Note: The deadline to receive your response is 27th July, 2017, please take a note in your diary.**

Yours faithfully,

Elizabeth Mkoba.

PhD Student in Information Technology Management,

University of Johannesburg.

QUESTIONNAIRE FOR A CHALLENGED INFORMATION TECHNOLOGY PROJECT

When answering this questionnaire I would like you to answer the questions in relation to the most recent project your organisation managed that *was challenged*. A challenged IT project is one where the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation.

SECTION A: DEMOGRAPHIC DATA

a) Please tell us about yourself. Please answer by putting a cross (x) in the appropriate box

1. **Gender**

   Male [ ]

   Female [ ]

2. **Organisation type**

   Public sector [ ]

   Private sector [ ]

   Other (Please specify) ……………………………………………………….

3. **Please indicate the relevant project management certification(s) you possess?**

   Certified Associate in Project Management (CAPM) [ ]

   Project Management Professional (PMP) [ ]

   PMI Agile Certified Practitioner (PMI-ACP) [ ]

   PMI Risk Management Professional (PMI-RMP) [ ]

   PMI Scheduling Professional (PMI-SP) [ ]

   Advanced Project Management Certification (APMC) [ ]

   CompTIA IT Project+ [ ]

   Certificated Project Management Associate (IPMA Level D) [ ]

   Certificated Project Manager (IPMA Level C) [ ]

   Certificated Senior Project Manager (IPMA Level B) [ ]

   Certificated Projects Director (IPMA Level A) [ ]

   PRINCE2 Foundation [ ]

   PRINCE2 Practitioner [ ]

   PRINCE2 Professional [ ]

   Other (Please specify) ……………………………………………………………..

4. **How many IT projects do you currently manage in your organisation?**

   Please write down the number of IT projects you currently manage [ ]

5. How many years of experience do you have in managing projects?

Less than 5 years [ ]

Between 5 years and 10 years [ ]

More than 10 years [ ]

SECTION B: PROJECT ASSURANCE PROCESSES IN THE INITIATION PHASE

Instruction: When completing this section think of the most recent challenged IT project that was managed by your organisation (the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation).

a) **Below is a list of project assurance processes that could occur during the initiation phase of a project. Thinking about the most recent project your organisation managed which was *challenged*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was challenged. Then, in Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **initiation phase** of the project that was challenged:	**Column A: Quality of implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PSAR1	Aligned IT project with organisational strategy and business objectives											
PSAR2	Provided business justification to invest in the IT project											
PSAR3	Provided approval to start IT project											
PSAR4	Performed a project audit											
PSAR5	Aligned IT project with the existing programme in the organisation											

SECTION C: PROJECT ASSURANCE PROCESSES IN THE PLANNING PHASE

Instruction: When completing this section think of the most recent challenged IT project that was managed by your organisation (the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation).

b) Below is a list of project assurance processes that could be used in the planning phase. Thinking about the most recent project managed by your organisation which was *challenged*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was challenged. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.

Code	Project assurance processes that could have been implemented during the **planning phase** of the project that was challenged:	**Column A: Quality of implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PMPR1	Involved top management and project stakeholders in developing project plans											
PMPR2	Ensured that project plans are developed, updated and realistic in achieving IT project outcomes											
PMPR3	Aligned IT project management with project management methodology and standards											
PMPR4	Ensured that the business case is still valid											
PMPR5	Assessed organisational readiness to execute the IT project											
PMPR6	Performed a project audit											

SECTION D: PROJECT ASSURANCE PROCESSES IN THE EXECUTION PHASE

Instruction: When completing this section think of the most recent challenged IT project that was managed by your organisation (the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation).

c) **Below is a list of project assurance processes that could be used in the execution phase. Thinking about the most recent project managed by your organisation which was *challenged*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was challenged. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could be implemented during the **execution phase** of the project that was challenged:	**Column A: Quality of implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PIR1	Assessed performance of the implemented IT project activities against planned activities in the project management plans											
PIR2	Ensured adequate project funding											
PIR3	Involved top management and project stakeholders during the execution of the IT project activities											
PIR4	Ensured adherence to project management methodology											
PIR5	Prevented IT project fraud and corruption											
PIR6	Provided IT project conflict management											
PIR7	Assessed IT security management to the IT project deliverables											

Code	Project assurance processes that could be implemented during the **execution phase** of the project that was challenged:	Column A: Quality of implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PIR8	Provided a motivation scheme for the project team members											
PIR9	Confirmed that the business case is still valid											
PIR10	Evaluated the external environment to ensure that is still conducive to implement IT project activities											
PIR11	Confirmed that the organisation is ready for change											
PIR12	Performed a project audit											

SECTION E: PROJECT ASSURANCE PROCESSES IN THE CLOSING PHASE

Instruction: When completing this section think of the most recent challenged IT project that was managed by your organisation (the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation).

d) Below is a list of project assurance processes that could be used in the closing phase. Thinking about the most recent project managed by your organisation which was *challenged*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was challenged. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.

Code	Project assurance processes that could have been implemented during the **closing phase** of the project that was challenged:	Column A: Quality of Implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PCR1	Confirmed that the IT project is ready for closure											
PCR2	Confirmed that the organisation has the capability to support and maintain the IT product											
PCR3	Confirmed that the environment is still conducive to provide IT services											
PCR4	Performed a project audit											

SECTION F: PROJECT ASSURANCE PROCESSES IN THE OPERATIONS AND MAINTENANCE PHASE

Instruction: When completing this section think of the most recent challenged IT project that was managed by your organisation (the project was delivered late, over budget, and/or with less than the required features and functions, but was used in the organisation).

e) **Below is a list of project assurance processes that could be used in the operations and maintenance phase. Thinking about the most recent project managed by your organisation which was *challenged*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that was challenged. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented in the **operations and maintenance phase** of the project that was challenged:	**Column A: Level of quality implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PBRR1	Confirmed that the planned benefits are realised from the IT project											
PBRR2	Ensured that organisational benefits realisation is sustained											
PBRR3	Identified what causes some of the planned benefits not to be delivered											
PBRR4	Confirmed that the benefits register is updated											
PBRR5	Performed a project audit											

****** Thank you very much for your valuable time ******

QUESTIONNAIRE FOR A FAILED INFORMATION TECHNOLOGY PROJECT

UNIVERSITY OF JOHANNESBURG

Dear Survey Participant,

Organisations worldwide continue to invest in Information Technology (IT) projects by aligning IT project activities with their business strategy to achieve strategic goals and create business value for the organisation. However, IT projects still fail at an alarming high rate.

The purpose of this study is to examine how well specific processes are implemented when a particular project outcome is achieved and how important you believe these processes are to achieve a successful project outcome. I am inviting you to participate in this survey which should only take about 10-15 minutes of your time. Your answers will be kept confidential in a secured database.

If you have any queries or concerns in the study, please do not hesitate to contact me through my email: emkoba72@yahoo.com. You may also contact my supervisor, **Prof. Carl Marnewick**, email: cmarnewick@uj.ac.za and on Tel: 011-559 1316.

Thank you for taking the time to help further our understanding of the relationship between IT project processes and project outcomes. **Note: The deadline to receive your response is 27th July, 2017, please take a note in your diary.**

Yours faithfully,

Mkoba

Elizabeth Mkoba.

PhD Student in Information Technology Management,

University of Johannesburg.

QUESTIONNAIRE FOR A FAILED INFORMATION TECHNOLOGY PROJECT

When answering this questionnaire I would like you to answer the questions in relation to the most recent project your organisation managed that *failed*. A failed IT project is one where the project was either cancelled prior to completion or delivered but never used in the organisation.

SECTION A: DEMOGRAPHIC DATA

a) Please tell us about yourself. Please answer by putting a cross (x) in the appropriate box

1. Gender

Male [ ]

Female [ ]

2. Organisation type

Public sector [ ]

Private sector [ ]

Other (Please specify) …………………………………………………….

3. Please indicate the relevant project management certification(s) you possess?

Certified Associate in Project Management (CAPM) [ ]

Project Management Professional (PMP) [ ]

PMI Agile Certified Practitioner (PMI-ACP) [ ]

PMI Risk Management Professional (PMI-RMP) [ ]

PMI Scheduling Professional (PMI-SP) [ ]

Advanced Project Management Certification (APMC) [ ]

CompTIA IT Project+ [ ]

Certificated Project Management Associate (IPMA Level D) [ ]

Certificated Project Manager (IPMA Level C) [ ]

Certificated Senior Project Manager (IPMA Level B) [ ]

Certificated Projects Director (IPMA Level A) [ ]

PRINCE2 Foundation [ ]

PRINCE2 Practitioner [ ]

PRINCE2 Professional [ ]

Other (Please specify) ……………………………………………………………..

4. How many IT projects do you currently manage in your organisation?

Please write down the number of IT projects you currently manage [ ]

5. How many years of experience do you have in managing projects?

Less than 5 years [ ]

Between 5 years and 10 years [ ]

More than 10 years [ ]

SECTION B: PROJECT ASSURANCE PROCESSES IN THE INITIATION PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that failed (the project was either cancelled prior to completion or delivered but never used in the organisation).

a) **Below is a list of project assurance processes that could occur during the initiation phase of a project. Thinking about the most recent project your organisation managed which *failed*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that failed. Then, in Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **initiation phase** of the project that failed:	**Column A: Quality of Implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PSAR1	Aligned IT project with organisational strategy and business objectives											
PSAR2	Provided business justification to invest in the IT project											
PSAR3	Provided approval to start IT project											
PSAR4	Performed a project audit											
PSAR5	Aligned IT project with the existing programme in the organisation											

SECTION C: PROJECT ASSURANCE PROCESSES IN THE PLANNING PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that failed (the project was either cancelled prior to completion or delivered but never used in the organisation).

b) **Below is a list of project assurance processes that could be used in the planning phase. Thinking about the most recent project managed by your organisation which *failed*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that failed. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **planning phase** of the project that failed:	**Column A: Quality of Implementation**						**Column B: Level of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PMPR1	Involved top management and project stakeholders in developing project plans											
PMPR2	Ensured that project plans are developed, updated and realistic in achieving IT project outcomes											
PMPR3	Aligned IT project management with project management methodology and standards											
PMPR4	Ensured that the business case is still valid											
PMPR5	Assessed organisational readiness to execute the IT project											
PMPR6	Performed a project audit											

SECTION D: PROJECT ASSURANCE PROCESSES IN THE EXECUTION PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that failed (the project was either cancelled prior to completion or delivered but never used in the organisation).

c) **Below is a list of project assurance processes that could be used in the execution phase. Thinking about the most recent project managed by your organisation which *failed*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that failed. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could be implemented during the **execution phase** of the project that failed:	Column A: Quality of Implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PIR1	Assessed performance of the implemented IT project activities against planned activities in the project management plans											
PIR2	Ensured adequate project funding											
PIR3	Involved top management and project stakeholders during the execution of the IT project activities											
PIR4	Ensured adherence to project management methodology											
PIR5	Prevented IT project fraud and corruption											
PIR6	Provided IT project conflict management											
PIR7	Assessed IT security management to the IT											

Code	Project assurance processes that could be implemented during the **execution phase** of the project that failed:	Column A: Quality of Implementation						Column B:Level of importance in achieving IT project success				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
	project deliverables											
PIR8	Provided a motivation scheme for the project team members											
PIR9	Confirmed that the business case is still valid											
PIR10	Evaluated the external environment to ensure that is still conducive to implement IT project activities											
PIR11	Confirmed that the organisation is ready for change											
PIR12	Performed a project audit											

SECTION E: PROJECT ASSURANCE PROCESSES IN THE CLOSING PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that failed (the project was either cancelled prior to completion or delivered but never used in the organisation).

a) **Below is a list of project assurance processes that could be used in the closing phase. Thinking about the most recent project managed by your organisation which *failed*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that failed. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented during the **closing phase** of the project that failed:	Column A: Quality of Implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PCR1	Confirmed that the IT project is ready for closure											
PCR2	Confirmed that the organisation has the capability to support and maintain the IT product											
PCR3	Confirmed that the environment is still conducive to provide IT services											
PCR4	Performed a project audit											

SECTION F: PROJECT ASSURANCE PROCESSES IN THE OPERATIONS AND MAINTENANCE PHASE

Instruction: When completing this section think of the most recent IT project that was managed by your organisation that failed (the project was either cancelled prior to completion or delivered but never used in the organisation).

d) **Below is a list of project assurance processes that could be used in the operations and maintenance phase. Thinking about the most recent project managed by your organisation which *failed*, in Column A indicate the level of quality implementation for each of the project assurance processes in the IT project that failed. In Column B, indicate how important each project assurance process is for achieving IT project success. For both columns (i.e. Column A and Column B) put a cross (x) in the appropriate box.**

Code	Project assurance processes that could have been implemented in the **operations and maintenance phase** of the project that failed:	Column A: Level of quality implementation						Column B: Level of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PBRR1	Confirmed that the planned benefits are realised from the IT project											
PBRR2	Ensured that organisational benefits realisation is sustained											
PBRR3	Identified what causes some of the planned benefits not to be delivered											
PBRR4	Confirmed that the benefits register is updated											
PBRR5	Performed a project audit											

****** Thank you very much for your valuable time ******

APPENDIX E: SURVEY QUESTIONNAIRES CODE BOOK

SECTION A: DEMOGRAPHIC DATA

b) Please tell us about yourself. Please answer by putting a cross (x) in the appropriate box

1. Gender:

Male [1]

Female [2]

2. Organisation type:

Public sector [1]

Private sector [2]

Other (Please specify) [3]

3. Please indicate the relevant project management certification(s) you possess?

Certified Associate in Project Management (CAPM) [1]

Project Management Professional (PMP) [2]

PMI Agile Certified Practitioner (PMI-ACP) [3]

PMI Risk Management Professional (PMI-RMP) [4]

PMI Scheduling Professional (PMI-SP) [5]

Advanced Project Management Certification (APMC) [6]

CompTIA IT Project+ [7]

Certificated Project Management Associate (IPMA Level D) [8]

Certificated Project Manager (IPMA Level C) [9]

Certificated Senior Project Manager (IPMA Level B) [10]

Certificated Projects Director (IPMA Level A) [11]

PRINCE2 Foundation [12]

PRINCE2 Practitioner [13]

PRINCE2 Professional [14]

Other (Please specify) [15]

4. **How many IT projects do you currently manage in your organisation?**

   Please write down the number of IT projects you currently manage in the space provided [ ]

5. **How many years of experience do you have in managing projects?**

   Less than 5 years [1]

   Between 5 years and 10 years [2]

   More than 10 years [3]

SECTION B: PROJECT ASSURANCE PROCESSES IN THE INITIATION PHASE

a) Below is a list of project assurance processes that could occur during the initiation phase of a project.

Code	Project assurance processes that could have been implemented during the **initiation phase** of the project:	**Column A: Quality of Implementation**						**Column B: Degree of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PSAR1	Aligned IT project with organisational strategy and business objectives	1	2	3	4	5	6	1	2	3	4	5
PSAR2	Provided business justification to invest in the IT project	1	2	3	4	5	6	1	2	3	4	5
PSAR3	Provided approval to start IT project	1	2	3	4	5	6	1	2	3	4	5
PSAR4	Performed a project audit	1	2	3	4	5	6	1	2	3	4	5
PSAR5	Aligned IT project with the existing programme in the organisation	1	2	3	4	5	6	1	2	3	4	5

SECTION C: PROJECT ASSURANCE PROCESSES IN THE PLANNING PHASE

b) Below is a list of project assurance processes that could be used in the planning phase.

Code	Project assurance processes that could have been implemented during the **planning phase** of the project:	**Column A: Quality of Implementation**						**Column B: Degree of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PMPR1	Involved top management and project stakeholders in developing project plans	1	2	3	4	5	6	1	2	3	4	5
PMPR2	Ensured that project plans are developed, updated and realistic in achieving IT project outcomes	1	2	3	4	5	6	1	2	3	4	5
PMPR3	Aligned IT project management with project management methodology and standards	1	2	3	4	5	6	1	2	3	4	5
PMPR4	Ensured that the business case is still valid	1	2	3	4	5	6	1	2	3	4	5
PMPR5	Assessed organisational readiness to execute the IT project	1	2	3	4	5	6	1	2	3	4	5
PMPR6	Performed a project audit	1	2	3	4	5	6	1	2	3	4	5

SECTION D: PROJECT ASSURANCE PROCESSES IN THE EXECUTION PHASE

c) Below is a list of project assurance processes that could be used in the execution phase.

Code	Project assurance processes that could be implemented during the **execution phase** of the project:	**Column A: Quality of Implementation**						**Column B: Degree of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PIR1	Assessed performance of the implemented IT project activities against planned activities in the project management plans	1	2	3	4	5	6	1	2	3	4	5
PIR2	Ensured adequate project funding	1	2	3	4	5	6	1	2	3	4	5
PIR3	Involved top management and project stakeholders during the execution of the IT project activities	1	2	3	4	5	6	1	2	3	4	5
PIR4	Ensured adherence to project management methodology	1	2	3	4	5	6	1	2	3	4	5
PIR5	Prevented IT project fraud and corruption	1	2	3	4	5	6	1	2	3	4	5
PIR6	Provided IT project conflict management	1	2	3	4	5	6	1	2	3	4	5
PIR7	Assessed IT security management to the IT project deliverables	1	2	3	4	5	6	1	2	3	4	5
PIR8	Provided a motivation scheme for the project team members	1	2	3	4	5	6	1	2	3	4	5
PIR9	Confirmed that the business case is still valid	1	2	3	4	5	6	1	2	3	4	5

Code	Project assurance processes that could be implemented during the **execution phase** of the project:	**Column A: Quality of Implementation**						**Column B: Degree of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PIR10	Evaluated the external environment to ensure that is still conducive to implement IT project activities	1	2	3	4	5	6	1	2	3	4	5
PIR11	Confirmed that the organisation is ready for change	1	2	3	4	5	6	1	2	3	4	5
PIR12	Performed a project audit	1	2	3	4	5	6	1	2	3	4	5

SECTION E: PROJECT ASSURANCE PROCESSES IN THE CLOSING PHASE

d) Below is a list of project assurance processes that could be used in the closing phase.

Code	Project assurance processes that could have been implemented during the **closing phase** of the project:	**Column A: Quality of implementation**						**Column B: Degree of importance in achieving IT project success**				
		Not implemented	**Very poor**	**Poor**	**Average**	**Good**	**Excellent**	**Unimportant**	**Low importance**	**Moderate importance**	**Important**	**Critically important**
PCR1	Confirmed that the IT project is ready for closure	1	2	3	4	5	6	1	2	3	4	5
PCR2	Confirmed that the organisation has the capability to support and maintain the IT product	1	2	3	4	5	6	1	2	3	4	5
PCR3	Confirmed that the environment is still conducive to provide IT services	1	2	3	4	5	6	1	2	3	4	5
PCR4	Performed a project audit	1	2	3	4	5	6	1	2	3	4	5

SECTION F: PROJECT ASSURANCE PROCESSES IN THE OPERATIONS AND MAINTENANCE PHASE

e) Below is a list of project assurance processes that could be used in the operations and maintenance phase.

Code	Project assurance processes that could have been implemented in the **operations and maintenance phase** of the project:	Column A: Quality of implementation						Column B: Degree of importance in achieving IT project success				
		Not implemented	Very poor	Poor	Average	Good	Excellent	Unimportant	Low importance	Moderate importance	Important	Critically important
PBRR1	Confirmed that the planned benefits are realised from the IT project	1	2	3	4	5	6	1	2	3	4	5
PBRR2	Ensured that organisational benefits realisation is sustained	1	2	3	4	5	6	1	2	3	4	5
PBRR3	Identified what causes some of the planned benefits not to be delivered	1	2	3	4	5	6	1	2	3	4	5
PBRR4	Confirmed that the benefits register is updated	1	2	3	4	5	6	1	2	3	4	5
PBRR5	Performed a project audit	1	2	3	4	5	6	1	2	3	4	5

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APPENDIX F: PATTERN MATRIX FOR LEVEL OF QUALITY IMPLEMENTATION OF THE IT PROJECT ASSURANCE PROCESSES

Run1: Result after removing PMPR5_Q

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR3_Q	.877				
PBRR2_Q	.838				
PBRR1_Q	.797				
PBRR4_Q	.769				
PIR9_Q	.753				
PMPR4_Q	.675				
PIR11_Q	.645	.369			
PIR8_Q	.641			.352	
PIR10_Q	.551				
PSAR3_Q		.785			
PIR2_Q		.761			
PIR3_Q		.740			
PMPR2_Q		.619			
PSAR5_Q		.552	.348		
PMPR1_Q		.482			
PMPR3_Q	.319	.474			
PIR4_Q		.467			
PIR1_Q		.462			
PSAR2_Q		.460			
PBRR5_Q			.852		
PSAR4_Q			.815		
PCR4_Q			.741		
PIR12_Q			.698		
PMPR6_Q			.614		
PIR7_Q				.891	
PIR6_Q				.867	
PIR5_Q				.811	
PCR2_Q					.629
PCR1_Q		.416			.607
PCR3_Q		.335			.511
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 13 iterations.					

Run2: Result after removing PSAR2_Q

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR3_Q	.881				
PBRR2_Q	.850				
PBRR1_Q	.810				
PBRR4_Q	.776				
PIR9_Q	.741				
PMPR4_Q	.670				
PIR11_Q	.634	.387			
PIR8_Q	.629			.355	
PIR10_Q	.538				
PIR2_Q		.770			
PSAR3_Q		.756			
PIR3_Q		.736			
PMPR2_Q		.606			
PSAR5_Q		.529	.357		
PMPR3_Q	.308	.472			
PIR4_Q		.470			
PMPR1_Q		.467			
PIR1_Q		.452			
PBRR5_Q			.845		
PSAR4_Q			.817		
PCR4_Q			.743		
PIR12_Q			.701		
PMPR6_Q			.617		
PIR7_Q				.904	
PIR6_Q				.871	
PIR5_Q				.820	
PCR2_Q					.638
PCR1_Q		.387			.624
PCR3_Q		.313			.522
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 12 iterations.					

Run3: Result after removing PIR1_Q

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR3_Q	.905				
PBRR2_Q	.857				
PBRR1_Q	.827				
PBRR4_Q	.803				
PIR9_Q	.726				
PMPR4_Q	.656				
PIR11_Q	.624	.389			
PIR8_Q	.618			.351	
PIR10_Q	.529				
PSAR3_Q		.748			
PIR2_Q		.735			
PIR3_Q		.723			
PMPR2_Q		.603			
PSAR5_Q		.546	.364		
PMPR3_Q		.473			
PMPR1_Q		.468			
PIR4_Q		.458			
PBRR5_Q			.833		
PSAR4_Q			.815		
PCR4_Q			.739		
PIR12_Q			.694		
PMPR6_Q			.615		
PIR7_Q				.905	
PIR6_Q				.880	
PIR5_Q				.822	
PCR2_Q					.650
PCR1_Q		.361			.623
PCR3_Q		.311			.533
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 12 iterations.					

Run4: Result after removing PIR4_Q

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR1_Q	.879				
PBRR2_Q	.871				
PBRR4_Q	.823				
PBRR3_Q	.785				
PIR3_Q		.748			
PSAR3_Q	-.303	.745			
PIR2_Q		.724			
PMPR2_Q		.639			
PCR1_Q		.628			
PCR2_Q	.510	.527			
PCR3_Q	.459	.525			
PMPR1_Q		.501			
PSAR5_Q		.496	.407		
PMPR3_Q		.347			.309
PSAR4_Q			.844		
PBRR5_Q	.508		.774		
PCR4_Q			.728		
PIR12_Q			.712		
PMPR6_Q			.641		
PIR6_Q				.845	
PIR7_Q				.842	
PIR5_Q				.784	
PIR9_Q	.331				.599
PIR8_Q				.322	.502
PMPR4_Q	.336				.480
PIR11_Q	.329	.340			.433
PIR10_Q					.399
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 13 iterations.					

Run5: Result after removing PMPR3_Q

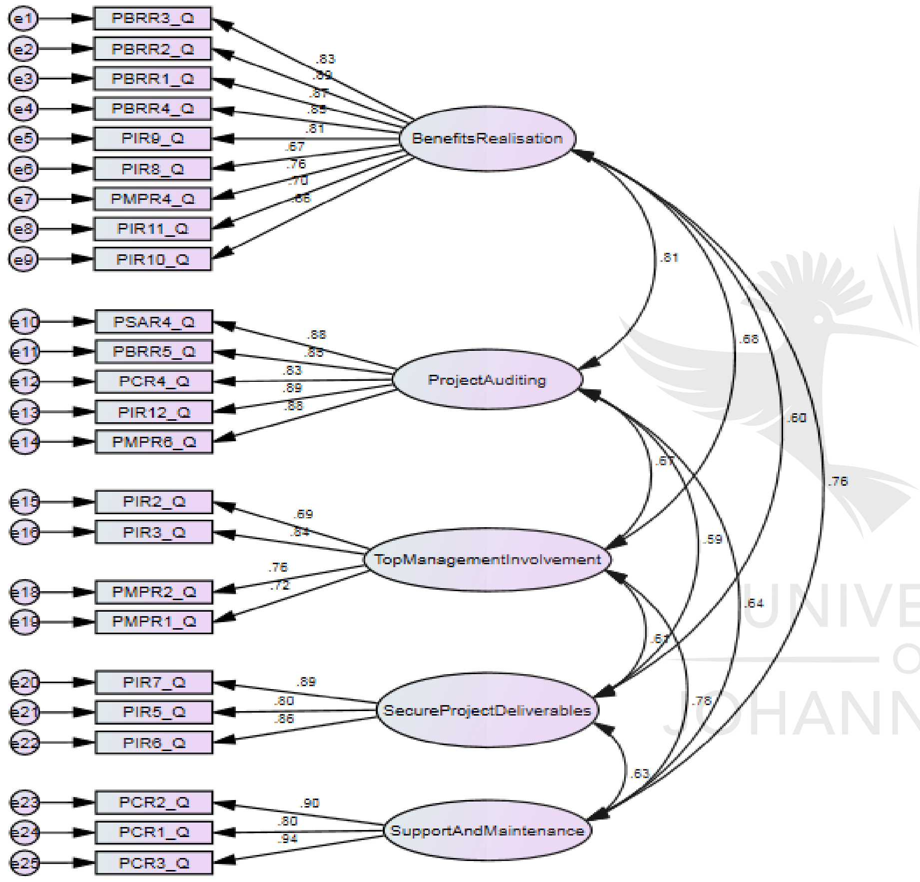
Pattern Matrix[a]					
	Factor				
	1	2	3	4	5
PBRR3_Q	.856				
PBRR2_Q	.822				
PBRR1_Q	.797				
PBRR4_Q	.764				
PIR9_Q	.738				
PIR8_Q	.642			.338	
PMPR4_Q	.631				
PIR11_Q	.623		.375		
PIR10_Q	.567				
PSAR4_Q		.844			
PBRR5_Q		.800			
PCR4_Q		.734			
PIR12_Q		.719			
PMPR6_Q		.641			
PIR3_Q			.705		
PSAR3_Q			.701		
PIR2_Q			.696		
PMPR2_Q			.584		
PMPR1_Q			.520		
PSAR5_Q		.405	.491		
PIR7_Q				.869	
PIR6_Q				.833	
PIR5_Q				.806	
PCR2_Q					.669
PCR1_Q			.316		.645
PCR3_Q					.551
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 13 iterations.					

Run6 : Final result after removing PSAR5_Q

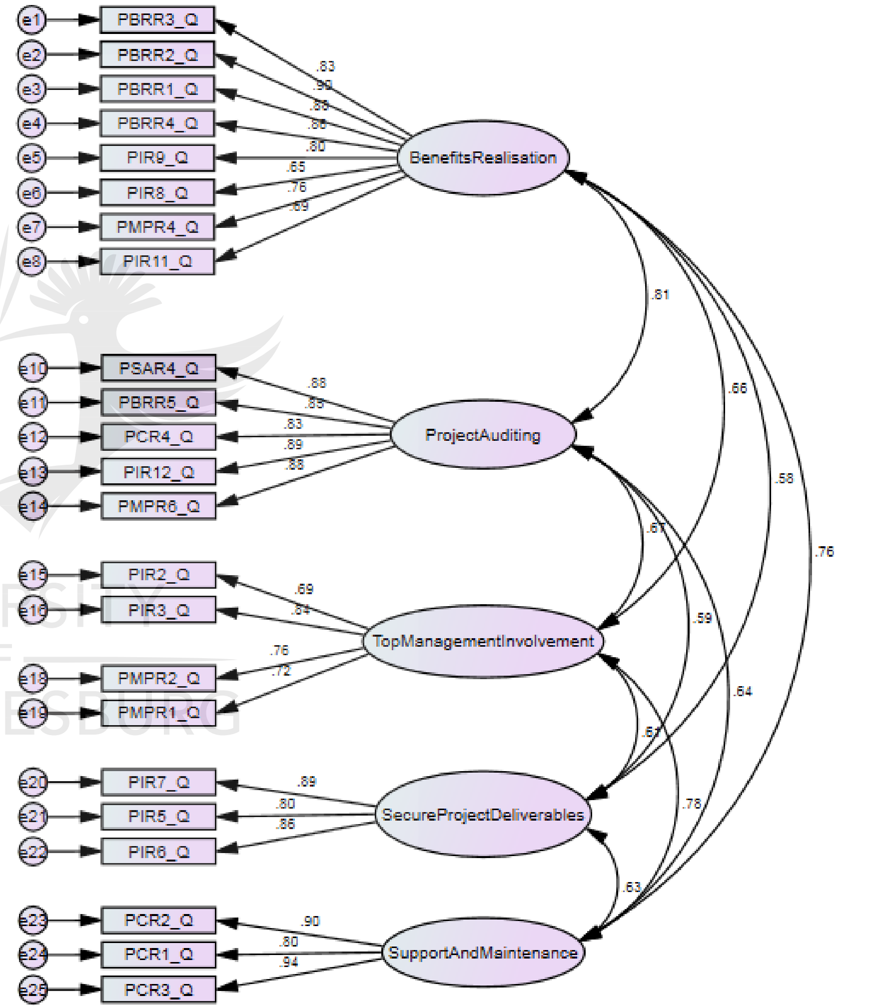
Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR3_Q	.864				
PBRR2_Q	.831				
PBRR1_Q	.810				
PBRR4_Q	.755				
PIR9_Q	.718				
PIR8_Q	.624			.345	
PMPR4_Q	.623				
PIR11_Q	.620		.405		
PIR10_Q	.556				
PSAR4_Q		.855			
PBRR5_Q		.814			
PCR4_Q		.759			
PIR12_Q		.742			
PMPR6_Q		.660			
PIR2_Q			.764		
PIR3_Q			.748		
PSAR3_Q			.690		
PMPR2_Q			.565		
PMPR1_Q			.518		
PIR7_Q				.883	
PIR5_Q				.819	
PIR6_Q				.813	
PCR2_Q					.681
PCR1_Q					.660
PCR3_Q					.555
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 11 iterations.					

APPENDIX G: SEM ANALYSIS RESULTS FOR LEVEL OF QUALITY IMPLEMENTATION OF THE IT PROJECT ASSURANCE PROCESSES

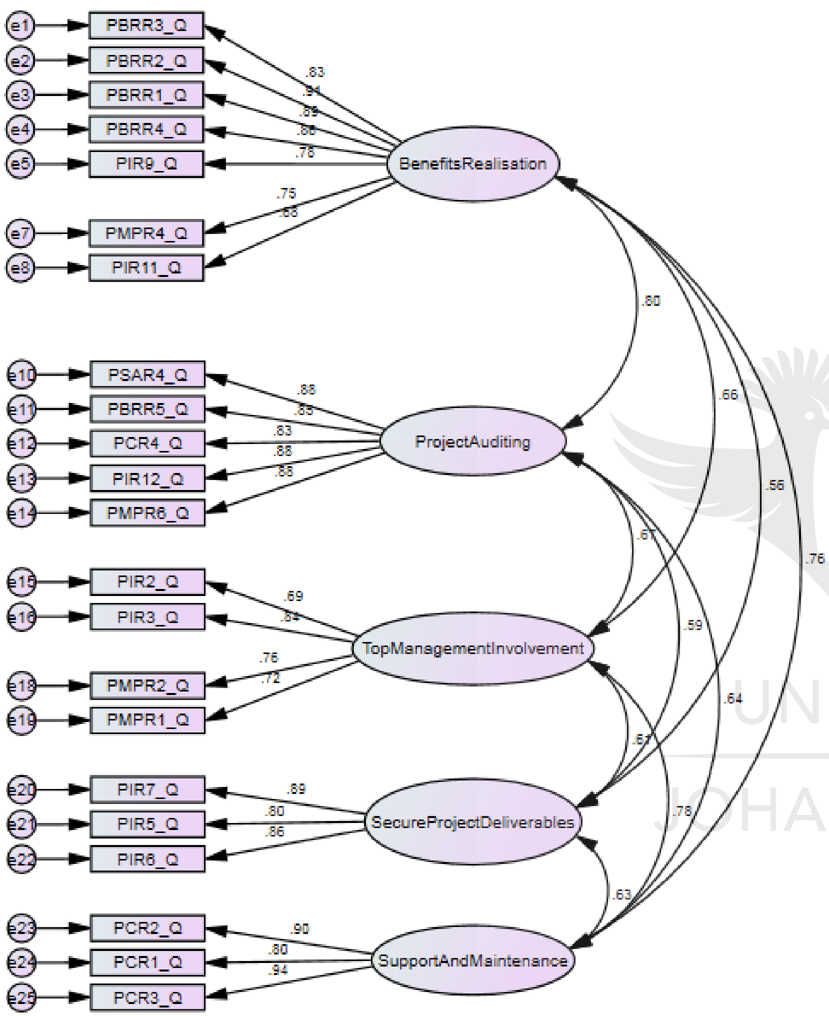
Run1: Structural model after removing PSAR3_Q



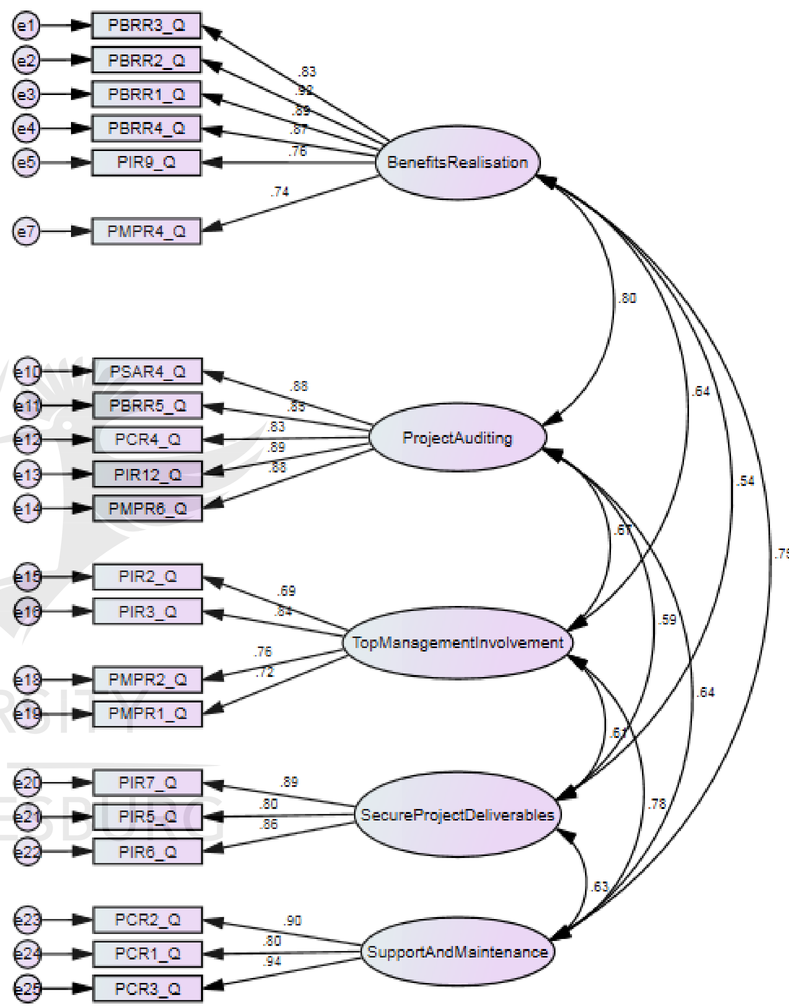
Run2: Structural model after removing PIR10_Q



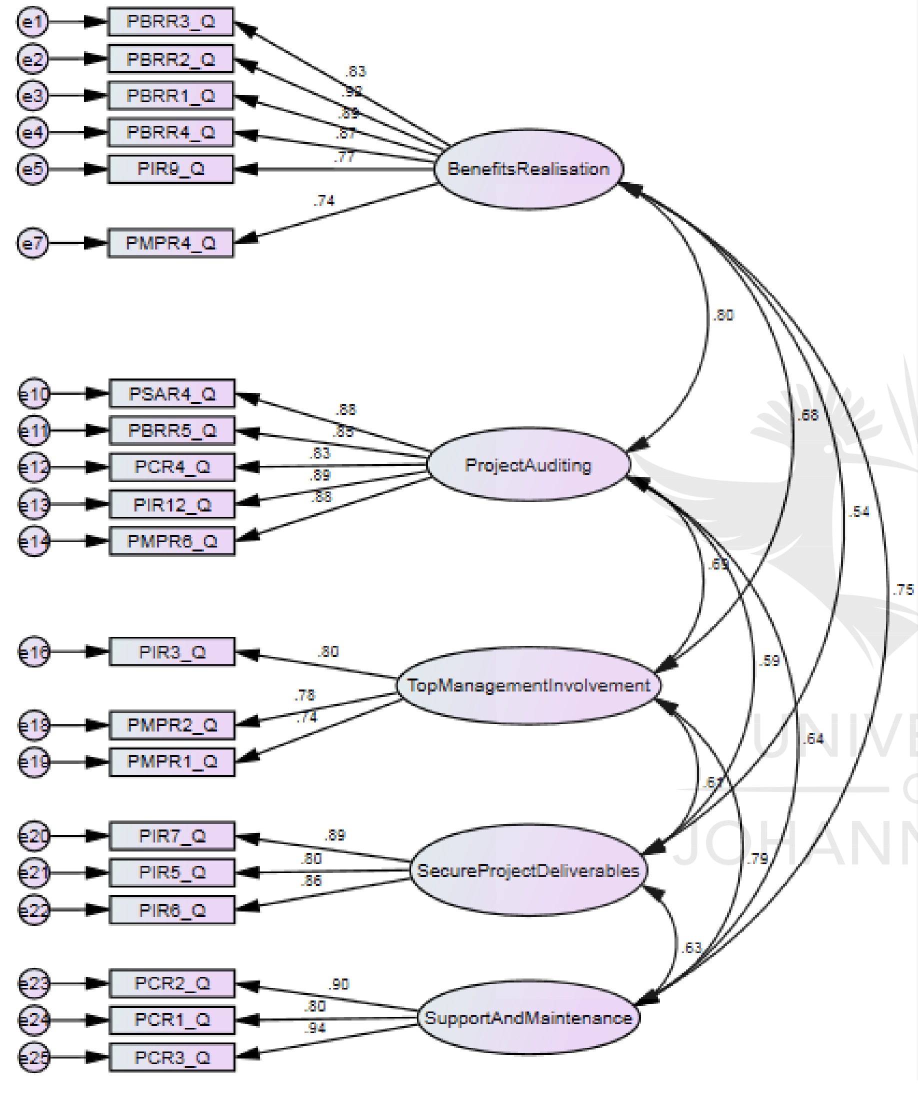
Run3:Structural model after removing PIR8_Q



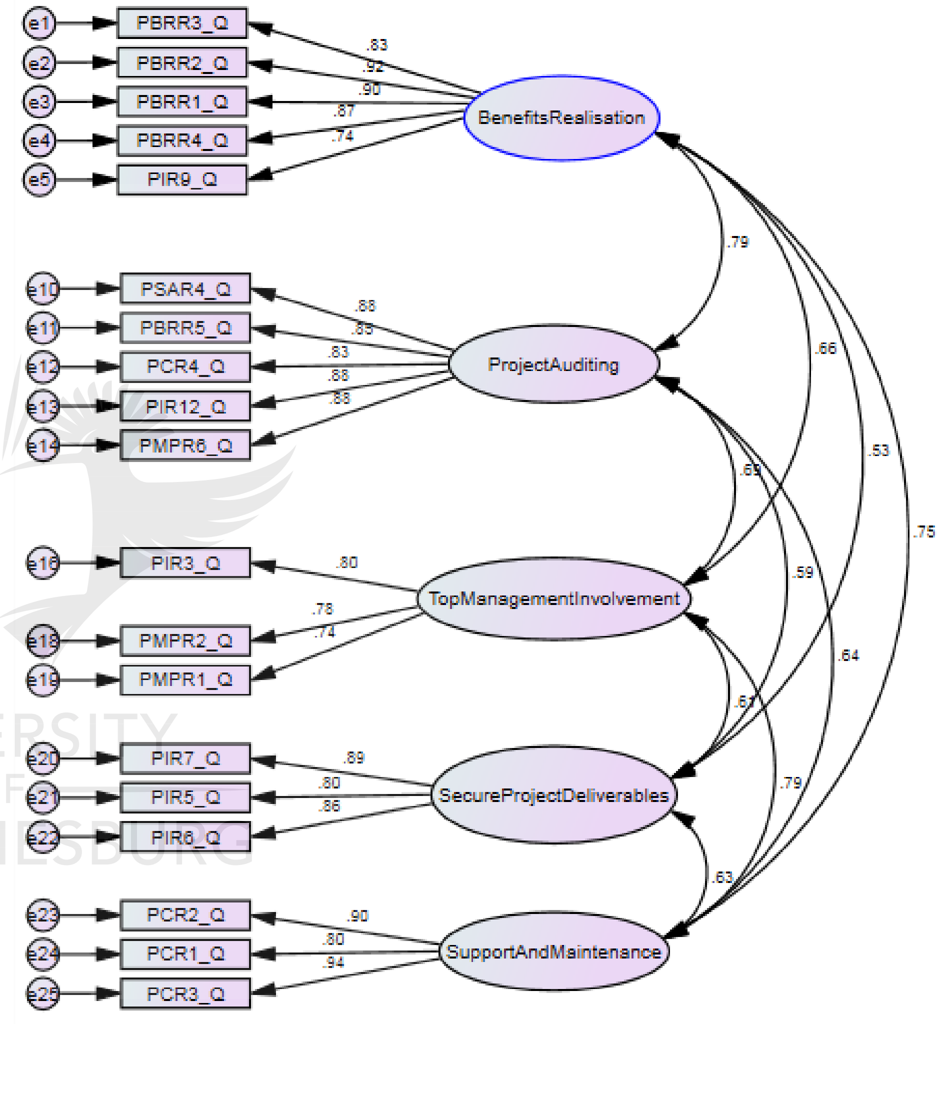
Run4: Structural model after removing PIR11_Q



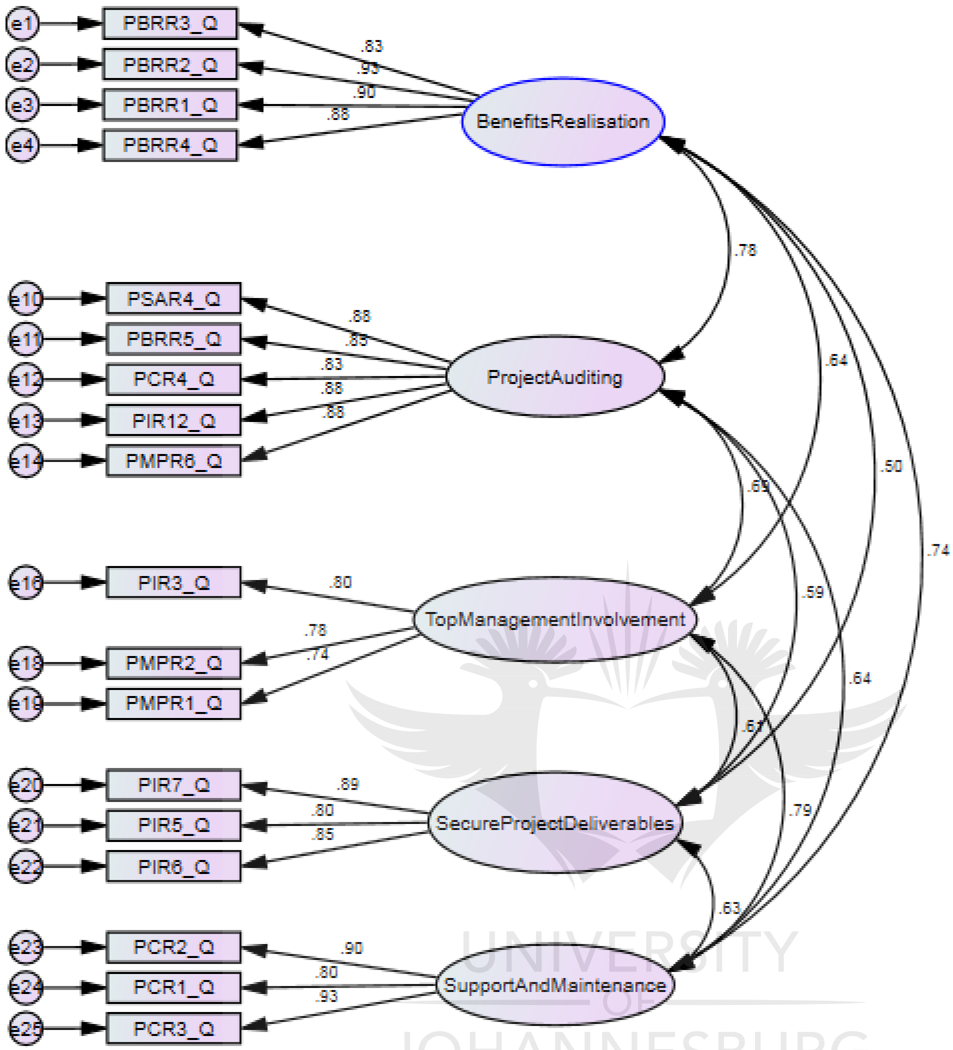
Run5:Structural model after removing PIR2_Q



Run6: Structural model after removing PMPR4_Q



Run7: Final structural model after removing PIR9_Q



APPENDIX H: PATTERN MATRIX FOR IMPORTANCE LEVEL OF THE PROJECT ASSURANCE PROCESSES

Run1: Result after removing PMPR1_I

Observed variables	Factor								
	1	2	3	4	5	6	7	8	9
PIR5_I	.883								
PIR6_I	.652								
PIR3_1	.647	.308							
PIR7_I	.508				.306				
PIR2_I	.412								
PCR2_I		1.155							
PCR1_I		.643							
PCR3_I		.518	-.309			.362			
PIR1_I		.457						.358	
PBRR1_I		.418			.345				
PBRR5_I			1.048						
PBRR4_I			.595						
PIR9_I				.973					
PMPR4_I				.622					
PIR8_I			.314	.559					
PIR10_I				.364					
PMPR3_I					.707				
PIR4_I	.516				.701				
PBRR3_I					.406				
PMPR6_I			.315			.738			
PSAR4_I						.716			
PIR12_I	.344					.422			
PSAR2_I			-.366				.710		
PSAR1_I							.606		
PSAR3_I							.542		
PBRR2_I						.320	.521		
PIR11_I									
PMPR2_I								.978	
PMPR5_I								.304	
PSAR5_I									.751
PCR4_I			.363						.479

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 18 iterations.

Run2: Result after removing PMPR5_I

Pattern Matrix[a]

Observed variables	Factor							
	1	2	3	4	5	6	7	8
PBRR1_I	.759							
PMPR3_I	.670							
PBRR2_I	.664							.357
PBRR3_I	.629							
PSAR1_I	.582							.328
PMPR2_I	.576							
PIR11_I	.302							
PIR5_I		.986						
PIR4_I	.325	.759						
PIR6_I		.683						
PIR7_I		.656						
PIR3_1		.561						
PIR2_I		.469						
PBRR5_I			.934					
PBRR4_I	.375		.542					
PIR10_I			.355			.323		
PCR2_I				1.073				
PCR1_I	.428			.432				
PIR1_I				.398				
PCR3_I				.393				
PMPR6_I					.770			
PSAR4_I					.674			
PIR12_I		.333			.405			
PIR9_I						1.027		
PMPR4_I						.584		
PIR8_I			.323			.487		
PSAR5_I							.826	
PCR4_I			.396				.474	
PSAR2_I								.642
PSAR3_I								.440

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 12 iterations.

Run3: Result after removing PIR11_I

Pattern Matrix[a]								
Observed variables	**Factor**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
PBRR1_I	.734							
PMPR3_I	.685							
PBRR3_I	.626							
PBRR2_I	.615							.372
PSAR1_I	.564							.333
PMPR2_I	.558							
PIR5_I		.968						
PIR4_I	.355	.774						
PIR6_I		.681						
PIR7_I		.658						
PIR3_1		.551						
PIR2_I		.477						
PCR2_I			1.091					
PCR1_I	.401		.443					
PIR1_I			.406					
PCR3_I			.394					
PMPR6_I				.771				
PSAR4_I				.686				
PIR12_I		.351		.417				
PBRR5_I					.944			
PBRR4_I	.367				.537			
PIR10_I					.333	.329		
PIR9_I						1.033		
PMPR4_I						.579		
PIR8_I					.308	.482		
PSAR5_I							.845	
PCR4_I					.377		.462	
PSAR2_I								.637
PSAR3_I								.443

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 13 iterations.

Run4: Result after removing PIR10_I

Pattern Matrix[a]							
Observed variables	Factor						
	1	2	3	4	5	6	7
PIR5_I	.985						
PIR6_I	.685						
PIR4_I	.617	.502	-.303				
PIR3_1	.615		.334				
PIR7_I	.590						
PIR2_I	.398						
PMPR3_I		.733					
PSAR1_I		.646					
PBRR3_I		.630					
PBRR1_I		.593					.351
PMPR2_I		.473					
PCR2_I			1.046				
PCR1_I			.537				
PIR1_I			.445				
PSAR3_I			.305				
PSAR4_I				.855			
PMPR6_I				.712	.325		
PIR12_I	.348			.489			
PCR4_I				.468	.376		-.361
PSAR5_I		.324		.461			
PCR3_I			.394	.444			
PBRR5_I					.957		
PBRR4_I		.339			.529		
PIR9_I						1.104	
PMPR4_I		.311				.532	
PIR8_I						.463	
PBRR2_I		.330					.669
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]							
a. Rotation converged in 8 iterations.							

Run5: Result after removing PSAR2_I

Pattern Matrix[a]

	Factor						
	1	**2**	**3**	**4**	**5**	**6**	**7**
PBRR1_I	.795						
PBRR2_I	.749		.313				
PBRR3_I	.609						
PSAR1_I	.600						
PMPR2_I	.529						
PMPR3_I	.527						.430
PCR1_I	.451			.431			
PIR5_I		1.009					
PIR6_I		.704					
PIR3_1		.645					
PIR4_I		.625					.330
PIR7_I		.603					
PIR2_I		.417					
PSAR4_I			.765				
PMPR6_I			.636			.328	
PIR12_I		.356	.437				
PCR2_I				.995			
PIR1_I				.372			
PCR3_I			.321	.367			
PIR9_I					1.095		
PMPR4_I					.517		.411
PIR8_I					.456		
PBRR5_I						.942	
PBRR4_I	.337					.524	
PCR4_I	-.316					.413	.390
PSAR5_I							.578

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 18 iterations.

Run6: Result after removing PSAR3_I

Pattern Matrix[a]

Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.829					
PBRR3_I	.683					
PMPR3_I	.641					
PBRR2_I	.640					
PSAR1_I	.635					
PMPR2_I	.528					
PIR5_I		.976				
PIR6_I		.732				
PIR4_I	.310	.680		-.302		
PIR7_I		.669				
PIR3_1		.637		.377		
PIR2_I		.483				
PIR12_I		.346	.324			
PBRR5_I			.836			
PCR4_I			.706			.381
PMPR6_I			.676			
PBRR4_I	.418		.551			
PSAR4_I			.441			.320
PCR2_I				.813		
PCR1_I	.448			.463		
PIR1_I				.404		
PIR9_I					1.043	
PMPR4_I					.493	.489
PIR8_I					.433	
PSAR5_I						.632

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 15 iterations.

Run7: Result after removing PCR3_I

Pattern Matrix[a]						
Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.828					
PMPR3_I	.673					
PBRR2_I	.670					
PBRR3_I	.657					
PSAR1_I	.622					
PMPR2_I	.560					
PIR5_I		.951				
PIR6_I		.718				
PIR4_I	.347	.672		-.303		
PIR7_I		.663				
PIR3_1		.621		.394		
PIR2_I		.481				
PBRR5_I			.895			
PCR4_I	-.338		.621			.480
PMPR6_I			.610			
PBRR4_I	.345		.586			
PSAR4_I			.356			.310
PCR2_I				.847		
PCR1_I	.409			.480		
PIR1_I				.422		
PIR9_I					1.057	
PMPR4_I					.505	.441
PIR8_I					.427	
PSAR5_I						.689
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]						
a. Rotation converged in 9 iterations.						

Run8: Result after removing PIR12_I

Pattern Matrix[a]						
Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.847					
PBRR2_I	.714					
PBRR3_I	.663					
PMPR3_I	.643					
PSAR1_I	.617					
PMPR2_I	.568					
PIR5_I		.979				
PIR6_I		.723				
PIR4_I	.315	.648		-.303		
PIR7_I		.648				
PIR3_1		.645		.361		
PIR2_I		.460				
PBRR5_I			.917			
PCR4_I	-.335		.599			.513
PBRR4_I	.354		.577			
PMPR6_I			.565			
PCR2_I				.857		
PCR1_I	.427			.458		
PIR1_I				.404		
PIR9_I					1.072	
PMPR4_I					.505	.436
PIR8_I					.429	
PSAR5_I						.648

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 12 iterations.

Run9: Result after removing PSAR4_I

Pattern Matrix[a]						
Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.882					
PBRR2_I	.748					
PBRR3_I	.661					
PSAR1_I	.614					
PMPR3_I	.610					
PMPR2_I	.568					
PCR1_I	.464					.423
PIR5_I		1.001				
PIR6_I		.728				
PIR3_1		.656				.316
PIR7_I		.644				
PIR4_I		.610				
PIR2_I		.446				
PBRR5_I			.946			
PCR4_I	-.345		.578		.516	
PBRR4_I	.356		.572			
PMPR6_I			.558			
PIR9_I				1.060		
PMPR4_I				.503	.461	
PIR8_I				.419		
PSAR5_I					.665	
PCR2_I						.820

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 11 iterations.

Run10: Result after removing PIR1_I

Pattern Matrix[a]						
Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.792			.313		
PBRR3_I	.689					
PSAR1_I	.653					
PMPR3_I	.649					
PBRR2_I	.579			.305		
PMPR2_I	.528					
PIR5_I		.957				
PIR6_I		.743				
PIR7_I		.670				
PIR4_I	.346	.647		-.341		
PIR3_1		.589		.385		
PIR2_I		.465				
PBRR5_I			.973			
PMPR6_I			.638			
PBRR4_I	.348		.607			
PCR4_I			.601			.412
PCR2_I				.804		
PCR1_I	.349			.508		
PMPR4_I					.862	
PIR9_I					.689	
PSAR5_I						.770

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 10 iterations.

Run11: Result after removing PIR8_I

Pattern Matrix[a]						
Observed variables	Factor					
	1	2	3	4	5	6
PBRR1_I	.897					
PBRR2_I	.750					
PBRR3_I	.676					
PSAR1_I	.664					
PMPR3_I	.539					
PMPR2_I	.515					
PCR1_I	.449				.371	
PIR5_I		1.024				
PIR6_I		.705				
PIR7_I		.617				
PIR4_I		.574				
PIR3_1		.574				
PBRR5_I			.926			
PMPR6_I			.632			
PCR4_I	-.335		.630			.400
PBRR4_I	.331		.593			
PMPR4_I				.812		.334
PIR9_I				.735		
PCR2_I					.959	
PSAR5_I						.639
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]						
a. Rotation converged in 11 iterations.						

Run12: Result after removing PIR2_I

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR1_I	1.003				
PBRR2_I	.790				
PBRR3_I	.571				
PCR2_I	.537				
PSAR1_I	.527			.321	
PMPR2_I	.399				
PIR5_I		1.015			
PIR6_I		.690			
PIR7_I		.606			
PIR3_1		.570			
PIR4_I		.542		.328	
PBRR5_I			.889		
PCR4_I			.650		
PMPR6_I			.645		
PBRR4_I			.609		
PSAR5_I				.654	
PMPR3_I	.315			.436	
PMPR4_I				.389	.810
PIR9_I					.664
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]					
a. Rotation converged in 7 iterations.					

Run13: Result after removing PCR1_I

Pattern Matrix[a]					
Observed variables	Factor				
	1	2	3	4	5
PBRR1_I	.940				
PBRR2_I	.780				
PCR2_I	.689				
PBRR3_I	.510				
PSAR1_I	.426				
PMPR2_I	.411				
PIR9_I					
PIR5_I		.911			
PIR3_1	.334	.663			
PIR6_I		.655			
PIR7_I		.546		.359	
PBRR5_I			.965		
PBRR4_I			.650		
PMPR6_I			.634		
PCR4_I			.619		.323
PMPR3_I				.756	
PIR4_I		.395		.689	
PSAR5_I					1.007

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

Run14: Result after removing PMPR4_I

Pattern Matrix[a]				
Observed variables	Factor			
	1	2	3	4
PBRR1_I	.931			
PBRR2_I	.795			
PCR2_I	.643			
PBRR3_I	.495			
PSAR1_I	.425			.344
PMPR2_I	.410			
PIR5_I		.896		
PIR3_1	.351	.676		
PIR6_I		.644		
PIR7_I		.541		.421
PBRR5_I			.885	
PCR4_I			.720	
PMPR6_I			.654	
PBRR4_I			.649	
PMPR3_I				.742
PIR4_I		.402		.612
PSAR5_I				.333

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

Run15: Result after removing PMPR2_I

Pattern Matrix[a]				
	Factor			
	1	2	3	4
PBRR1_I	.940			
PBRR2_I	.782			
PCR2_I	.679			
PBRR3_I	.526			
PSAR1_I	.454			
PMPR2_I	.431			
PIR5_I		.882		
PIR3_1	.338	.678		
PIR6_I		.665		
PIR7_I		.554		.388
PBRR5_I			.935	
PCR4_I			.674	
PBRR4_I			.654	
PMPR6_I			.646	
PMPR3_I				.744
PIR4_I		.405		.626

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

Run16: Result after removing PSAR1_I

Pattern Matrix[a]				
	Factor			
	1	2	3	4
PBRR1_I	.961			
PBRR2_I	.745			
PCR2_I	.652			
PBRR3_I	.494			
PSAR1_I	.440			.315
PIR5_I		.863		
PIR3_1	.323	.704		
PIR6_I		.662		
PIR7_I		.536		.404
PBRR5_I			.921	
PCR4_I			.682	
PBRR4_I			.669	
PMPR6_I			.655	
PMPR3_I				.722
PIR4_I		.374		.654

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

Run17: Result after removing PSAR5_I

Pattern Matrix[a]				
Observed variables	Factor			
	1	2	3	4
PBRR1_I	.939			
PBRR2_I	.758			
PCR2_I	.679			
PBRR3_I	.495			
PIR5_I		.858		
PIR3_1	.342	.699		
PIR6_I		.662		
PIR7_I		.531		.410
PBRR5_I			.949	
PCR4_I			.673	
PBRR4_I			.655	
PMPR6_I			.637	
PMPR3_I				.738
PIR4_I		.366		.682

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 7 iterations.

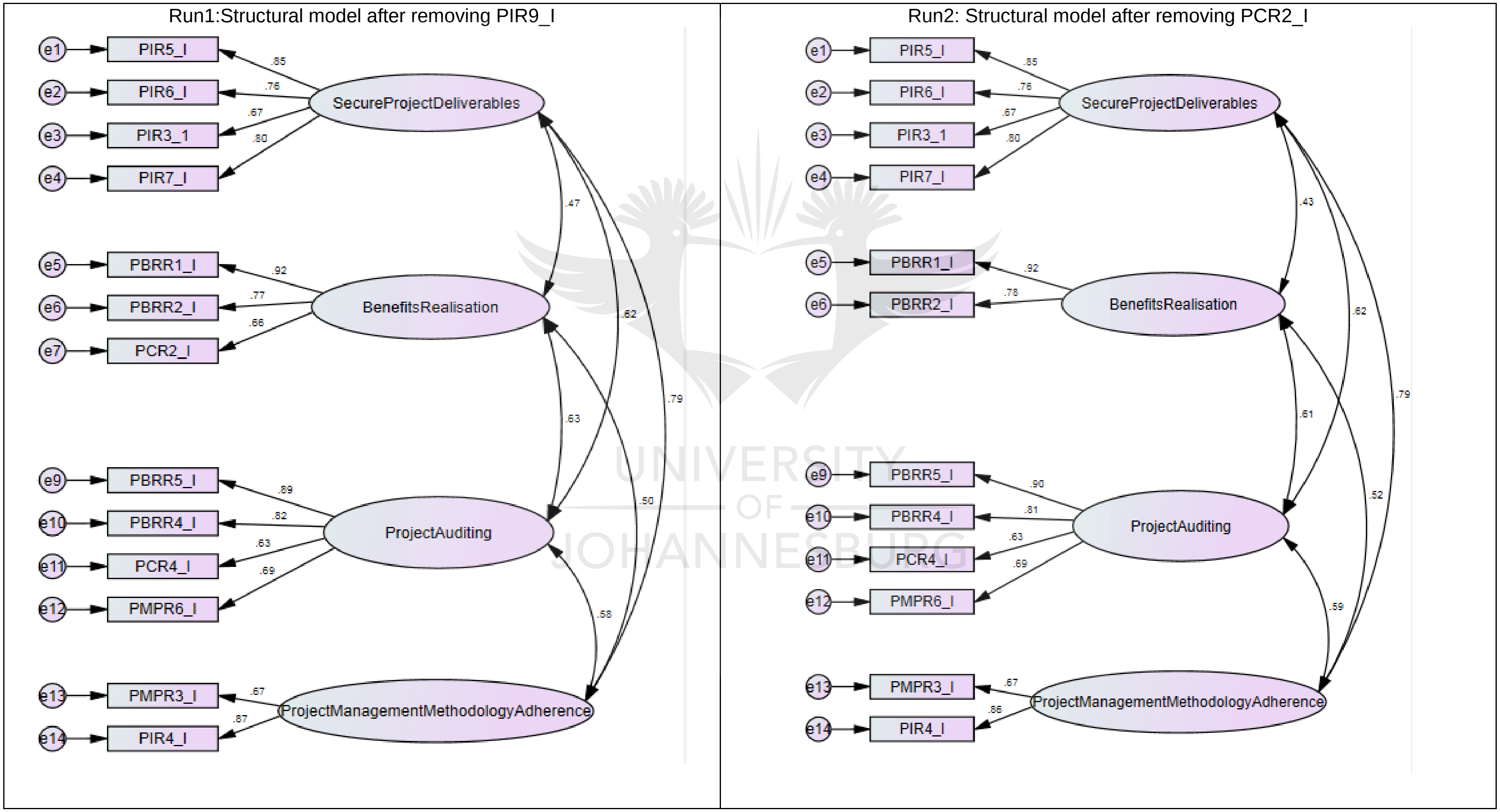
Run18: Final result after removing PBRR3_I

Pattern Matrix[a]				
Observed variables	Factor			
	1	2	3	4
PIR5_I	.887			
PIR6_I	.703			
PIR3_I	.678	.348		
PIR7_I	.538			
PBRR1_I		.877		
PBRR2_I		.760		
PCR2_I		.688		
PBRR5_I			.973	
PBRR4_I			.643	
PCR4_I			.626	
PMPR6_I			.622	
PMPR3_I				.770
PIR4_I	.379			.640

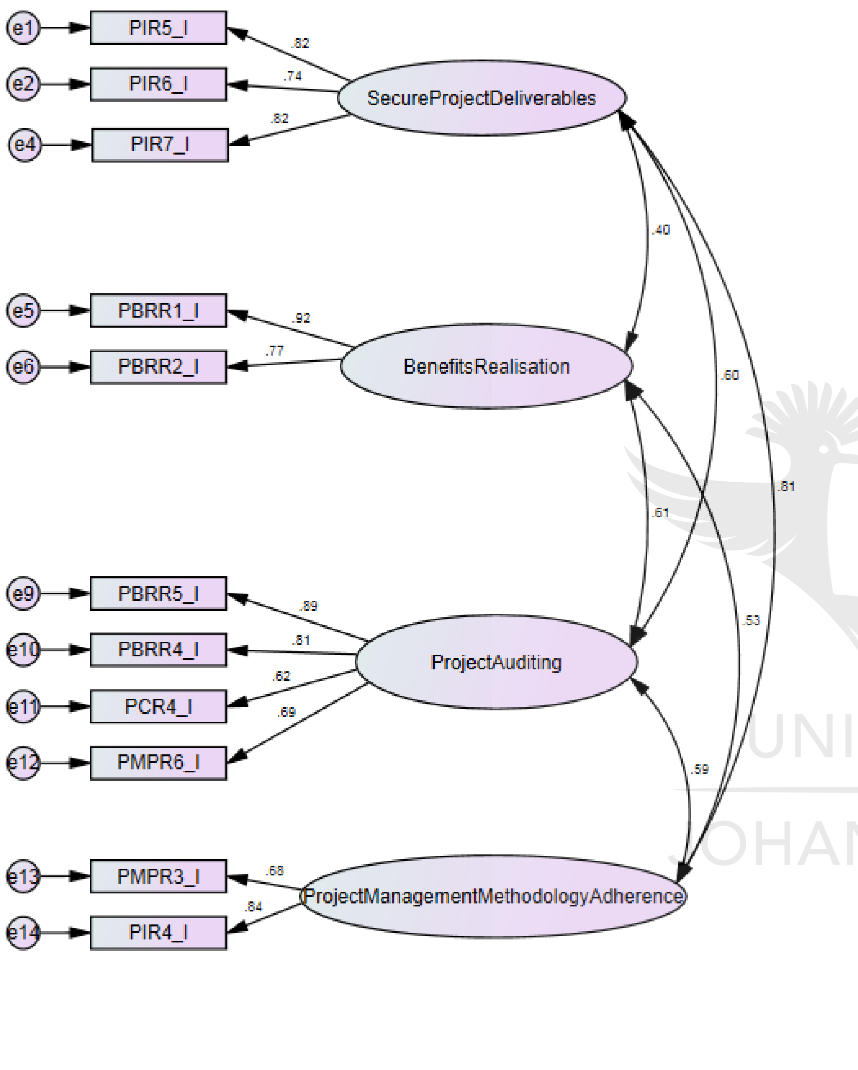
Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.a

a. Rotation converged in 7 iterations.

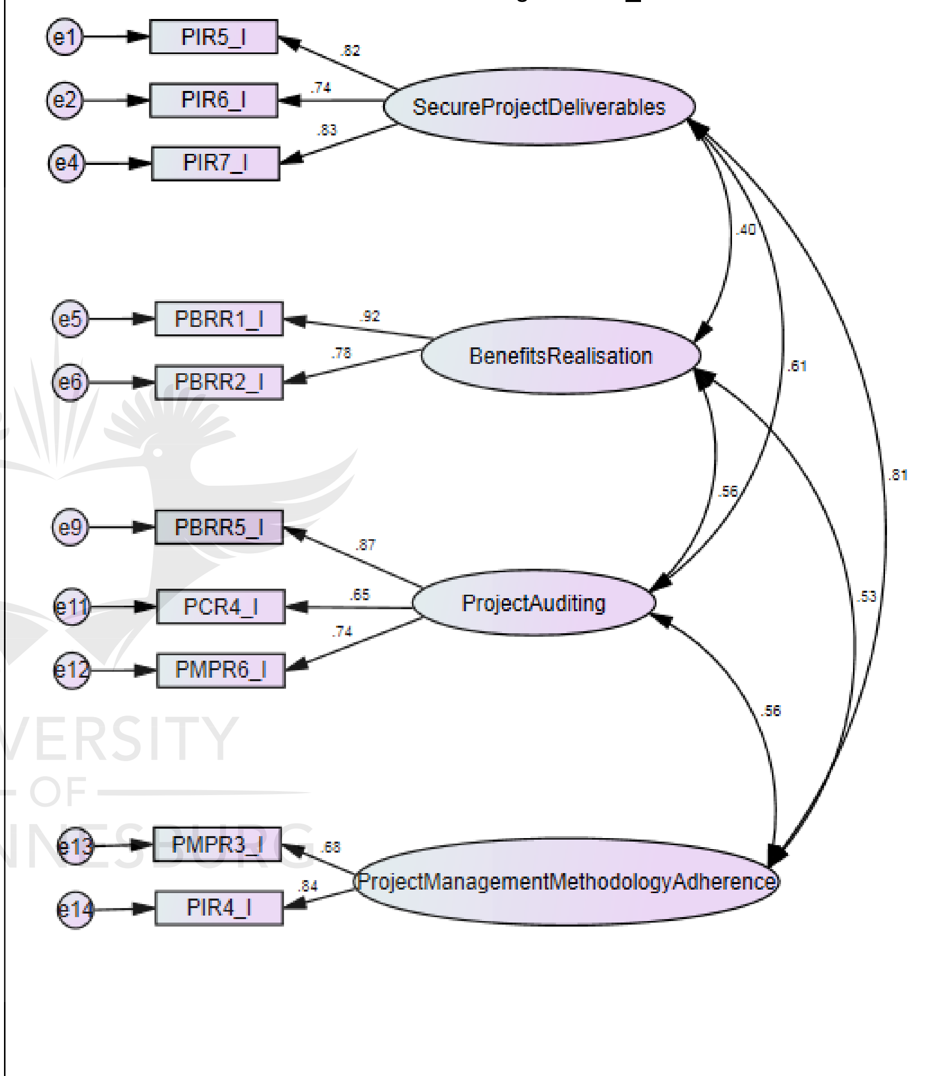
APPENDIX I: SEM ANALYSIS RESULTS FOR IMPORTANCE LEVEL OF THE IT PROJECT ASSURANCE PROCESSES



Run3:Structural model after removing PIR3_I



Run4: Final structural model after removing PBRR4_I



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