UNIVERSITY OF CAPE TOWN

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF MECHANICAL ENGINEERING

Title:

INVESTIGATING CRITICAL SUCCESS FACTORS FOR PROJECT COMPLETION IN A SOUTH AFRICAN TELECOMMUNICATIONS COMPANY

Dissertation in partial fulfilment of the degree of Masters of Philosophy in Engineering Management

Prepared by

IRFAAN HAMDULAY
HMDIRF001

Supervisor: Dr Corrinne Shaw

31 December 2017

Plagiarism declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.
2. Each significant contribution to, and quotation in, this assignment from the work(s) of other people has been attributed to, and has been cited and referenced.
3. This assignment is my own work.
4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as their own work.

I. Hamdulay 

Contents

List of Figures and Tables

Glossary

Abbreviation	Explanation
CLD	Causal Loop Diagram
CSF	Critical Success Factor
ESF	Empirical Success Factor
FQA	Functional Quality Assurance
FSM	Formal System Model
GSM	Global System for Mobile Communications
ISS	Initial Site Survey
LSF	Literature Success Factor
LTE	Long Term Evolution
PMI	Project Management Institute
PMBOK	Project Management Body of Knowledge
PSM	Project Success Model
RNP	Radio Network Planning
RRP	Revised Radio Planning
QA	Quality Assurance
SA	Site Acquisition
SSF	Synthesised Success Factor
SSM	Soft Systems Methodology
SSV	Single Site Verification
TSS	Technical Site Survey
WCDMA	Wideband Code Division Multiple Access

Acknowledgements

The completion of this dissertation has only been possible through the support of my friends, family and colleagues.

I would like to thank my Engineering Management friends for sharing their insights and opinions during the completion of my dissertation and throughout the Engineering Management course.

I appreciate and acknowledge the support of my family in motivating and supporting me during the challenging period while I was completing my dissertation.

I thank my supervisor Dr Corrinne Shaw for all the guidance and advice given during the completion of this research project.

Abstract

With the growth of the internet and the proliferation of mobile devices, network operators are constantly building and upgrading mobile network technologies. To provide quality voice and data services for increasing customer bases, and to cope with the growing demand for data, network operators embark on capital-intensive base station roll-out projects. The success of these technology projects is critical to the success and sustainability of network operators. These projects involve diverse project teams, vendors and contractors who contribute to the success of the project. The project teams consist of different departments within the organisation, each having their own perceptions of the factors required to complete projects successfully. The lack of agreed upon project success factors from these different stakeholders has resulted in project delays.

Therefore this study set out to answer the questions of:

1. What are the success factors that are required to ensure successful project completion in telecommunications Company X in South Africa?
2. How can these factors be managed systemically to improve project success?

The approach adopted in this study was first, an integrative review of literature on project success and critical success factors to identify the most important success factors that contribute to the success of projects. A context was given to the literature study by focusing on success factors in developing countries. A total of 71 success factors were identified and condensed into nine literature success factors. Thereafter, a survey was conducted to elicit the perceptions of project team members on success factors. A total of 65 success factors were obtained which were condensed into 10 empirical success factor categories.

Both sets of data was analysed using qualitative techniques including content analysis and comparing and contrasting. The literature and empirical success factors were synthesised into nine success factor categories. The nine success factor categories developed from the synthesis process were: managing project constraints; aligning projects with strategy; managing external factors; management support; strong leadership; project team competency; continuous learning; implementing project management bodies of knowledge and stakeholder management.

To address the second research question relating to the systemic management of the success factors, systems ideas were drawn upon in the form of a causal loop diagram to develop a project success model. Systems theory was used to determine the relationships between individual success factors and their overall effect on the system in focus. The system behaviour of the project success model initially predicts project success, but as the limiting conditions in the balancing loop take effect in the system, the overall success of the system is negatively affected.

The system behaviour of the project success model matched the pattern of behaviour of the “limits to growth” systems archetype. The high leverage system intervention for the “limits to growth” systems archetype is at the limiting conditions of the system. Thus, the proposed system intervention targeted the system limiting conditions which were the “Managing project constraints” and “Managing external factors” variables. Through the implementation of the synthesised success factors and the effective management of project constraints and external factors, the project success model contributes to the success of projects in the context of the telecommunications industry of South Africa.

The study concluded by finding that the research questions and concerns were addressed. Recommendations were made for the implementation of the synthesised success factors. Lastly, it was proposed that future studies use multiple case studies and examine the various systems archetypes in the project context.

Chapter 1: Introduction

This chapter introduces the topic of the study and sets the context and motivation of the study, leading to the development of the research questions. Thereafter, a brief outline of the content of each chapter in the dissertation is provided.

1.1 Telecommunication projects

Projects form part of a diverse range of industries. Industries such as the construction and power industry deliver projects that result in the construction of key infrastructure such as buildings, roads and dams, power stations and power distribution systems.

For the purpose of this study, a project is defined as follows: "A project is a temporary endeavour undertaken to create a unique product, service, or result" (Project Management Institute, 2013). Thus, every project has a defined period for completion since a project is defined as a temporary activity. Furthermore, the project must have an outcome that may be in the form of a product or it may result in the delivery of a service.

This study will focus on the project environment of the South African telecommunications industry, which is product- as well as service-driven. The product aspect involves the roll-out of network infrastructure technologies, while the service aspect delivers voice and data services to customers.

The South African telecommunications industry is worth approximately R276 billion and employs more than 70 000 people (Statistics South Africa, 2013). The largest telecommunication companies in South Africa are Vodacom, MTN and Telkom. The core function of these companies is to provide voice and internet services through the roll-out of network infrastructure technology projects.

In the South African telecommunications environment, mobile cellular operators need to manage the following trends: increasing data traffic and subscriber growth. This necessitates a growing number of capital-intensive site build projects. These trends can be seen in the annual reports of some of the large cellular network providers. Vodacom reports the growing trend towards increasing data usage, which has translated into higher data revenue growth and an increase in active subscribers (Vodacom annual results presentation, 2014). MTN's results reveal a similar trend (MTN annual results presentation, 2014). To cope with the increase in network subscribers and to provide sufficient cellular coverage, additional capacity has to be added by building base stations, thereby expanding network infrastructure.

Telecommunication projects typically involve the installation of communication technologies and networks. These projects are constantly evolving as technology progresses, replacing older technologies with newer technologies. In the mobile cellular industry, for example, older technologies such as the Global System for Mobile communications (GSM) are being replaced with newer technologies.

As new mobile technology develops and equipment becomes available, the older technologies are replaced. These newer technologies include Wideband Code Division Multiple Access (WCDMA) and the current benchmark for high speed mobile networks, Long Term Evolution (LTE) technology. These technologies require network upgrades and new site build projects for their implementation.

These network roll-out projects are characterised by strict deadlines, constantly changing specifications and limited resources (Ono, 2005). Key challenges facing network operators implementing telecommunication infrastructure projects include rapidly changing technology; rising costs and increased competition (Telkom integrated report, 2015). Operators have also identified potential risks including managing costs; quality concerns relating to network performance and the ability to respond to market changes (MTN integrated report, 2014). Critical factors such as these can result in project failure if they are not identified and addressed (Pinto and Mantel, 1990).

Current research on project success does not provide an industry-specific approach to project success which would be specifically applicable to the South African telecommunications industry. Research on project success by Pinto and Slevin (1987) indicates that the focus of early research was based on generic success factors. Later research by Belassi and Tukel (1996) also built upon the generic success factor approach but differed from the earlier research since the relationship between the generic success factors was also examined. However, this generic approach is problematic, as alluded to by Fortune and White (2006), who highlighted the increasing likelihood of project failure.

The development of success factors culminated in the formulation of system models demonstrated by Alias et al (2014) and Fortune and White (2006). Other authors such as Carvalho, Patah and Bido (2015) used models to study various sectors such as the energy, manufacturing and transport industries in developing countries. These authors constructed systems models with the objective of improving the success of projects using critical success factors. These models were derived from these different industries and from projects in various countries, so further study is needed to determine a suitable model that is applicable to the specific context of the South African telecommunications industry (Cooke-Davies, 2002; Carvalho, Patah & Bido, 2015).

The success of telecommunication projects is affected by the extent of the application of formal project management methodologies to projects. An example of a formal project management approach is illustrated by a project involving the provision of technology infrastructure in the school environment, the Mathsnet project (Pade-Khene, Mallinson & Sewry, 2011). The use of project management in this project resulted in the Mathsnet project having clear project objectives and project monitoring systems in place (Pade-Khene, Mallinson & Sewry, 2011). However, the adoption of project management in a project does not guarantee the success of a project (Munns & Bjeirmi, 1996).

In a study of telecommunication projects in a developing country, Murambiwa and Barry (2012) examined the implementation of project management methodologies. The project management knowledge areas of risk management and quality management were found to be lacking in the local telecommunications industry (Murambiwa & Barry, 2012). This result was due to varying levels of use of project management methodologies.

The use of project management methodologies by operators in telecommunications projects is not compulsory and is dependent on the organisation, business unit or project team. This has resulted in differing levels of usage of project management in telecommunications projects. An example of a project that did not use a formal project management approach is the Dwesa project, which involved providing internet services to the surrounding communities (Pade-Khene, Mallinson & Sewry, 2011). This project experienced planning and implementation challenges, due to unclear project objectives and the absence of continuous project monitoring (Pade-Khene, Mallinson & Sewry, 2011).

Opinions differ as to whether the use of project management affects the success of projects (Rolstadås, Tommelein, Per & Ballard, 2014; Munns and Bjeirmi, 1996). Rolstadås et al (2014) believe the success of the project does depend on the project management approach. Furthermore, project success is dependent on project management through the project management approach selected. The prescriptive approach focuses on the qualities of the project organisation, documentation and procedures and the adaptive approach relates to the process of improving project culture and the organisation (Rolstadås et al, 2014).

An alternative view is held by Munns and Bjeirmi (1996) who suggest that the success of the project does not depend solely on the use of project management. Project success includes project management success and project success which is determined throughout the project life-cycle, which includes project initiation, planning, execution, monitoring and closure (Project Management Institute, 2013; Munns & Bjeirmi, 1996). These differing viewpoints require further examination in the telecommunications context of this study.

1.2 Case study context and concerns

The base station roll-out project in a South African telecommunications company forms the context for the case study. The organisation will be referred to as Company X. The base station project involves the planning, build and commissioning of the mobile cellular network of Company X. The base station roll-out project forms part of the South African telecommunications industry, where network operators are facing challenges managing projects. The resources and budget for the base station roll-out project of Company X are limited. However, the project must be completed in a stipulated period.

The management of project costs, quality and response to market changes have been identified to affect the success of projects (MTN integrated report, 2014). Furthermore, infrastructure-intensive roll-out projects such as the base station roll-out project, must deal with constantly changing technology requirements, escalating costs and increased competition (Telkom integrated report, 2015).

The base station roll-out project consists of numerous stakeholders who can influence the outcome of the project. The base station roll-out project consists of the project management, radio planning, installations, property and vendor teams. Each of the teams have their own project targets to reach, which may not be in conformity with the other teams. An example of the lack of conformity between the objectives of each of the teams is the relationship between the planning and installation teams. The planning team may identify a base station location that would provide excellent coverage but with high site build costs. Since the installation team has cost targets for site build, they would not want to build on that site because the costs would negatively affect their project performance targets.

The site planning team would have to find other lower-cost sites that may not be as effective from a site coverage perspective. The result is that delays are introduced into the project due to the need to resolve differences amongst project teams regarding an agreed set of project success factors. Table A indicates the base station project roll-out with the corresponding project phases over a 12 month period. Project delays requiring additional sites to be located and acquired results in the project not meeting project roll-out targets. Delays in the project stages such as the site surveying and acquisition phases affects the entire project roll-out timeline.

Table A: Base station project roll-out phases

Rollout project (month)	1	2	3	4	5	6	7	8	9	10	11	12
Project phase	Site planning	Initial survey	Acquisition	Survey	Kickoff	Site build	Site build	Site build	Quality assurance	Quality assurance	Verification	On Air

There is no system currently in place in the base station roll-out project that identifies and prioritises the most important factors affecting the overall project. This creates a lack of focus for the project teams since there are no defined influence factors. Project teams currently pursue their own objectives without considering what other team factors they have the potential to influence. The project management team, for example, only deals with the scheduling and project planning aspect of the project and is not aware of other important factors that could increase the likelihood of the project concluding successfully.

By not identifying and addressing the relevant factors affecting the project, the project could fail (Pinto & Mantel, 1990). The failure of the project would result in the project targets not being met for all project teams. This would negatively impact company targets and could result in cost-cutting, retrenchments and loss of revenue.

To reduce the risk of project failure, success factors should be investigated, as was done by Pinto and Slevin (1987), Belassi and Tukel (1996) and Alias, Zawawi, Yusof and Aris (2014). These authors identified critical success factors for implementing projects. These authors include generic critical success factors. However, this research study intends to provide critical success factors that would be specifically applicable in the project environment of the South African telecommunications industry.

1.3 Developing research questions

The research questions were developed to address the challenges and concerns of projects in the South African telecommunications industry. The context of this study is the base station roll-out project of Company X. Due to the different project targets of the different project teams, there is the risk of project failure. There is no system in place for the identification and modelling of factors that would contribute to the project concluding successfully.

The first research question was formulated to address the need to determine the success factors applicable to the base station project. The success factors would be obtained through the available literature on the subject and through the perceptions of project team members. The second research question was formulated to determine how the identified factors could be modelled systemically. The following research questions were developed:

1. What are the success factors that are required to ensure successful project completion in telecommunications Company X in South Africa?

2. How can these factors be managed systemically to improve project success?

The rationale behind the first research question comes from the challenges facing the base station roll-out project, which forms part of the South African telecommunications industry. By studying the perceptions

of the project team members involved in the project, more insight will be obtained by identifying the factors affecting the success of the project.

The rationale behind the second research question is the proposal for a systemic model of project success that would be applicable to the South African telecommunications industry. Project success was conceptualised as a system with a boundary that separated it from the rest of the organisation. This allowed for the identification of project success factors to be viewed as variables that contributed to systems behaviour and to identify high leverage variables for intervention. Qualitative systems dynamics modelling was used as a means of modelling systems behaviour as it provided as logic for the relationships between variables. The systemic model is intended to include the success factors and the resulting relationships to project success, similar to other systemic models incorporating success factors (Alias et al, 2014; Fortune & White, 2006).

1.4 Overview of dissertation chapters

This dissertation consists of five chapters which are summarised below:

In Chapter 1, the research area of interest is introduced, the context of the study is established, the research questions are proposed and an overview of the content of the research chapters is provided.

Chapter 2 contains the literature review of the following topics: project success, critical success factors, the systems approach to projects and systems modelling.

In Chapter 3 the research philosophy is described and the case study approach is detailed. Thereafter, the qualitative nature of the study is established and the data collection and analysis methods are discussed. Lastly the ethical implications and criteria for trustworthiness of the research study are examined.

In Chapter 4, the results of the research findings obtained from the integrative literature review and the empirical data are presented and a systemic model is proposed.

In Chapter 5, the research study is reviewed, recommendations for implementation of the success factors are made and future studies are proposed.

1.5 Conclusion

This chapter has introduced the topic of this study by providing the background for telecommunication projects and has set the context of this study as the South African telecommunications industry. Challenges and concerns relating to telecommunications projects have been described and, thereafter, the research questions were developed. The chapter concludes with an overview of the five chapters in the dissertation.

Chapter 2: Integrative literature review

In this chapter, literature on four topics are reviewed: 1) project success; 2) critical success factors for project success; 3) success factors in a developing country context; and 4) the systems approach to projects and systems modelling.

2.1 Project success

The traditional model of project success is known as the "Iron Triangle" which enables the evaluation and prioritisation of project constraints (Atkinson, 1999). This model regards the success of a project as determined by whether the project is completed according to the project objectives of time, cost and quality (Bronte-Stewart, 2015). This means that, since a project is temporary, this model requires that the project is completed within a pre-determined period. Furthermore, if the project is completed within budget and at an acceptable level of quality then the project is regarded as a success.

The traditional model of project success was extended by Atkinson (1999), who argued that the focus on cost, quality and time does not provide the only measure of project success. The revised model of project success also considers the project stakeholders, the project organisation and the information system of the project (Atkinson, 1999). Some of the additional criteria for project success include "Organisational-learning", "Environmental impact", and "Satisfied users" (Atkinson, 1999).

Bronte-Stewart (2015) further supports the view of Atkinson (1999) and suggests that the "Iron Triangle" does not represent a complete view of project success. Bronte-Stewart (2015) provides an example of the Sydney Opera House, which was a failure according to the "Iron Triangle" since the project finished ten years after the planned end date and was more than 1000 per cent over budget (Bronte-Stewart, 2015). However, when looking at additional criteria such as long-term success and the benefits and value that this project has added, Bronte-Stewart (2015) argues that it can be regarded as a success.

An alternative interpretation of project success is that the success of the project and the success of project management are each measured according to different objectives (Cooke-Davies, 2002; Munns & Bjeirmi, 1996). Munns and Bjeirmi (1996) define a project to be objective-orientated while project management is described as process-based. Cooke-Davies (2002) also distinguishes between project success and project management success. Project success is determined by whether the project objectives are achieved; while project management success depends on satisfying project constraints such as the project schedule, specifications and budget (Cooke-Davies, 2002).

Munns and Bjeirmi (1996) developed criteria that are used to ensure the successful completion of projects. These criteria involve recognising the importance of project management tools and techniques, establishing the relationship between the client and the project management team and evaluating the project throughout the project life cycle (Munns & Bjeirmi, 1996).

The ambiguous nature of project success has resulted in different interpretations of project success (Ika, 2009; Shenhar & Dvir, 2007). Furthermore, the common view of project success as a generic framework is contrasted by the suggestion of a more directed approach to project success (Ika, 2009). This approach takes into consideration that every project is different and would require context-specific criteria (Ika, 2009). Shenhar and Dvir (2007) consolidate the success criteria into an operational, team and organisational aspect. An additional approach to measuring the success of projects is through the perceptions of project stakeholders (Ika, 2009). This approach to project success is proposed as an alternative to the theoretical and empirical research approaches (Atkinson, 1999; Munns & Bjeirmi, 1996; Shenhar & Dvir, 2007, Bronte-Stewart, 2015).

Project success has also been influenced by the development of project management tools and techniques, as alluded to by Munns and Bjeirmi (1996). For example, the Project Management Institute has developed the Project Management Body of Knowledge (PMBOK) and defines project management as follows: "Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (Project Management Institute, 2013:4). This body of knowledge, according to PMI (Project Management Institute, 2013), contains the best practices of the project management field, which, when applied to a project, increases the likelihood that the project concludes successfully..

The PMBOK was developed and documented through the experiences of practitioners of project management in industry (Project Management Institute, 2013). This indicates that project management is continuously evolving and can be regarded as a "learning profession" (Atkinson, 1999). Furthermore, the PMBOK provides process guidelines and methods to ensure that each knowledge area is managed effectively (Project Management Institute, 2013). There are ten knowledge areas; however, the application of any knowledge area from the project management body of knowledge is dependent on the project team or organisation. These knowledge areas include Scope management, Time management, Cost management, Quality management, Human resource management, Communications management, Risk management, Procurement management, Stakeholder management and Integration management.

2.2 Examining critical success factors (CSFs)

Project success is the most desirable outcome for any project. However, since the success of a project cannot be guaranteed, it is necessary to determine the key success factors that contribute to the success of projects. Critical success factors (CSFs) are defined as the "characteristics, conditions, or variables that can have a significant impact on the success of the project when properly sustained, maintained, or managed" (Milosevic, & Patanakul, 2005).

Research on CSFs dates back as far as the 1980s when Pinto and Slevin (1987) generated key CSFs for successful project implementation. While the CSFs can depend on the particular industry in which the project is implemented, Pinto and Slevin (1987) sought to generate a generic list of success factors that could be applicable irrespective of industry. The resulting framework resulted in the formulation of key factors that relate to project mission, management support, project scheduling, client-related factors, technical factors and human-resource-related factors (Pinto & Slevin, 1987).

Similarly to Pinto and Slevin (1987), Belassi and Tukel (1996) developed a framework for generating CSFs. This framework involved grouping key success factors into factor groups relating to the project, the project manager and project team, the organisation in which the project operates and the external environment (Belassi & Tukel, 1996). By classifying the success factors into four distinct categories, Belassi and Tukel (1996) comment that this approach is advantageous with regard to classifying success factors in different types of industries and organisations.

Although the success factor categories proposed by Belassi and Tukel (1996) are separated into different category types, the importance of the relationships between the categories is highlighted by the authors. This observation indicates that in formulating and developing success factors, these factors should not only be viewed independently, but rather the relationships between the factors should also be considered.

The approach of Fortune and White (2006) to CSFs contrasts with earlier research.. In addition to identifying critical success factors from 63 publications, a systems model known as the Formal System Model (FSM) is used in conjunction with the identified CSFs (Fortune & White, 2006). This systems model incorporates decision-making and monitoring sub-systems, inter-relationships between the identified CSFs and interactions with the external environment, to ensure successful project completion (Fortune & White, 2006). An important point regarding the research of Fortune and White (2006) is that the systems model proposed was only used while the researched projects were in the implementation stage.

Alias et al (2014) highlighted the importance of viewing CSFs as variables that contribute to the success of projects. The conceptual model developed aims to influence the success of the project through the classification and identification of the CSFs. Furthermore, the link between CSFs and the performance of the project is developed using a conceptual model, containing project management and project-related factors, as well as human-related factors and external environmental factors (Alias et al, 2014). Furthermore, the conceptual model proposed by Alias et al (2014) differs from other models, such as that proposed by Belassi and Tukel (1996), in that the proposed framework clearly highlights project management as a contributing factor to the success of the project.

Although the formulation of CSFs results in the formation of numerous factors which contribute to the successful implementation and completion of projects, this approach does not consider the relationships that exist between the CSFs themselves. Fortune and White (2006) observe that it is not only the success factors themselves which contribute to the success of the project but also, more importantly, it is the relationships between the CSFs that also contribute.

An example of a CSF is management support, which would contribute to the success of a project. However, this factor may also be influenced by external factors such as the prevailing economic situation of the country (Fortune & White, 2006). This situation indicates the importance of viewing critical success factors by considering and examining the impact that external variables can have on the identified CSFs. A summary of the review on CSFs is provided in Table B.

Table B: Summarised review of critical success factors (CSFs)

Pinto and Slevin (1987)	**Belassi and Tukel (1996)**	**Cooke-Davies (2002)**	**Fortune and White (2006)**	**Alias et al (2014)**
Project mission	Project manager competency	Risk management	Senior management support	Communication
Senior management support	Project team competency	Project responsibilities	Project manager competency	Planning
Project scheduling	Project description	Time management	Communication	Organisational structure
Client management	Management support	Scope management	Risk management	Client management
Human resource management	Organisational structure	Quality management	Project champion	Project type
	Project champion	Collaboration between project management and line management	Change management	Project complexity
		Learning from previous project experiences	Project team competency	External factors including political, social and economic issues
		Project performance feedback	Project monitoring and control	
		Aligning projects with business and strategy objectives		

2.3 Project success factors in developing countries

Various databases and journals were searched for success factors including Web of Science, Emerald, EBSCOhost, the International Journal of Project Management and the Project Management Journal. The search revealed a limited number of results for success factors in the telecommunications industries of developing countries. However, a few studies were obtained focusing on telecommunications projects in South Africa, Zimbabwe and Ghana (Pade-Khene, Mallinson & Sewry, 2011; Murambiwa & Barry, 2012).

Murambiwa and Barry (2012) investigated the relationship between project management methodologies and project performance success. The results of this study indicated that the success of telecommunications projects is affected by the project management methodology (Murambiwa & Barry, 2012). The researchers defined the performance of projects according to the traditional time, cost and quality objectives. The following knowledge areas of the Project Management Institute (PMI, 2013) were used by Murambiwa and Barry (2012) as factors in a survey to measure project success:

1. Procurement management
2. Risk management
3. Communication management
4. HR management
5. Quality management
6. Cost management
7. Time management
8. Scope management
9. Integration management.

In a study of success factors in projects located in South Africa, Pade, Mallinson and Sewry (2007) identified 19 CSFs. The success factors were examined in a selection of case studies over the project life cycle (Pade-Khene, Mallinson & Sewry, 2011). The success factors proposed by Pade, Mallinson and Sewry (2007) are listed in Table C. Furthermore, this study also looked at the sustainability of projects so additional social and economic factors were also included. Factors such as "Incorporating socially excluded groups" and "Significant participation of community target groups in the project process" were also included by Pade, Mallinson and Sewry (2007) as CSFs.

Table C: CSFs identified by Pade, Mallinson and Sewry (2007)

Number	Critical success factor
1	Simple and clear project objectives
2	Approaching the project in a holistic way
3	Using ICT to enhance existing rural development activities
4	Cultivating an enthusiastic influential project champion
5	Incorporating socially excluded groups
6	Incorporating/awareness of specific ICT policy influencing the project
7	A good understanding of the local political context
8	Significant participation of community target groups in the project process
9	Focusing on local/demand-driven needs
10	Building on local information and knowledge systems
11	Appropriate training and capacity building
12	Facilitating local content development
13	Existing motivation and incentive for ICT job placement in the community
14	Focusing on economic self-sustainability – business development (entrepreneurship)
15	Encouraging local ownership
16	Building local partnerships
17	Choosing the appropriate or right technology
18	Building on existing public facilities
19	Ongoing monitoring and evaluation of the project

In a study of success factors in the telecommunications industry in Ghana, Atsu, Andoh-Baidoo, Osatuyi and Amoako-Gyampah (2010) developed a framework for project success. This framework consists of cultural, economic, organisational and governmental factors (Atsu, Andoh-Baidoo, Osatuyi & Amoako-Gyampah, 2010). The 17 success factors identified by Atsu et al (2010) were ranked in terms of importance and are illustrated in Table D. These success factors were found to be relevant in the context of the project environment of a developing country such as Ghana (Atsu et al, 2010).

Table D: CSFs in Ghana (Atsu et al, 2010)

Number	Success factor
1	Available funds
2	Top management support
3	Training
4	Motivation
5	Proper planning
6	Minimised scope
7	User involvement
8	Firm basic requirements
9	Clear statement of requirements
10	Formal methodology
11	Ownership
12	Culture
13	Political interference
14	Risk management
15	Capital budgeting and post implementation audit
16	Competent staff
17	Experienced project manager

2.4 Systems approach to projects

The systems approach can be described as "an approach to a problem which takes a broad view, which tries to take all aspects into account, which concentrates on interactions between the different parts of the problem" (Checkland, 1993).

Systems thinking has been used in projects in diverse industries such as the civil, defence, railway and telecommunications industries to deliver successful projects (Mawby & Stupples, 2002). Systems thinking views the world as being systemic, whereby the understanding of phenomena is gained by the emergent properties and interrelationships of the whole system (Flood, 2010). Senge (1994) describes systems thinking as a language which describes interrelationships and enables the identification of patterns in the resultant systems.

The systems approach is an alternative to the linear cause and effect understanding of phenomena which is known as reductionism (Flood, 2010). Reductionism is the opposite of systems thinking in that a system is divided into separate parts and studied linearly. The systems approach allows more detailed

system modelling and analysis, considering the underlying behaviour of systems compared to the cause and effect approach of reductionism.

The multi-dimensional and systemic nature of projects is emphasised by San Cristóbal et.al (2016), who propose that project managers "take a systemic view" to successfully manage the relationships between the personal, material and social worlds in a project. They (San Cristóbal et.al, 2016) propose the use of multiple methodologies for dealing with the complexities in projects that are revealed by taking a systemic view rather than a single methodology such as PMBOK or Soft systems methodology (SSM). The multimethodology approach involves examining the project dimensions on social, personal and material levels and intervening in appreciation, assessment, analysis and action phases (San Cristóbal et.al, 2016).

Traditional project methodologies focus on project processes, techniques and structures whereas systemic project management prescribes "aligning the project objectives, tasks and execution with the direction of energy flows of the organisation (Song, 2011). The systemic approach to managing projects arises due to the existence of inter-dependent relationships between the self, work and organisation (Song, 2011). The project is not viewed in independence but as an inter-dependent entity. The foundation of the systemic approach consists of creating a learning environment with information sharing, collaboratively generating methods, practicing methods among team members and developing outcome based guides for implementation (Song, 2011). Table E illustrates the systemic approach to projects across the scoping, planning and executing project phases with corresponding outcomes.

Table E: Systemic approach to projects (Song, 2011)

Methodology	Project Phase	Questions	Outcomes
Systems thinking	Scoping	Why?	Refining business case and vision
		What?	Assessing change and complexity
	Planning	Who?	Generate sponsorship
		When?	Charting a measurable and flexible course
	Executing	How?	Empowering team work
		Where?	Managing transitions

The systems approach to projects is further extended by Cicmil et.al (2006), who propose the systemic modelling of projects in order to address project failure. Cicmil et.al (2006) highlight the ability of systemic models to show non-linear project behaviour. Furthermore, systemic modelling of projects allows the behaviour of the project to be viewed by considering "soft" factors such as project team morale and dynamic client behaviour (Cicmil, 2006).

2.5 Conclusion

This review chapter has firstly discussed the development of project success. Secondly, CSFs were examined and project models were reviewed. Thereafter, the study focused on success factors in developing countries including South Africa, Ghana and Zimbabwe.

The intention was to identify sources and studies that could inform theory development on project success factors that are appropriate for the South African context and telecommunications industry.

Traditional project methodologies focus on project constraints, processes and factors in order to achieve project success. The systems approach broadly considers the inter-relationships and interactions between project constraints and success factors. An overview of system behaviour is derived through the systems approach which allows interventions to be proposed, which has the ability to alter the behaviour of the project and influence the success or failure of the project. This study aims to use the systems approach to positively affect project outcomes.

Chapter 3: Research Design

This chapter will explain the research philosophy and design used to investigate the research questions that were raised in Chapter 1. Thereafter, the qualitative research approach is detailed, followed by the consideration of validity and the trustworthiness issues for this study. Lastly, the ethical considerations of this study are discussed.

3.1 Research philosophy

The research philosophy of a study forms the basis of the research design, since the philosophical view influences the research strategies and methods (Creswell, 2009). To answer the research questions posed in Chapter 1 an appropriate research philosophy is required. The focus of this study is on gaining insights from the individual members of the project team in the case of the base station roll-out project. Thus, philosophical views such as positivism would not be appropriate, which are not dependent on the views or opinions of human subjects (Easterby-Smith, Thorpe & Jackson, 2012).

Constructionism is an epistemological branch of philosophy which relies on interpretation and experiences to construct reality (Jonassen, 1991). This study adopts the constructionist philosophical view which allows the researcher to interpret the opinions and views that individuals have about reality (Creswell, 2009). This qualitative form of research is used to answer the research questions. By answering the research questions and interpreting these findings, this study intends to highlight the important factors and models that contribute to successful project completion in the South African telecommunications industry. Figure 1 provides an overview of the research foundation pyramid for this study. The research philosophy forms the foundation of this study and is the base of the pyramid. The methodology is built on the research philosophy and supports the methods used for data collection, which forms the apex of the pyramid.

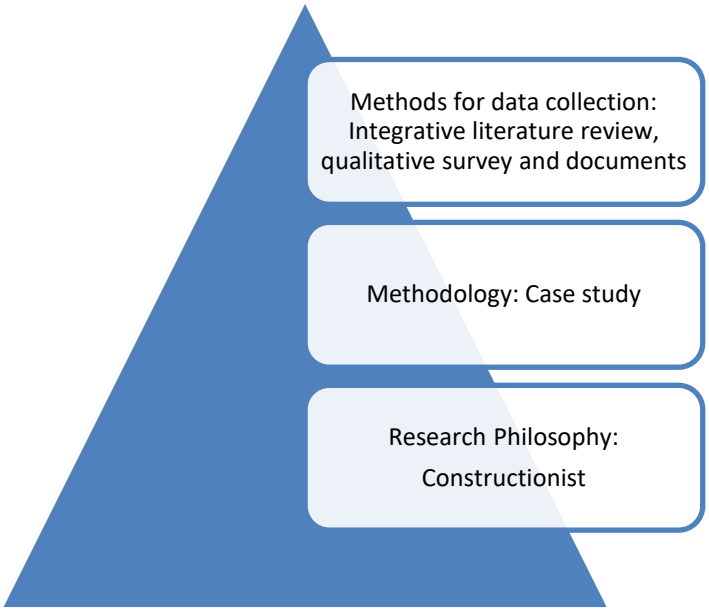


Figure 1: Research foundation pyramid

3.2 Research design

As this study investigates the perspectives on project success factors of participants involved in projects in a company, a qualitative approach is argued. This study adopts the qualitative research design of Maxwell (2012), who uses the following components to address the research design:

1. Goals
2. Conceptual framework
3. Research questions
4. Methods
5. Validity.

The research design components are illustrated in a model of qualitative research design in Figure 2. The goals, conceptual context and research questions are described in Chapter 1. In this chapter the methodology and validity will be discussed.

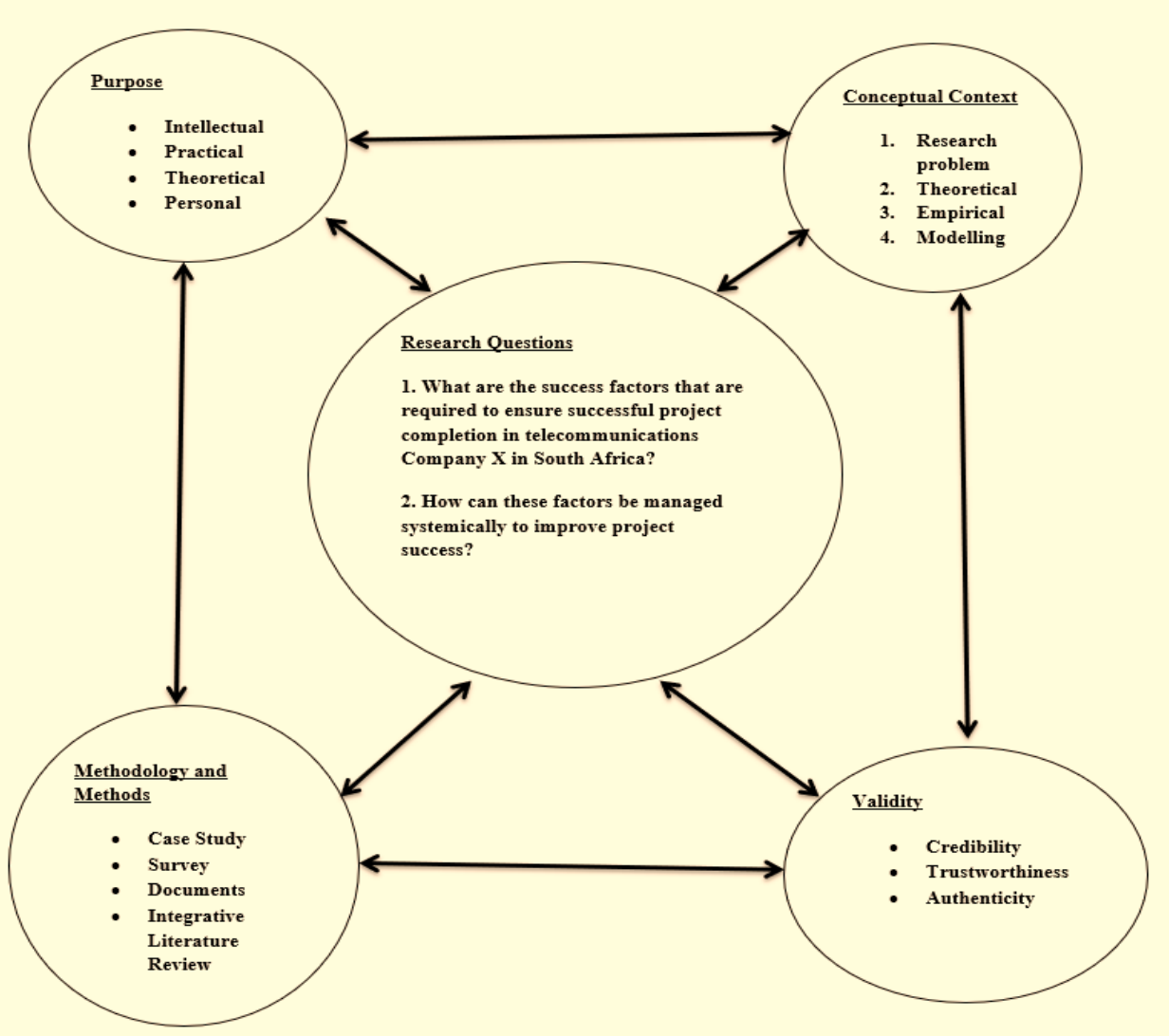


Figure 2: Model of qualitative research design (Maxwell, 2012)

3.3 Methodology: Case study

The research methodology used in this study is the case study methodology. The case study approach is categorised into two distinct areas, namely the single case study and the multiple case study (Easterby-Smith, Thorpe & Jackson, 2012). The single case study focuses in detail on one case, while the multiple case study approach has a broader focus and involves the study of multiple cases.

Stake (2006) further categorises case studies as either 'instrumental' or 'expressive' case studies. The instrumental case study described by Stake (2006) involves examining single cases with the objective of deriving results that could be applicable in a general context. The key difference between the expressive case study compared to the instrumental case study is that the results from the expressive study are more specific and might not be applicable and extendable to a general context (Easterby-Smith, Thorpe & Jackson, 2012).

The focus of this research study is on the base station roll-out project in Company X, hence the single case study is the most appropriate case study method. This research study aims to produce and model CSFs that are transferable to other contexts, which is in line with the instrumental case study methodology developed by Stake (2006).

3.3.1 The case of the base station roll-out project

The selected case for this study is the base station roll-out project in Company X. This study intends to identify success factors and their contribution to project success from the case study into Company X.

Company X is a technology company that forms part of the telecommunications industry in South Africa. This company provides mobile voice and data services through the planning, construction and activation of base stations. The base station roll-out project consists of a planning phase, site build phase, site activation phase and site handover phase. The teams involved in the base station roll-out project include the radio network planning (RNP), property, installations, project management and vendor teams. Figure 3 shows the participating teams that contribute to the delivery of the project. The purpose of the research is to determine and model the CSFs in the base station roll-out project that contribute to the success of the project.

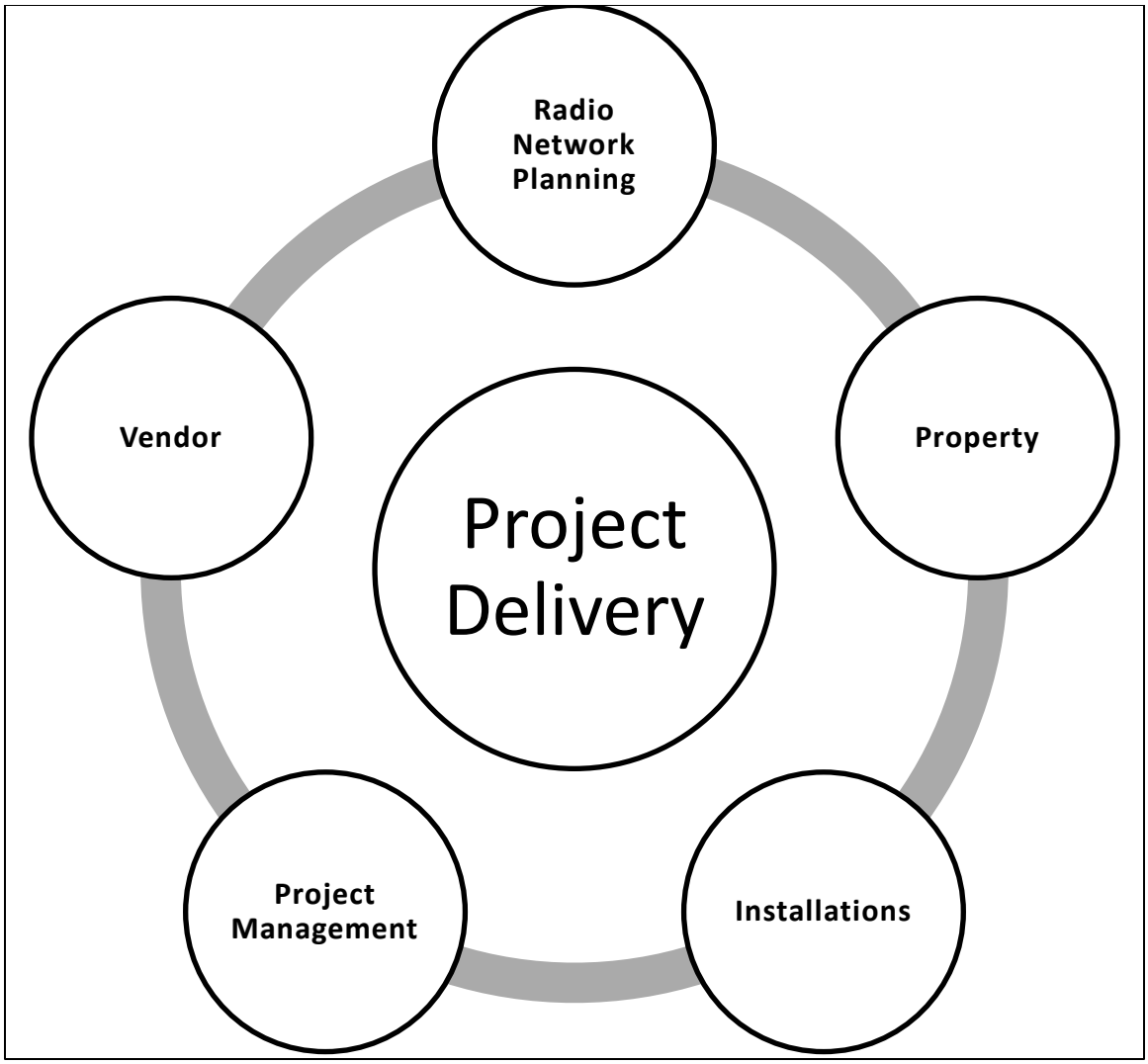


Figure 3: Contributing teams to project delivery

The base station roll-out project is initiated by the initial site planning process, where the radio planning team produces a nominal site plan to satisfy network coverage and quality objectives. Once the final site list has been compiled, the project is initiated, and the site identification phase commences.

The RNP team identifies the actual site locations by conducting an initial site survey (ISS). Once the ISS has been successfully completed and the site is agreed as feasible, it is added to the site build list. The property team commences site acquisition (SA) after the RNP team has identified the site and when negotiations are successful between the property owner and the property team, the site build process is initiated.

The site build process is initiated by the technical site survey (TSS) stage, which develops site build designs. When the site design stage has been concluded, the site is built according to specifications. As part of the build phase functional quality assurance (FQA) testing is done to ensure that the site is built to specification.

Before the base station is activated and brought on air, a final performance check is done called single site verification (SSV). When the site performance criteria have been met, and the site has been optimally configured to provide voice and data services, the SSV stage is passed and the site is announced as on air.

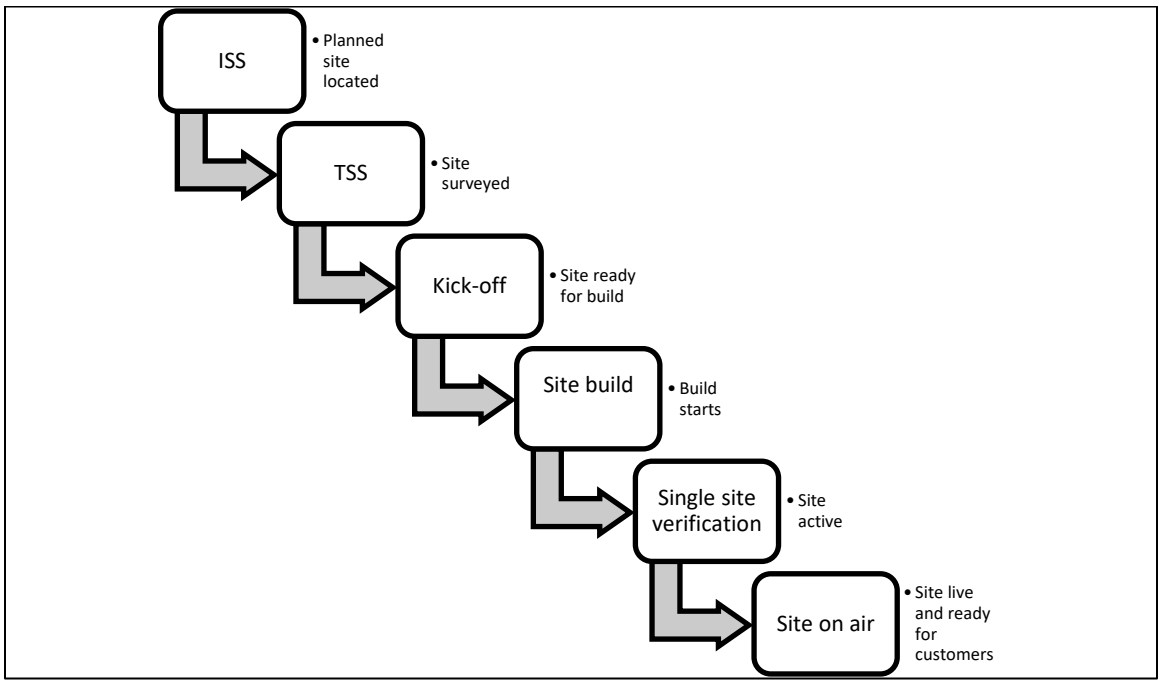


Figure 4: Project roll-out milestones

The concern affecting the base station roll-out is that there is no system currently in place that allows the project teams to identify and model the factors affecting the success of the project. Each team only considers their own factors independently of the other teams, without an overview on the success of the project. This results in project delays and affects the successful completion of the project.

This study aims to investigate the perceptions of project team members regarding the critical success factors (CSFs) that contribute to successful project completion. Furthermore, the relationship between success factors and the success of the project will be discussed and modelled by using the systems approach. By identifying and modelling the success factors, this study intends to extend the findings from the case study context into the broader telecommunications industry in South Africa, through the instrumental case study approach (Stake, 2006).

3.3 Methods for data collection

This study used three methods to collect data. Theoretical data was obtained from the integrative literature review, while empirical data was gathered from the qualitative survey and documents.

3.3.1 Integrative literature review

The first data collection method in this study was the integrative literature review. This type of literature review synthesises existing literature to generate new insights and knowledge (Torraco, 2016). The integrative literature review was conducted to collect data on project success and CSFs. This involved extracting success factors from the relevant literature in various databases including Web of Science, Emerald, EBSCOhost, the International Journal of Project Management and the Project Management Journal.

3.3.2 Qualitative survey

The second method used in this study is the qualitative survey method. A survey is the study of a population by observing the members to determine characteristics of the population in focus (Jansen, 2010). The survey method is normally used in quantitative research to numerically describe a target population with regards to underlying trends (Creswell, 2009). The qualitative survey method does not use the conventional survey technique of determining frequencies of responses but rather measures the diversity of responses, which is possible due to the use of open-ended questions (Jansen, 2010). The survey questions used for the study into the perceptions of the project teams are located in Appendix B.

Qualitative data was gathered from the case study using qualitative surveys from project team members that are currently involved in the base station roll-out project. The google forms platform was used and the survey was populated on the platform. The survey was emailed to the research participants from the radio network planning, property, installations, project management and vendor teams. Responses were gathered automatically and stored on the platform.

3.3.3 Documents

The third method used in this study to address the research questions is through the analysis of documents. Documentary analysis provides valuable insights and can be used to contextualise data gathered from other research methods (Bowen, 2009). Documents, once obtained, are easily accessible, already transcribed and provide the researcher with a means of gaining insight into the views or opinions of the authors or research participants (Cresswell, 2009). The qualitative data gathered from documents was obtained from monthly project team progress meeting minutes over a period of five months.

3.4 Sampling

The purposive sampling method allows the researcher to efficiently target the required sample units by introducing filtering questions, to satisfy pre-determined criteria (Easterby-Smith, Thorpe & Jackson, 2012). By introducing filtering criteria in the questioning process, the researcher can gather valid data more effectively. The data collection process is made more efficient, since the questioning process only commences once the validity of the sample unit is determined.

Easterby-Smith, Thorpe and Jackson (2012) provide an example of the purposive sampling method in a marketing context where the initial questioning establishes the suitability of the sample unit. Following this approach, this study established the suitability of the sample units by gathering data only from members of the project team involved in the base station roll-out project in Company X. Respondents not part of the base station roll-out project were not selected.

The qualitative research conducted into the success factors of projects in the base station roll-out project used the purposive sampling method, due to the small size of the sample group compared to the large sample size required for statistical sampling methods. The sample group included seven representatives from departments involved in the base station roll-out project, including the radio network planning, installations, project management and vendor teams. This ensured that the sample was representative and inclusive of the departments involved in the project roll-out. The sample profile involved in the base station roll-out project are illustrated in Table F, which provides further details of project experience, department and qualifications of selected respondents.

Table F: Sample profile

Sample group	Involvement in the base station roll-out project	Project Experience	Project department	Qualification
Respondent A	Yes	5 years	Radio network planning	Bachelor of science
Respondent B	Yes	21 years	Installations	National diploma
Respondent C	Yes	5 years	Project management	National diploma
Respondent D	Yes	12 years	Radio network planning	National diploma
Respondent E	Yes	10 years	Project management	Bachelor of technology
Respondent F	Yes	8 years	Vendor	Bachelor of Science
Respondent G	Yes	10 years	Radio network planning	Bachelor of Science

3.5 Data Analysis

The research into the CSFs of projects in the base station roll-out project involved the collection of qualitative data. The qualitative data analysis approach used in this study involved seven stages adapted from Creswell (2009):

1. Gathering the raw data
2. Organising the data for analysis
3. Reading the data
4. Coding the data
5. Generating themes
6. Describing the themes
7. Interpreting the themes.

The qualitative data gathered was analysed using content analysis. Content analysis is a text-based method of data analysis used by the researcher to make inferences objectively and to generate new information from the gathered textual data (Bauer, & Gaskell, 2000). The gathered textual data from this study was coded into different categories which are described in Chapter 4.

The literature study data analysis involved first gathering and coding 71 success factors from the literature. Thereafter, a second level of coding was implemented to reduce the 71 success factors to nine categories.

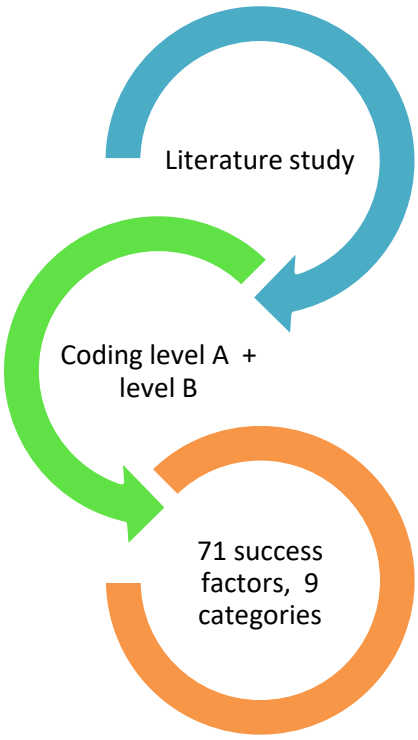


Figure 5: Coding process from the literature study

The empirical study data analysis involved gathering and coding 65 success factors. A second level of coding was employed to reduce the 65 success factors to 10 categories.

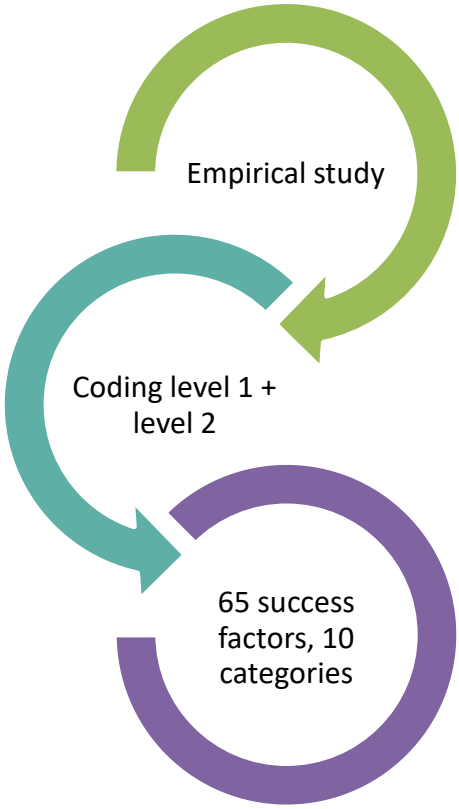


Figure 6: Coding process from the empirical study

The synthesis of the literature and the empirical success factor categories first involved combining the success categories. The combined success factor categories included 19 success factor categories. Thereafter synthesised coding was implemented and a list of nine success factor categories was developed.

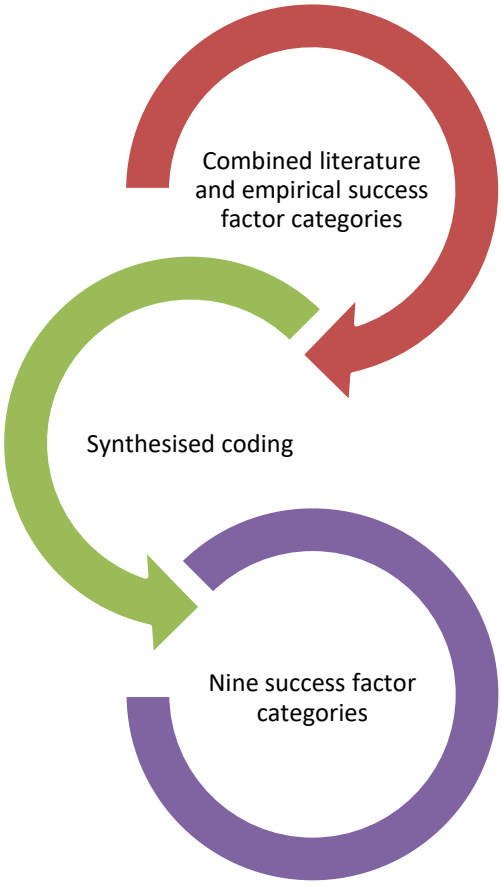


Figure 7: Synthesis and combined coding of the literature and empirical studies

Figure 8 provides an overview of the complete data analysis process used in this study to generate the nine final success factor categories. The conclusion of the data analysis process results from the synthesis of the empirical and the theoretical data into the final success factor categories.

Thereafter, data triangulation was used to determine the success factor categories most affected by project delays. This involved examining documents obtained from meeting minutes and grouping project delays into the applicable success factor categories. Examples of project delays and the applicable success factor categories are provided in Chapter 4.

To ensure the validity of this study data triangulation was used and the success factor categories were compared with the delays in the current project using meeting minutes. This allowed the success factor categories most impacted by project delays to be identified.

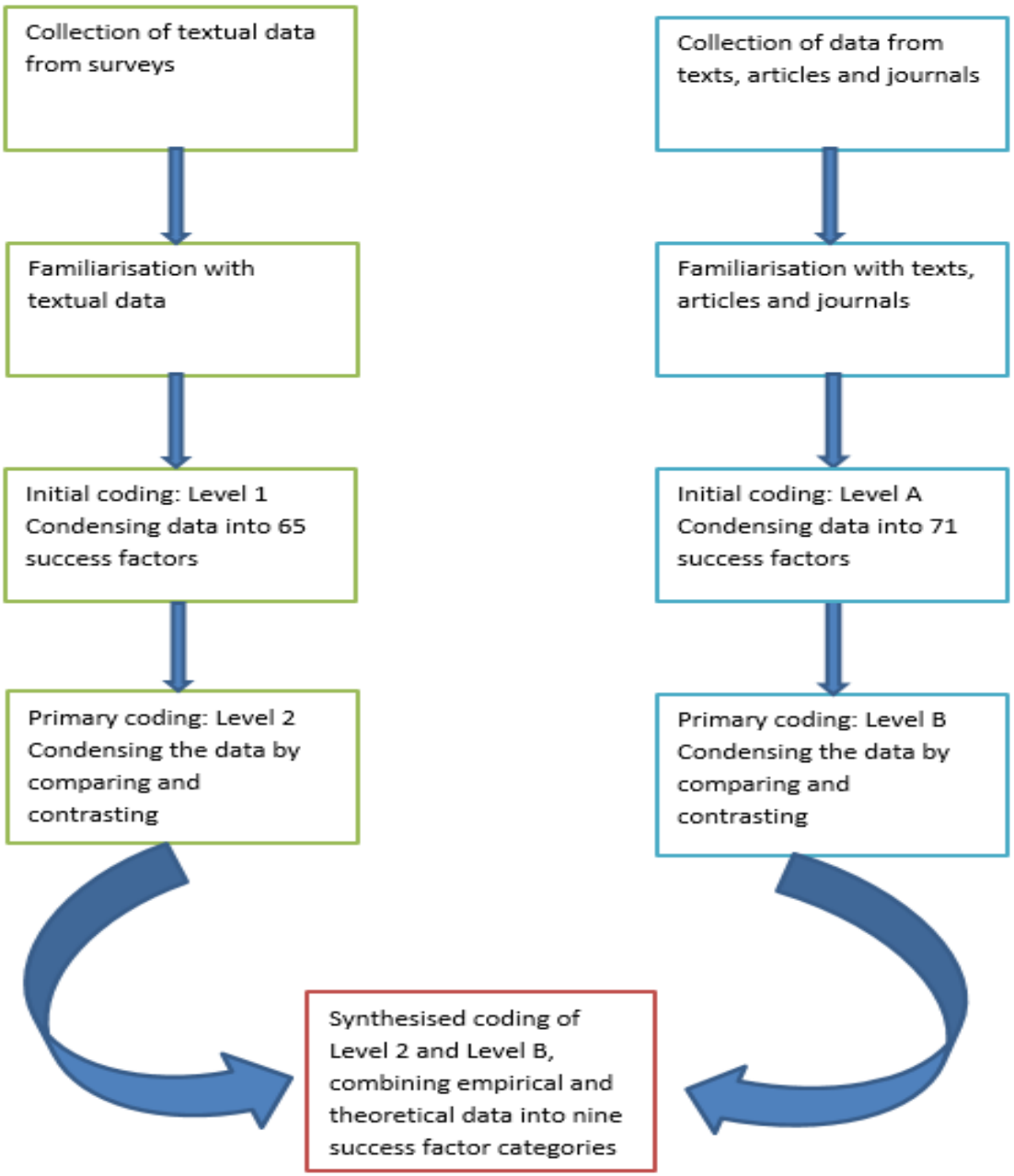


Figure 8: Overview of data analysis process

3.6 Validity and trustworthiness

The aims and objectives of this research study were communicated individually to all the research participants to ensure transparency throughout the data-gathering process (Bell & Bryman, 2007). The study obtained qualitative data through surveys and documentary sources.

No alterations were made to any of the data obtained from research participants and care was taken to avoid bias or any potential conflicting interests by maintaining independence from the research participants. All contact and communication with research participants was strictly academic and related to this study, with no conflicting interests, thus ensuring the validity and trustworthiness of the research (Bell & Bryman, 2007).

To ensure the accuracy of the findings, the categorising and coding of data from the literature and the empirical study were clearly documented. This transparent process ensured that the integrity of gathered data was maintained, thus further enhancing the credibility of this study.

Furthermore, the study used multiple sources of information to triangulate the coded data. The case study and survey were used in combination with the documentary analysis to triangulate the data. By triangulating the data, there is a reduced risk of bias that could result if only a single method is used (Bowen, 2009).

3.7 Research ethics

The ethical principles of this study are derived from the research of Bell and Bryman (2007), who established the importance of the protection of the interests, rights and privacy of the research participants to ensure the trustworthiness of the gathered data.

During the data gathering stage of the research on success factors, there was no physical or emotional harm to any of the research participants and their integrity and dignity were respected (Bell & Bryman, 2007).

Furthermore, the consent of all participants was established prior to the commencement of the survey process. All information and data obtained from the participants are confidential and the identity of participants remains anonymous. In addition, the privacy of the research participants was guaranteed through the anonymous survey process. Appendix B contains the consent form used to obtain permission from the research participants.

The research on critical success factors was done transparently, with all research findings and data sources honestly referenced.

3.8 Conclusion

This chapter first discussed the research philosophy and design. The research methods were detailed and the case study approach was introduced and contextualised in the telecommunications project context. Thereafter the qualitative approach was discussed with regards to the sampling, data collection and data analysis procedures. Lastly, the validity and trustworthiness of the study was elaborated on and the ethical considerations were examined.

Chapter 4: Research findings from the telecommunications project

This chapter introduces the results of the research study obtained through the qualitative research process. Thereafter, the project success categories are discussed and a model of project success is developed for use in the South African telecommunications industry.

4.1 Results from the integrative literature review

From the literature 71 success factors were identified for project success. The literature success factors are displayed in Table J, located in Appendix A.

An example of the process used to generate the literature success factor (LSF) categories is provided for LSF 3: "competency of the project team to the successful completion of the project". There were six success factors from Table J, Appendix A that were used to generate LSF 3. These success factors included success factors 7 and 27: both "project team competency"; success factor 51: "competent staff"; success factor 38: "training"; success factor 39: "motivation"; and success factor 63: "appropriate training and capacity building".

An additional example for generating the LSF categories is provided for LSF 7. There were eight success factors from Table J, Appendix A that were used to generate LSF 7: "Learning from past projects to contribute to the successful completion of projects".

Success factors used to generate LSF 7 included success factor 17: "collaboration between project management and line management"; success factor 18: "learning from previous project experiences"; success factor 19: "project performance feedback": success factor 23: "communication"; success factor 40: "proper planning"; success factor 42: "user involvement"; and success factor 71: "ongoing monitoring and evaluation of the project".

The full set of LSF categories was condensed by the primary Level B coding process into nine literature success factors (LSF) categories which are shown in Table M, Appendix A. The LSF categories and the corresponding success factors are illustrated in Table G.

Table G: Literature success factor (LSF) categories

Success factor	Literature Success Factor Categories
LSF 1	Project mission
LSF 2	Support from senior management in successfully completing projects
LSF 3	Competency of the project team to the successful completion of the project
LSF 4	Competency of the project manager
LSF 5	Management of external factors including the contribution of social, economic and political factors to successful project completion

LSF 6	Importance of having a project champion involved in implementing projects
LSF 7	Learning from past projects to contribute to the successful completion of projects
LSF 8	Alignment of projects with the strategy of the organisation
LSF 9	The use of project management principles

4.2 Results from the empirical data

From the empirical results obtained from the qualitative data and the initial Level 1 coding, 65 project success factors were identified and are illustrated in Table K, Appendix A.

An example of the initial coding was the success factor 4 obtained from the qualitative empirical data, located in Table K. This success factor 4: "importance of the competency of the project team" was generated from survey data in response to the survey question: "How important is the competency of the project team to the successful completion of the project?"

The recorded empirical data in response to the above question: "competency of the project team is essential, as a plan can only be executed by people who know how" was initially coded into "competency of the project team is important for the success of the project". An additional example was a response to the same question: "Very important. Every successfully completed project positions the team well for future projects". This response resulted in the creation of success factor 24 in Table K: "competency of the project team is essential and aids in project execution".

Comparing and contrasting of the success factors in Table K resulted in the formulation of the empirical success factor (ESF) 3: "degree of competency of the project manager and the project team". All similar success factors relating to the competency of the project manager and the project team were grouped in ESF 3.

The success factor categories were derived from the initial success factors obtained from the initial level 1 coding. Primary level 2 coding was used to generate the ten ESF categories. The ESF categories are shown in Table H. The derivation of the ESF categories and the corresponding level 1 initial success factor coding are in Appendix A, Table L.

An example of the method used to obtain the ESF 7 shown in Table H: "having a culture of organisational learning" involved level 2 coding. Similar success factors relating to organisational learning were grouped together including success factors such as "learning from past projects is the foundation of growth and achievement"; "learning from past projects can be used to predict risks in future projects"; "importance of learning from past projects"; and "importance of learning from past project experiences". Thus, ESF 7, shown in Table H, was generated: "having a culture of organisational learning".

Table H: Empirical success factor (ESF) categories

Success factor	Empirical success factor categories
ESF 1	Relationship between project success and project constraints
ESF 2	Effects of outside influences on the success of the project
ESF 3	Degree of competency of the project manager and the project team
ESF 4	Relationship between the project and the strategy of the company
ESF 5	Effectiveness of the project management bodies of knowledge
ESF 6	Implementation of selected project management knowledge areas
ESF 7	Having a culture of organisational learning
ESF 8	Promoting project continuity through project leaders
ESF 9	Defining roles and responsibilities of project stakeholders
ESF 10	Successful project delivery through management support

4.3 Synthesis of literature and empirical success factors

After the primary coding of the literature and empirical success factors, a total of 19 success factors was obtained. The combined literature and empirical success factors are shown in Table I, together with the nine synthesised success factor (SSF) categories. The corresponding success factors are displayed together with the source.

An example of the synthesis process was the “managing external factors” category. This category was created by grouping the success factors obtained from the combined literature and empirical data into a new but similar category grouping. The success factors used to create the synthesised category included the “management of external factors including the contribution of social, economic and political factors to successful project completion”, and “effects of outside influences on the success of the project”. The same process was followed in the creation of the other SSF categories.

Table I: Synthesised success factor (SSF) categories

Success factor	Synthesised success factor categories	Combined literature and empirical success factors	Source
SSF 1	Managing project constraints	Relationship between project success and project constraints	empirical
SSF 2	Aligning projects with strategy	Alignment of projects with the strategy of the organisation	literature
		Relationship between the project and the strategy of the company	empirical
SSF 3	Managing external factors	Management of external factors including the contribution of social, economic and political factors to successful project completion	literature
		Effects of outside influences on the success of the project	empirical
SSF 4	Management support	Support from senior management in successfully completing projects	literature
		Successful project delivery through management support	empirical
SSF 5	Strong leadership	Importance of having a project champion involved in implementing projects	literature
		Promoting project continuity through project leaders	empirical
SSF 6	Project team competency	Competency of the project team to the successful completion of the project	literature
		Competency of the project manager	literature
		Degree of competency of the project manager and the project team	empirical
SSF 7	Continuous learning	Learning from past projects to contribute to the successful completion of projects	literature
		Having a culture of organisational learning	empirical
SSF 8	Implementing project management bodies of knowledge	The use of project management principles	literature
		Effectiveness of the project management bodies of knowledge	empirical
		Implementation of selected project management knowledge areas	empirical
SSF 9	Stakeholder management	Defining roles and responsibilities of project stakeholders	empirical
		Relationship between project mission and stakeholders	literature

4.4 Data triangulation of success factor categories

The SSF categories were triangulated with documentary data obtained from meeting minutes. Table N, Appendix A shows the project delays and the applicable success factor categories obtained from meeting minutes. The SSF categories most affected by project delays were SSF 1: “managing project constraints” and SSF 3: “managing external factors”.

For SSF 1: “managing project constraints”, data triangulation showed project delays resulting from the poor quality of site build; outstanding project build documentation; the lack of available revised radio planning (RRP) sites; and high build costs.

Data triangulation of the SSF 3: “managing external factors” indicated that project delays were caused by competitors delaying site build approval of shared network sites; vandalism and theft of site build equipment; and poor contractor performance.

4.5 Discussing the synthesised success factor (SSF) categories

This section discusses the relevance of the SSF categories in relation to the success of the base station roll-out project which formed part of the case study. The applicability of these SSF categories is also examined from the literature perspective.

4.4.1 Managing project constraints

The first category documented the relationship between the success of the project and the project constraints. The following extract was obtained from the survey indicating the relationship between the success of the project and the project constraints, “Project success depends on whether the project is completed within budget and time and at an acceptable level of quality”. The project constraints included project timelines, project budgets, project quality and project risks. The empirical data indicated that project constraints directly affected the success of the project because they resulted in project delays.

An example of project constraints obtained from the empirical results was the rejection by site owners of potential sites for base stations. This constraint delayed the project since a new search had to be initiated to find an alternative site. The search for a replacement site introduced delays into the project and resulted in additional project expenditure since the whole project cycle had to be restarted.

A study on project success by Ika (2009) revealed the importance of not only concentrating on the traditional project constraints of cost, quality and time. Other project constraints should also be considered such as project stakeholder or project team constraints (Ika, 2009).

The findings from the empirical data and the literature indicated that neglecting project constraints resulted in project delays which could affect the success of the project. Managing project constraints provided a high leverage intervention to steer the project back on course toward a successful outcome.

4.4.2 Aligning projects with strategy

The relationship between the project and strategy of the company was found to play an important role in the success of the project. The following extract was obtained from the survey, “Projects should align with the strategy of the organization to ensure support from the organisation”. This was due to the support that the company provided to the project if it was in conformity with the strategy of the organisation.

From the empirical results of the study it was found that the alignment of the project with the strategy of the organisation was critical. An example was the technology deployment configuration of a base station deployment. The strategy of the company was to deploy wireless technology based on the subscriber’s location. If the network roll-out project did not consider the subscribers’ location, then the project did not align with the strategy of the organisation.

DeFillippi and Roser (2014) conducted studies into aligning the projects undertaken by the company with the overall strategy of the company. These authors provided a framework that illustrated the level of strategic importance associated with different types of projects. The highest level of strategic emphasis was placed on projects that were aligned with the purpose of the organisation (DeFillippi and Roser, 2014).

The theoretical finding corroborated the empirical findings and illustrated that the telecommunications project that the company was embarking on was dependent on the organisational strategy.

4.4.3 Managing external factors

This study was conducted in the context of the South African telecommunications industry. In that context, external factors such as labour strikes, social uprisings and economic recession could have an impact on the success of telecommunications projects. The following extract was obtained from the survey, “External project factors have a serious impact on the competitiveness of the project”. This indicates that external project factors affects the success of the project.

The effect of external influences included social, economic and political influences and was found to have an impact on the success of the project. Although these factors were separate to the implementation of the project, they still formed part of the prevailing environment in which the project operated.

External factors beyond the control of the project team were found to have a serious effect on the success of the project. For example, site vandalism was prevalent and resulted in project roll-out delays. Additional equipment had to be ordered and repairs and replacements had to be scheduled, lengthening the project build period.

In the conceptual framework developed by Alias et al (2014) a clear link was established between the effect of external factors that are in the prevailing environment of the project and the success of the project. The findings of this study indicated that external influences on the project therefore represented a valid factor that could also affect the success of the project (Alias et al, 2014).

4.4.4 Management support

According to the empirical findings, research participants indicated that with support from management the project delivery process was streamlined. The following extract was obtained from the survey indicating the importance of management support, “Management should have a clear view on the project goals and their support is important”.

Management support was also found to ensure the commitment of project stakeholders to the success of the project. The project team were influenced by the support from management to become more motivated in achieving project objectives. Furthermore, support from management cannot only be restricted to certain portions of the project roll-out phase, such as the project initiation phase, but then withdrawn during the project implementation phase. Continuous support from management was required throughout the project life cycle.

The empirical findings were supported by Fortune and White (2006), who identified management support as critical to the success of projects. This factor also formed an important subsystem in their Formal System Model.

Management support was a critical component of successful project delivery which was required throughout the project life cycle. The findings of this study highlighted the importance of support from management during all the project phases.

4.4.5 Strong leadership

Strong leadership was identified to be crucial to the success of the project. The following extract was obtained from the survey regarding the importance of leadership as being a catalyst for project success, "Project champion is a catalyst for project success". Different departments such as the property, project management and radio network planning departments had to work together to achieve project goals. With strong leadership, these departments could execute operational activities such as site acquisition and revised radio network planning more effectively, since there was greater synergy between the different departments in achieving the project objectives. Leadership of the project sustained the continuity of the project such that, when challenging situations such as site rejections occurred, the project could still be kept on course and reach the desired outcome.

Geoghegan and Dulewicz (2008) indicated that leadership has numerous dimensions which contribute to successful projects. The ability of leaders to motivate, effectively manage resources and empower their teams contributed to successful projects (Geoghegan and Dulewicz, 2008). The ability to provide strong leadership also depended on intellectual, managerial and emotional competencies (Müller and Turner,2010). These leadership competencies enabled the use of strategic insights, resource management and conscientiousness by leaders (Müller and Turner,2010). Furthermore, when there was no strong leadership in the project, then the success of the project was negatively affected (Fortune and White, 2006). Conversely, when the project had strong leadership and there was support from management, then the success of the project was likely to increase (Fortune and White, 2006).

The findings from this research study and the literature indicated that strong leadership was a requirement for a successful project. Furthermore, in the context of the base station project roll-out, strong leadership formed an important component in achieving the project objectives.

4.4.6 Project team competency

The findings of this study highlighted the importance of the competency of the project teams in executing and delivering successful projects. The following extract was obtained from the survey regarding the project team competency, "Competency of the project team is important for the success of the project". The base station roll-out project required skilled and experienced project team members to ensure the success of the project. Due to the technical nature of the project, project team members were required to have the necessary qualifications and skills to join the project.

In studies on critical success factors, Belassi and Tukel (1996), and Fortune and White (2006) indicated the importance of the competency of the project team, as well as the project manager, in ensuring the success of the project. In addition, the competency of the project team was described as a critical success factor, thus indicating the important role that the competency of the project team played in contributing to the success of projects (Belassi and Tukel, 1996).

The findings from the empirical study and the literature indicated that the project team competency played an important role in ensuring the successful completion of projects. Furthermore, the project team members had to possess all the required qualifications and skills to ensure that the project was delivered successfully.

4.4.7 Continuous learning

The empirical studies revealed that continuous learning was critical to the success of projects and formed the foundation for growth and achievement. Learning from past projects was found to contribute to mitigating project risks that could be encountered in future projects. The following extract was obtained from the survey indicating the importance of learning, “Learning from past projects and project experience is critical to the success of the project”.

The base station roll-out project used a database management system that stored the history of all completed projects. This data provided insights into project risks that had affected past projects. Project team members could access this data, which provided an important guide and resource when embarking on new projects.

In a literature study, Fuller et al (2011) conducted research into learning in organisations that were involved in projects and found that it was possible for organisational learning to take place throughout the company. However, the learning had to be disseminated throughout the organisation for the true benefits to be achieved (Fuller et al, 2011). Furthermore, the project teams had an important role to play since the lessons that were learnt from past projects could be used when commencing new projects (Fuller et al, 2011). By proposing a cycle of project learning, Fuller et al (2011) demonstrated that it was possible for continual learning to take place when closing projects and commencing new projects.

The empirical and theoretical findings demonstrated the importance of continuous learning. Project teams became better equipped and more prepared to deal with project risks through continuous learning. Furthermore, with the lessons learned from the completion of past projects, the project team could manage the successful completion of the project through continuous learning.

4.4.8 Implementing project management bodies of knowledge

The project management bodies of knowledge consisted of scope management, time management, cost management, quality management, human resource management, communications management, risk management, procurement management, stakeholder management and integration management.

From the empirical results, the understanding and the implementation of the project management methodologies was found to play a key role in the success of telecommunications projects. The following extract was obtained from the survey, “Competency and understanding of the project management bodies of knowledge are key to the success of the project”. Although these knowledge areas could be applied across a range of industries, the empirical results indicated the importance of these knowledge areas in the context of the South African telecommunications industry. Furthermore, the synergy between knowledge areas was identified to be crucial in creating harmony between the project management knowledge areas.

An example applicable to the base station roll-out project was site quality testing. When the quality testing of the site did not conform to the initial project planning requirements, the site was failed. The failure of the site quality, although part of quality management, affected other knowledge areas such as

time management due to the additional time required for follow-up quality testing. Due to the requirement for additional resources, cost management and human resource management were impacted. This example indicated the importance of understanding and creating synergy between the knowledge areas so that they were impacted positively, contributing to the success of the project.

According to the literature, the project management knowledge areas form an important component of project success. Munns and Bjeirmi (1996) highlighted the importance of the project management knowledge areas and indicated that poor project management was likely to negatively impact a promising project. Cooke-Davies (2002) commented that the success of the project was dependent on the promotion of factors that promoted effective project management of the project, which included promoting project management knowledge areas such as risk management and scope management.

The empirical results and the literature indicated that the understanding and implementation of the project management knowledge areas were crucial to the success of the project. Furthermore, when project teams effectively used the project management knowledge areas throughout the project life-cycle, it contributed to the project concluding with a favourable outcome.

4.4.9 Stakeholder management

The empirical findings indicated that the clear defining of the roles and responsibilities of the project stakeholders was crucial to the successful completion of the base station roll-out project. The following extract was obtained from the survey relating to project stakeholders and mission, “Project mission clarifies stakeholder expectations and is crucial to project success”. In addition, the empirical findings also highlighted the importance of effectively managing project stakeholders. Project stakeholders such as the vendor team are required to deliver project milestones such as the single site verification phase in specified timelines. Hence, when the vendor project stakeholder is not managed effectively, it could have a negative impact on the timely delivery of the project, since there is no guarantee on the delivery of agreed upon timelines for project milestones.

When stakeholders had conflicting roles and responsibilities, this had a negative impact on the success of the project. In a research study on project stakeholders Vos and Achterkamp (2006) commented on the need to not only identify and classify stakeholders, but also to keep in mind the dynamic relationships that these stakeholders had to assume throughout the project. Furthermore, by examining the role and contribution of project stakeholders at every stage of the project, this clarified the roles and the responsibilities that should be expected of the relevant stakeholders (Vos and Achterkamp, 2006).

The literature and empirical findings from the study highlighted the important role that project stakeholders occupy in delivering a successful project. The importance of managing and clearly defining the roles and responsibilities of project stakeholders all contributed to the delivery a successful project.

4.5 Systems modelling and CSFs

The systems approach, when applied to CSFs, allows the relationship between the success factors to be examined, as well as the overall system behaviour. Furthermore, although the success factors are important, their interrelationships are equally or even more important than the individual success factors

(Fortune & White, 2006). The systems approach facilitates the modelling of projects and success factors by using systems thinking and systems dynamics tools such as CLDs (Causal loop diagrams).

A system can be described using various methods including diagrams, mapping methods and CLDs (Sterman, 2000). The use of systems modelling tools such as CLDs provides a powerful tool to display and model systems, as well as to interpret their behaviour. Causal loop diagrams contain a set of variables which are all interconnected to each other with causal links or connections (Sterman, 2000). The CLD thus enables the interpretation of underlying system behaviour through the modelling of complex systems and their interrelationships.

The systems approach has been used to model CSFs by using system models such as the Formal System Model (FSM) used by Fortune and White (2006). In addition, the system modelling approach of CSFs has been used by Belassi and Tukel (1996) in modelling CSFs which are interrelated. This approach also illustrates the system behaviour which could lead to project success or failure. By using systems thinking modelling tools such as FSM or CLDs, this ensures that the CSFs are not represented in isolation but rather as an interconnected system.

The systems approach views the project as a system, with the relationships and interactions between the various parts of the system allowing the project to be modelled (Rubenstein-Montano et al, 2001). From a project perspective, the systems approach allows high leverage interventions to address project-related concerns such as project risks, complexity or scope in complex project systems (Mawby & Stupples, 2002).

Leverage in systems thinking is defined as “seeing where actions and changes in structures can lead to significant, enduring improvements” (Senge, 1994). Through systems modelling, the variables possessing the greatest impact on the system, known as the “drivers” of the system, can be targeted for the most effective change to the system behaviour. Furthermore, by introducing high leverage interventions into the system, this enables the effective management of system concerns and positively influences system behaviour.

4.6 Project success model (PSM) in the South African telecommunications context

The project success model (PSM) was the result of the empirical and literature study and the derived SSF categories formed the basis of the model. The PSM system formed the basis for the success of telecommunication projects in the South African context. The SSFs of the PSM did not exist in isolation as separate and independent factors: they were all interconnected and form part of the PSM system.

The CLD was constructed by considering the relationship of each variable in the model with the theoretical and empirical data. The variables and their effects on project success and project delays were determined through the qualitative data obtained from theoretical and empirical sources including surveys and the literature review. Furthermore, the relationship between variables was also determined through data triangulation with additional sources of data such as meeting minutes, in addition to the qualitative data obtained from the survey and literature review.

The project success model (PSM) consisted of the nine synthesised success factors (SSFs), and the additional "project success" and "project delays" variables. The PSM consisted of two main feedback loops R and B and is illustrated in Figure 9.

The "+" notation indicated a similar relationship between variables so that when the variable "continuous learning" increased there was a corresponding increase in the variable "stakeholder management". Conversely, if there was a decrease in the variable "continuous learning", then the variable "stakeholder management" decreased. The decrease was denoted by the "-" notation. When a loop consisted of positively increasing variables, it exhibited reinforcing behaviour which was otherwise known as a positive loop (Sterman, 2000).

The variables in Loop R had similar or positive relationships with each other. The resultant effect of the positive behaviour of the variables in Loop R was the reinforcing system behaviour which resulted in project success. The PSM did not result in continual project success due to the balancing behaviour of Loop B. The balancing Loop B counteracted the reinforcing behaviour of Loop R by negatively affecting project success, due to project delays from project constraints and external factors.

For the PSM model to deliver successful projects in the South African telecommunications context in the future, the system will require high leverage intervention to address the balancing behaviour of Loop B. If Loop B is left to operate uninterrupted, the project delays would result in project failure. The variables that should form the target for intervention to offset the balancing behaviour of Loop B are the "managing project constraints" and "managing external factors" variables. By addressing the behaviour of these two variables it would have the greatest impact on the success of the system.

To ensure the success of the PSM, all SSFs in Loop R and Loop B were required to contribute to the success of the project. For example, if "strong leadership" and "project team competency" were not present, then the negative effects on the entire system could be seen. The resultant behaviour in Loop R became negatively reinforcing and affected the success of the project. Additional project delays from Loop B by the "managing project constraints" and "managing external factors" variables further contributed to the worsening behaviour of the system.

In the context of the base station roll-out project, the PSM initially yielded a successful project. The reason for the initial success was the presence of quick build sites in the project plan that were ready for site occupation and construction. As the initial sites were built and brought on air, the remaining sites formed part of the project schedule; but build was unable to start due to project constraints and external factors.

Project constraints such as the poor quality of site build; delays in completing site design documentation; the need for revised radio planning (RRP) of alternative base station locations; and the high cost of non-standard site build solutions resulted in project delays. External factors causing project delays included competitors delaying site build approval of shared network sites; vandalism and theft of site build equipment; and poor contractor performance.

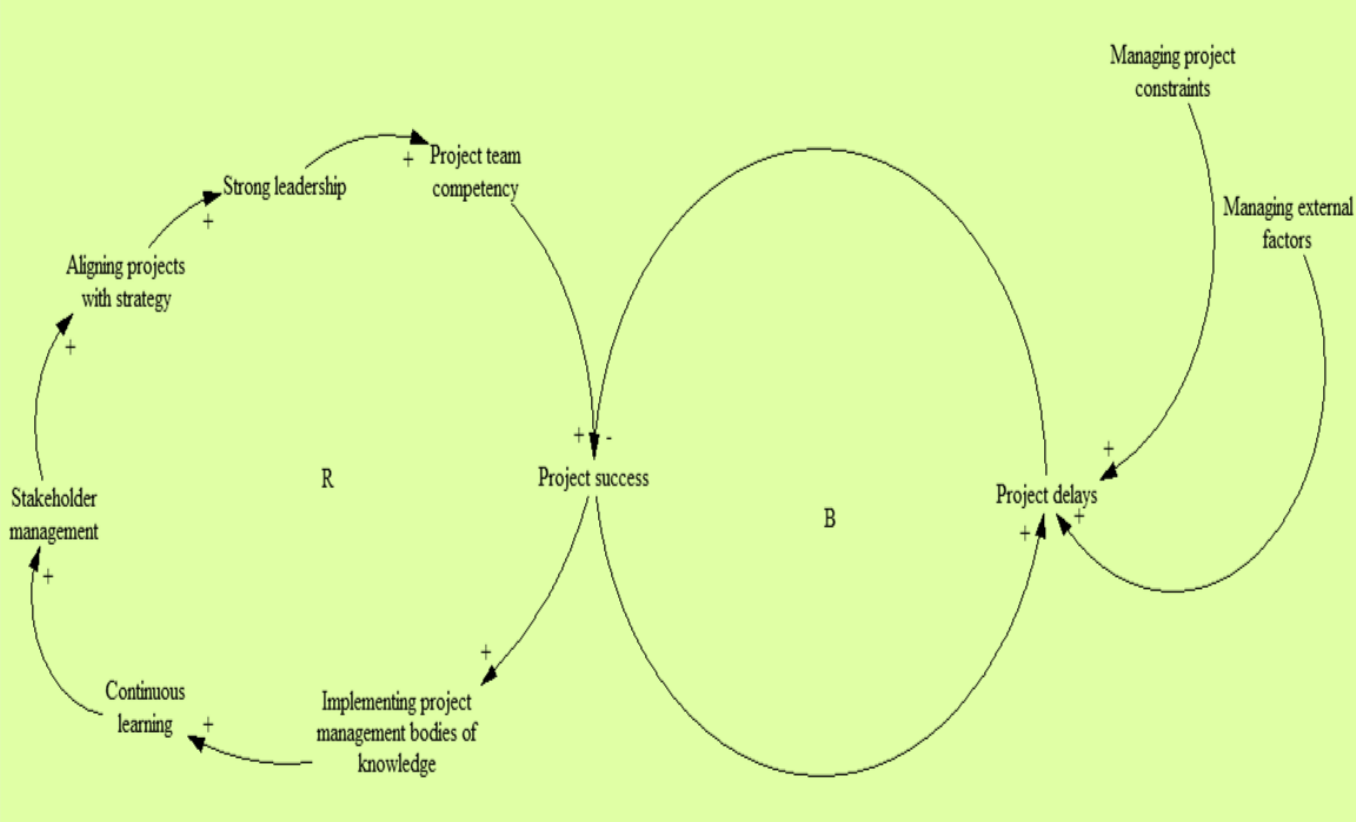


Figure 9: Project success model (PSM) in the South African telecommunications industry

4.7 Systems archetypes

Systems archetypes are models used in systems thinking which allow the researcher to gain insights by exploring the behaviour of systems and developing interventions (Kim, 1995). There are eight main generic systems archetypes, each possessing their own characteristics. The main systems archetypes are listed below (Senge, 1994).

1. Eroding goals
2. Escalation
3. Fixes that fail
4. Growth and under-investment
5. Limits to growth
6. Shifting the burden
7. Success to the successful
8. Tragedy of the commons.

The behaviour of the "limits to growth" systems archetype was found to match the PSM system behaviour. This archetype argues that there is a cycle of growth or success which operates for a period of

time. Thereafter, the system becomes constrained with opposing and limiting processes which cause the growth or success to slow down (Senge, 1994). This systems archetype indicates that when there is growth or periods of success, it should not be assumed that the periods of growth or success would continue indefinitely. Unforeseen actions and opposing forces could affect the success of the system. The "limits to growth" archetype is also known as the "limits to success" archetype (Braun, 2002).

The archetype is shown in Figure 10. The basic structure of the "limits to growth" archetype contains two feedback loops with four main variables. Loop R is a positive reinforcing loop that ensures a positive result. Loop B is a negatively reinforcing loop which exhibits the opposite behaviour of Loop R. Loop B detracts from the postive results of Loop R with the introduction of limiting conditions and slowing actions. This system archetype demonstrates that, despite increased efforts in trying to get a positive result, the system will produce poorer results unless the limiting factors are managed, weakened or removed (Kim, 1995).

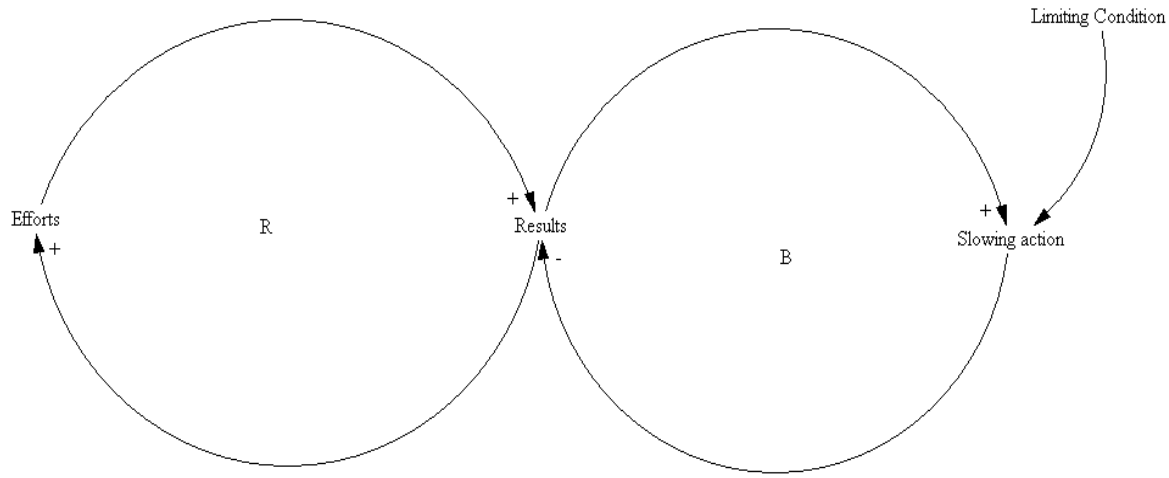


Figure 10: Limits to growth generic systems archetype (Senge, 1994)

The pattern of behaviour of the PSM conformed with the "limits to growth" systems archetype. The "effort" variable of the archetype corresponded with the "stakeholder management", "aligning projects with strategy", "strong leadership", "project team competency", "implementing project management bodies of knowledge" and "continuous learning" variables. Loop R showed positive reinforcing behaviour which results in project success. The "slowing action" variable corresponded with the "project delays" variable. The "limiting condition" variable of the "limits to growth" systems archetype was related to the "managing project constraints" and the "managing external factors" variables. Loop B exhibited negative reinforcing behaviour which reversed the resultant project success of Loop R.

The point of high leverage intervention in the “limits to growth” systems archetype was at the limiting conditions. Hence, the “management of project constraints” and the “management of external factors” formed the driving variables of the system. Intervening at these variables balanced the system and additional interventions could be introduced into the system to offset the negatively reinforcing behaviour of Loop B.

By ensuring the implementation of all the SSFs and the effective management of project constraints and external factors, the PSM contributed to the success of projects in the context of the telecommunications industry in South Africa.

4.8 Conclusion

This chapter has introduced the findings of the research study. The results from the literature and the empirical study were presented. The success factor categories were developed through the synthesis of the literature and the empirical study. Thereafter, systems modelling was discussed and the PSM was introduced, possessing a pattern of behaviour similar to the “limits to growth” systems archetype. Lastly, the model was discussed in the context of this study.

Chapter 5: Recommendations and conclusion

This chapter reviews the research study, interprets and discusses the findings, shows the relevance of the study, suggests recommendations and discusses opportunities for future research.

5.1 Reviewing the research study

The literature on project success contains a vast amount of success factors, as well as models of project success which contribute to the success of projects. The reason for this study was to discover success factors that are relevant to the telecommunications industry in the South African context. Additional focus was given to the study by using the single case study approach to investigate the perceptions of project team members in the telecommunications industry. The contribution of this study was to provide a telecommunications context to the generation of synthesised success factors. The study also produced a project success model (PSM) that is relevant to a developing country such as South Africa.

The research study involved identifying key success factors which contribute to the success of telecommunication projects in the South African context. The findings provided insight into the success factors that are required for successful project completion. Success factors were extracted from the literature and the empirical data and nine synthesised success factors (SSF) categories were developed. Thereafter, a systems model of project success consisting of the success factor categories was constructed.

5.2 Discussion and interpretation of results

The first research question was: “What are the success factors that are required to ensure successful project completion in telecommunications Company X in South Africa?” This research question was addressed by the qualitative research process, which involved gathering, interpreting and generating data from surveys, documents and literature. The nine success factor categories are shown below.

- **Managing project constraints**
- **Aligning projects with strategy**
- **Managing external factors**
- **Management support**
- **Strong leadership**
- **Project team competency**
- **Continuous learning**
- **Implementing project management bodies of knowledge**
- **Stakeholder management.**

The second research question stated: “How can these factors be managed systemically to improve project success?” To answer the second research question, the nine success factor categories were incorporated into a project success model. Triangulation from documentary sources was used to determine the behaviour of the success factor variables and illustrated that two success factors, “managing project constraints” and “managing external factors”, had the highest likelihood of affecting project success if not managed effectively.

The project success model was constructed using the success factor categories as variables. Additional variables of "project success" and "project delays" were added to the model. The model indicated that the success factor categories "management support", "aligning projects with strategy", "strong leadership", "project team competency", "continuous learning", "implementing project management bodies of knowledge" and "stakeholder management" formed part of a reinforcing process that resulted in the success of the project. The model also contained a balancing loop which resulted in project delays consisting of the "managing project constraints" and "managing external factors" success categories.

The study found that the reinforcing loop of the project success model initially contributed to the success of the project. However, as the project progressed, the limiting variables of the balancing loop affected the success of the project, unless interventions were introduced into the system. The pattern of behaviour of the project success model matched the behaviour of the "limits to growth" systems archetype. This archetype indicated that the growth or success of the system could not continue indefinitely. There were always constraints or opposing forces which prevented the continuous success of the system.

The high leverage interventions in the "limits to growth" systems archetype should focus on the balancing loop where there are limiting conditions. Thus, the project team should focus on managing project constraints as well as external factors that are impacting the project. Furthermore, the continual implementation of all nine SSF categories should be maintained to ensure successful project completion.

5.4 Recommendations for implementation in the telecommunications industry of South Africa

This section provides recommendations for implementation to contribute to the success of telecommunication projects in the South African context. The alternative recommendations are based on the project experience of the author of this study in the project context of the South African telecommunications industry. The high leverage recommendations for "Managing project constraints" and "Managing external factors" are expected to have the greatest impact on the success of the project. Recommendations are also provided for the other lower leverage variables.

5.4.1 Managing project constraints

- The quality of site build should be improved through adherence to site quality assurance (QA) standards.
- Additional human resources should be committed to completing site design documentation.
- Alternative sites should be planned when there is a shortage of available site locations.
- Cost-effective solutions for high cost sites should be examined.

5.4.2 Managing external factors

- High-level engagement with competitor network operators should be introduced to resolve delayed site approvals.
- High risk network roll-out areas should be identified and provided with security during site build.
- Contractor performance should be monitored and non-performing contractors replaced.

5.4.3 Aligning projects with strategy

- Project initiation should be in line with corporate strategy.

- Network roll-out areas should match the company's customer-targeting strategy.

5.4.4 Management support

- Management should be made aware when key project milestones are reached.
- Project delays should be reported directly to management to gain support.
- Project progress should be reported and monitored from project initiation to project completion.
- Operational teams should identify project concerns and escalate to management to enable early resolution.

5.4.5 Strong leadership

- Leadership training should be provided for project team members that are in leadership positions.
- Project leaders should provide guidance and direction in ensuring a successful project outcome.
- Each project team should be led by a senior and experienced project member to ensure effective decision-making for critical project issues.

5.4.6 Project team competency

- The competency of the project team should be improved through introducing training initiatives to improve the technical and project-related skills of project team members.
- New project recruits should meet minimum requirements in terms of industry project experience and qualification.
- Continuous skills development should be implemented to keep the project team updated on constantly changing technology.

5.4.7 Continuous learning

- All successful projects should be studied and the lessons implemented for future projects.
- Failed projects should be investigated and failures addressed so they are not repeated in future projects.

5.4.8 Implementing project management bodies of knowledge

- Project management knowledge areas should be implemented for all initiated projects.
- Project risk should be anticipated through the implementation of the relevant knowledge areas such as risk management.

5.4.9 Stakeholder management

- The roles and responsibilities of all project stakeholders should be defined.
- Internal project stakeholders consisting of the project teams should be managed to ensure project objectives are met.
- External project stakeholders contributing to project activities should be identified and monitored.

5.3 Proposals for future studies

This study used the single case study approach which could be built upon in future research where multiple case studies could be used. In addition, the study focused on a project in a single company. Future research could examine multiple companies and projects.

This study was limited to the telecommunications industry. Further studies on success factors could be initiated across different industry sectors. Other potential sectors could include mining, the automotive industry, the power industry, the agricultural sector and other segments of the South African economy.

Furthermore, this study also opens up the possibility of researching into success factors in the industries of other countries and continents. This indicates the vast potential for future research on project success, which would benefit organisations, as well as project teams, in pursuing more favourable project outcomes.

Future studies could also further investigate the applicability of the systems archetypes in the project management context. The studies could focus on their relevance in the context of improving the success of projects and addressing project concerns.

References

Atsu, M.Y., Andoh-Baidoo, F., Osatuyi, B. & Amoako-Gyampah, K. 2010. *An Exploratory Study of the Contextual Factors that Influence Success of ICT Projects in Developing Nations: a Case Study of a Telecommunications Company in Ghana.* Taylor & Francis Ltd.

Alias, Z., Zawawi, E.M.A., Yusof, K. & Aris, N.M. 2014. Determining Critical Success Factors of Project Management Practice: A Conceptual Framework. *Procedia - Social and Behavioral Sciences.* 153(0):61-69. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/j.sbspro.2014.10.041.

Atkinson, R. 1999. Project management: cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria. *International Journal of Project Management*. 17(6):337-342. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/S0263-7863(98)00069-6.

Bauer, M.W. & Gaskell, G. 2000. *Qualitative researching with text, image and sound: A practical handbook*. Great Britain: CPI Antony Rowe.

Belassi, W. & Tukel, O.I. 1996. A new framework for determining critical success/failure factors in projects. *International Journal of Project Management.* 14(3):141-151. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/0263-7863(95)00064-X.

Bell, E. & Bryman, A. 2007. The ethics of management research: An exploratory content analysis. *British Journal of Management*, 18(1):63-77

Bowen, G.A., 2009. Document analysis as a qualitative research method. *Qualitative research journal*, 9(2), pp.27-40.

Bronte-Stewart, M. 2015. Beyond the Iron Triangle: Evaluating Aspects of Success and Failure using a Project Status Model. *Computing & Information Systems.* 19(2):21-37.

Braun, W., 2002. The system archetypes. *System*, 2002, p.27.

Carney, T.F.1972. *Content analysis: A technique for systematic inference from communications*. Winnipeg, Canada: University of Manitoba Press.

Carvalho, M.M.d., Patah, L.A. & de Souza Bido, D. 2015. Project management and its effects on project success: Cross-country and cross-industry comparisons. *International Journal of Project Management.* 33(7):1509-1522. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/j.ijproman.2015.04.004.

Checkland, P. 1993. *Systems thinking, systems practice.* Great Britain: Bookcraft

Cicmil, S., Williams, T., Thomas, J. and Hodgson, D., 2006. Rethinking project management: researching the actuality of projects. *International Journal of Project Management*, *24*(8), pp.675-686.

Cooke-Davies, T. 2002. The "real" success factors on projects. *International Journal of Project Management.* 20(3):185-190. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/S0263-7863(01)00067-9.

Creswell, J.W. 2009. *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications, Incorporated.

Cristóbal, J.R.S., Diaz, E., González, M.A., Madariaga, E., López, S. & Trueba, M. 2016. From the Hard Paradigms towards Multimethodology in Project Management. Available: http://www.sciencedirect.com.ezproxy.uct.ac.za/science/article/pii/S1877050916323201 .

DeFillippi, R. & Roser, T. 2014. Aligning the co-creation project portfolio with company strategy. *Strategy & Leadership*. 42(1):30-36. DOI:10.1108/SL-10-2013-0075.

Easterby-Smith, M., Thorpe, R., & Jackson, P. 2012. *Management Research 4th Edition*. Great Britain: Ashford Colour

Flood, R.L., 2010. The relationship of 'systems thinking' to action research. *Systemic Practice and Action Research*, 23(4), pp.269-284.

Fuller, P.A., Andrew R.J. Dainty & Thorpe, T. 2011. Improving project learning: a new approach to lessons learnt. *Int J Managing Projects in Bus*. 4(1):118-136. DOI:10.1108/17538371111096926.

Fortune, J. & White, D. 2006. Framing of project critical success factors by a systems model. *International Journal of Project Management.* 24(1):53-65. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/j.ijproman.2005.07.004.

Geoghegan, L. and Dulewicz, V., 2008. Do project managers' leadership competencies contribute to project success?. *Project Management Journal*, *39*(4), pp.58-67.

Ika, L.A. 2009. Project success as a topic in project management journals. *Project Management Journal.* 40(4):6-19. DOI:10.1002/pmj.20137.

Kim, D.H., 1995. Systems archetypes as dynamic theories. *The Systems Thinker*, 6(5), pp.6-9.

Jansen, H., 2010. *The Logic of Qualitative Survey Research and its Position in the Field of Social Research Methods*. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, vol. 11, no. 2.

Jonassen, D.H., 1991. Objectivism versus constructivism: Do we need a new philosophical paradigm?. Educational technology research and development, 39(3), pp.5-14.

Mawby, D. & Stupples, D. 2002. Systems thinking for managing projects. *IEEE International Engineering Management Conference*. 344.10.1109/IEMC.2002.1038455.

Maxwell, J.A. 2012. *Qualitative research design: An interactive approach: An interactive approach*. Sage.

Milosevic, D. and Patanakul, P., 2005. Standardized project management may increase development projects success. *International Journal of Project Management*, 23(3), pp.181-192.

MTN annual results presentation. 2014. For the year ended 31 December 2014, December 2014. Available: https://www.mtn.com/Investors/FinancialReporting/Documents/ANNUALREPORTS/Presentations/presentation-2014.pdf

MTN integrated report. 2014. For the year ended 31 December 2014, December 2014. Available: https://www.mtn.com/Sustainability/Documents/MTN_Group_Integrated_Report_2014.pdf

Müller, R. and Turner, R., 2010. Leadership competency profiles of successful project managers. *International Journal of Project Management*, *28*(5), pp.437-448.

Munns, A. & Bjeirmi, B. 1996. The role of project management in achieving project success. *International Journal of Project Management.* 14(2):81-87. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/0263-7863(95)00057-7.

Murambiwa, T.M. & Barry, M.L. 2012. An investigation into the relationship between project management maturity and project performance in the telecommunications industry in Zimbabwe. Industrial Engineering and Engineering Management (IEEM), 2012 *IEEE International Conference on*. 812.10.1109/IEEM.2012.6837852.

Ono, S.2005. A project management methodology for advanced product development: the case of system LSI development for the third generation mobile cellular telecommunication system. *Engineering Management Conference*, 2005. Proceedings. 2005 IEEE International. 804.10.1109/IEMC.2005.1559260.

Pade, C., Mallinson, B. & Sewry, D. 2007. An exploration of the critical success factors for the sustainability of rural ICT projects: The Dwesa case study. *Proceedings of the 16th International Conference on Information Systems Development*, 2007. Galway, Ireland.

Pade-Khene, C., Mallinson, B. & Sewry, D. 2011. Sustainable rural ICT project management practice for developing countries: investigating the Dwesa and RUMEP projects. *Information Technology for Development.* 17(3):187-212. DOI:10.1080/02681102.2011.568222.

Pinto, J.K. & Slevin, D.P. 1987. Critical factors in successful project implementation. *Engineering Management, IEEE Transactions on.* EM-34(1):22-27. DOI:10.1109/TEM.1987.6498856.

Pinto, J.K. & Mantel, S.J., Jr. 1990. The causes of project failure. *Engineering Management, IEEE Transactions on.* 37(4):269-276. DOI:10.1109/17.62322.

Project Management Institute. 2013. *A guide to the project management body of knowledge.* 5th ed. USA: Pennsylvania.

Rubenstein-Montano, B., Liebowitz, J., Buchwalter, J., McCaw, D., Newman, B. & Rebeck, K. 2001. A systems thinking framework for knowledge management. *Decision Support Systems*. 31(1):5-16. DOI:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/S0167-9236(00)00116-0.

Rolstadås, A., Tommelein, I., Per, M.S. & Ballard, G. 2014. Understanding project success through analysis of project management approach. *Int J Managing Projects in Bus*. 7(4):638-660. DOI:10.1108/IJMPB-09-2013-0048.

San Cristóbal, J.R., Diaz, E., González, M.A., Madariaga, E., López, S. and Trueba, M., 2016. From the Hard Paradigms towards Multimethodology in Project Management. *Procedia Computer Science*, *100*, pp.1228-1234.

Senge, P.M. 1994. *The fifth discipline: the art and practice of the learning organization*. United States of America: Currency Paperback. pp. 73,97,380-390.

Shenhar, A.J. & Dvir, D. 2007. Project management research-the challenge and opportunity. *Project Management Journal*. 38(2):93.

Stake, R.E. 2006. *Multiple case study analysis*. New York: The Guilford Press

Statistics South Africa. 2013. Post and telecommunications industry. Pretoria: Statistics South Africa.

Sterman, J.D. 2000. *Business Dynamics: Systems thinking and modeling for a complex world.* United States of America: McGraw-Hill

Song, Y., 2011. Systemic project management. *Journal of Project, Program & Portfolio Management*, *2*(1), pp.67-82.

Telkom integrated report. 2015. For the year ended 31 March 2015, April 2015. Available:http://www.telkom.co.za/ir/apps_static/ir/pdf/financial/pdf/Telkom%20IR%202015%20Final.PDF

Torraco, R.J., 2016. Writing integrative literature reviews: Using the past and present to explore the future. *Human Resource Development Review*, *15*(4), pp.404-428.

Vodacom annual results presentation. 2014. For the year ended 31 March 2014, May 2014. Available:http://www.vodacom.co.za/cs/groups/public/documents/vodacom.co.za_portal_webassets/presentation-may-14-2.pdf

Vos, F. J. & Achterkamp, M.C. 2006. Stakeholder identification in innovation projects: Going beyond classification. *Euro Jrnl of Inn Mnagmnt*. 9(2):161-178. DOI:10.1108/14601060610663550.

Yin, R.K. 2002. *Case Study Research: Design and Methods*. 3rd ed. USA: SAGE

Appendices

Appendix A

Table J: Success factors from the literature review

No	Success Factors: Coding Level A	Source
1	Project mission	Pinto and Slevin (1987)
2	Senior management support	Pinto and Slevin (1987)
3	Project scheduling	Pinto and Slevin (1987)
4	Client management	Pinto and Slevin (1987)
5	Human resource management	Pinto and Slevin (1987)
6	Project manager competency	Belassi and Tukel (1996)
7	Project team competency	Belassi and Tukel (1996)
8	Project description	Belassi and Tukel (1996)
9	Management support	Belassi and Tukel (1996)
10	Organizational structure	Belassi and Tukel (1996)
11	Project champion	Belassi and Tukel (1996)
12	Risk management	Cooke-Davies (2002)
13	Project responsibilities	Cooke-Davies (2002)
14	Time management	Cooke-Davies (2002)
15	Scope management	Cooke-Davies (2002)
16	Quality management	Cooke-Davies (2002)
17	Collaboration between project management and line management	Cooke-Davies (2002)
18	Learning from previous project experiences	Cooke-Davies (2002)
19	Project performance feedback	Cooke-Davies (2002)
20	Aligning projects with business and strategy objectives	Cooke-Davies (2002)
21	Senior management support	Fortune and White (2006)
22	Project manager competency	Fortune and White (2006)
23	Communication	Fortune and White (2006)
24	Risk management	Fortune and White (2006)
25	Project champion	Fortune and White (2006)
26	Change management	Fortune and White (2006)
27	Project team competency	Fortune and White (2006)
28	Project monitoring and control	Fortune and White (2006)
29	Communication	Alias et al. (2014)
30	Planning	Alias et al. (2014)
31	Organizational structure	Alias et al. (2014)
32	Client management	Alias et al. (2014)
33	Project type	Alias et al. (2014)
34	Project complexity	Alias et al. (2014)

35	External factors including political, social and economic issues	Alias et al. (2014)
36	Available Funds	(Atsu et al., 2010)
37	Top Management Support	(Atsu et al., 2010)
38	Training	(Atsu et al., 2010)
39	Motivation	(Atsu et al., 2010)
40	Proper Planning	(Atsu et al., 2010)
41	Minimized Scope	(Atsu et al., 2010)
42	User Involvement	(Atsu et al., 2010)
43	Firm Basic Requirements	(Atsu et al., 2010)
44	Clear Statement of Requirements	(Atsu et al., 2010)
45	Formal Methodology	(Atsu et al., 2010)
46	Ownership	(Atsu et al., 2010)
47	Culture	(Atsu et al., 2010)
48	Political Interference	(Atsu et al., 2010)
49	Risk management	(Atsu et al., 2010)
50	Capital budgeting and post implementation audit	(Atsu et al., 2010)
51	Competent Staff	(Atsu et al., 2010)
52	Experienced Project Manager	(Atsu et al., 2010)
53	Simple and clear project objectives	(Pade-Khene, Mallinson & Sewry, 2011)
54	Approaching the project in a holistic way	(Pade-Khene, Mallinson & Sewry, 2011)
55	Using ICT to enhance existing rural development activities	(Pade-Khene, Mallinson & Sewry, 2011)
56	Cultivating an enthusiastic influential project champion	(Pade-Khene, Mallinson & Sewry, 2011)
57	Incorporating socially excluded groups	(Pade-Khene, Mallinson & Sewry, 2011)
58	Incorporating/awareness of specific ICT policy influencing the project	(Pade-Khene, Mallinson & Sewry, 2011)
59	A good understanding of the local political context	(Pade-Khene, Mallinson & Sewry, 2011)
60	Significant participation of community target groups in the project process	(Pade-Khene, Mallinson & Sewry, 2011)
61	Focusing on local/demand-driven needs	(Pade-Khene, Mallinson & Sewry, 2011)
62	Building on local information and knowledge systems	(Pade-Khene, Mallinson & Sewry, 2011)
63	Appropriate training and capacity building	(Pade-Khene, Mallinson & Sewry, 2011)
64	Facilitating local content development	(Pade-Khene, Mallinson & Sewry, 2011)
65	Existing motivation and incentive for ICT job placement in the community	(Pade-Khene, Mallinson & Sewry, 2011)

66	Focus on economic self-sustainability – business development (entrepreneurship)	(Pade-Khene, Mallinson & Sewry, 2011)
67	Encouraged local ownership	(Pade-Khene, Mallinson & Sewry, 2011)
68	Building local partnerships	(Pade-Khene, Mallinson & Sewry, 2011)
69	Choosing the appropriate or right technology	(Pade-Khene, Mallinson & Sewry, 2011)
70	Building on existing public facilities	(Pade-Khene, Mallinson & Sewry, 2011)
71	Ongoing monitoring and evaluation of the project	(Pade-Khene, Mallinson & Sewry, 2011)

Table K: Success factors from the qualitative survey

No	Success Factors: Coding Level 1
1	Project success being based on project time, cost and quality
2	Crucial nature of the project mission
3	High degree of support by senior management
4	Importance of the competency of the project team
5	The competency of the project manager is crucial
6	Importance of having a project champion
7	Independence of projects and the strategy of the organization
8	Importance of the project management bodies of knowledge
9	Importance of time management, cost management and quality management
11	Project success related to timely completion of projects within budget
12	Importance of project mission
13	Importance of senior management support
14	Importance of competency of the project team
15	Importance of competency of the project manager
16	External factors must be managed in relation to the project mission
17	Project champion sustains project continuity
18	Learning from past projects is the foundation of growth and achievement
19	Importance of aligning the project with the strategy of the company
20	Importance of all project management knowledge areas
21	Project success related to initial project goals, completing the project on time and also related to managing project risk
22	Project mission clarifies stakeholder expectations and is crucial to project success
23	Management should have a clear view on the project goals and their support is importance
24	Competency of the project team is essential and aids in project execution
25	Competency of the project team is of more importance than the competency of the project manager
26	External project factors have a serious impact on the competitiveness of the project

27	External factors affect the quality of the project execution
28	Project champions streamline many aspects of the project
29	Learning from past projects can be used to predict risks in future projects
30	Projects should align with the strategy of the organization to ensure support from the organisation.
31	Project management bodies of knowledge are crucial to the success of the project.
32	Harmony and synergy between the knowledge areas contributes to project success.
33	Importance of scope management, cost management, human resource management, risk management, stakeholder management and integration management.
35	Project success related to the level of scope implementation of the project
36	Project mission importance depends on the stakeholder profile
37	Importance of management support to ensure project delivery
38	Competency of the project team depends on the nature of the project
39	Project manager competency depends on the nature of the project
40	Effect of external factors depends on the nature of the project
41	Importance of the project champion is dependent on the nature of the project
42	Importance of learning from past projects
43	Critical alignment of projects with the strategy of the organization
44	Importance of the project management bodies of knowledge depends on the nature of the project
45	Importance of scope management, quality management, risk management
46	Project success depends on whether the project is completed within budget and time and at an acceptable level of quality
47	Project mission is very important since it clarifies how the project objectives will be achieved
48	Senior management support ensures commitment from stakeholders and motivates the project team
49	Competency of the project team is important for the success of the project
50	Future project success depends on experiences gained from successful completed projects
51	Management skills of the project manager are required to steer the project to completion
52	External factors affect the success of the project
53	Learning from past projects and project experience is critical to the success of the project
54	Organisational planning done through aligning projects with the strategy of the organization.
55	Competency and understanding of the project management bodies of knowledge are key to the success of the project
56	All project management bodies of knowledge are crucial for successful project completion
57	Project completion through teamwork
58	Management support through dedication
59	Competency of the project team in completing the project
60	Importance of the competency of the project manager in completing the project
61	Project champion is a catalyst for project success
62	Importance of learning from past project experiences
63	Aligning the project with the company strategy
64	Importance of the project management bodies of knowledge
65	All project management knowledge areas contribute to successful completion of projects

Table L: Empirical success factor (ESF) categories

Success Factor	Empirical Success Factor Categories: Primary coding Level 2	Initial Coding: Level 1
ESF 1	Relationship between project success and project constraints	Project success being based on project time, cost and quality
		Crucial nature of the project mission
		Project success related to initial project goals, completing the project on time and also related to managing project risk
		Project success related to timely completion of projects within budget
		Project success related to the level of scope implementation of the project
		Project success depends on whether the project is completed within budget and time and at an acceptable level of quality
		Future project success depends on experiences gained from successful completed projects
ESF 2	Effects of outside influences on the success of the project	External project factors have a serious impact on the competitiveness of the project
		External factors affect the quality of the project execution
		Effect of external factors depends on the nature of the project
		External factors affect the success of the project
		External factors must be managed in relation to the project mission
ESF 3	Degree of competency of the project manager and the project team	Importance of the competency of the project team
		The competency of the project manager is crucial
		Importance of competency of the project team
		Importance of competency of the project manager
		Competency of the project team is essential and aids in project execution
		Competency of the project team is of more important than the competency of the project manager
		Competency of the project team depends on the nature of the project
		Project manager competency depends on the nature of the project
		Competency of the project team is important for the success of the project
		Management skills of the project manager are required to steer the project to completion
		Project completion through teamwork
		Competency of the project team in completing the project

		Importance of the competency of the project manager in completing the project
ESF 4	Relationship between the project and the strategy of the company	Independence of projects and the strategy of the organization
		Importance of project mission
		Importance of aligning the project with the strategy of the company
		Projects should align with the strategy of the organization to ensure support from the organisation.
		Critical alignment of projects with the strategy of the organization
		Organisational planning done through aligning projects with the strategy of the organization.
		Aligning the project with the company strategy
ESF 5	Effectiveness of the project management bodies of knowledge	Importance of the project management bodies of knowledge
		Importance of all project management knowledge areas
		Harmony and synergy between the knowledge areas contributes to project success.
		Project management bodies of knowledge are crucial to the success of the project.
		Importance of the project management bodies of knowledge depends on the nature of the project
		Competency and understanding of the project management bodies of knowledge are key to the success of the project
		All project management bodies of knowledge are crucial for successful project completion
		Importance of the project management bodies of knowledge
		All project management knowledge areas contribute to successful completion of projects
ESF 6	Implementation of selected project management knowledge areas	Importance of time management, cost management and quality management
		Importance of scope management, cost management, human resource management, risk management, stakeholder management and integration management.
		Importance of scope management, quality management, risk management
ESF 7	Having a culture of organizational learning	Learning from past projects is the foundation of growth and achievement
		Learning from past projects can be used to predict risks in future projects
		Importance of learning from past projects
		Learning from past projects and project experience is critical to the success of the project
		Importance of learning from past project experiences
ESF 8	Promoting project continuity through project leaders	Project champion sustains project continuity
		Importance of having a project champion

		Project champions streamline many aspects of the project
		Importance of the project champion is dependent on the nature of the project
		Project champion is a catalyst for project success
ESF 9	Defining roles and responsibilities of project stakeholders	Project mission clarifies stakeholder expectations and is crucial to project success
		Project mission importance depends on the stakeholder profile
		Project mission is very important since it clarifies how the project objectives will be achieved
ESF 10	Successful project delivery through management support	High degree of support by senior management
		Importance of senior management support
		Management should have a clear view on the project goals and their support is important
		Importance of management support to ensure project delivery
		Senior management support ensures commitment from stakeholders and motivates the project team
		Management support through dedication

Table M: Literature success factor (LSF) categories

Success Factor	Literature Success Factor Categories: Primary coding Level B	Initial Coding: Level A
LSF 1	Project mission	Simple and clear project objectives
		Project description
		Building on local information and knowledge systems
		Using ICT to enhance existing rural development activities
LSF 2	Support from senior management in successfully completing projects	Management support
		Senior management support
		Top Management Support
LSF 3	Competency of the project team to the successful completion of the project	Project team competency
		Competent Staff
		Training
		Motivation
		Appropriate training and capacity building
LSF 4	Competency of the project manager	Experienced Project Manager
		Project manager competency
LSF 5	Management of external factors including social, economic and political factors in contributing to successful project completion	External factors including political, social and economic issues
		Political Interference
		Incorporating socially excluded groups
		Incorporating/awareness of specific ICT policy influencing the project
		A good understanding of the local political context
		Significant participation of community target groups in the project process
		Focusing on local/demand-driven needs

		Building on existing public facilities
		Facilitating local content development
		Existing motivation and incentive for ICT job placement in the community
		Focus on economic self-sustainability – business development (entrepreneurship)
		Building local partnerships
		Culture
		Encouraged local ownership
LSF 6	Importance of having a project champion involved in implementing projects	Cultivating an enthusiastic influential project champion
		Project champion
		Ownership
		Project responsibilities
LSF 7	Learning from past projects to contribute to the successful completion of projects	Learning from previous project experiences
		Project performance feedback
		Collaboration between project management and line management
		Ongoing monitoring and evaluation of the project
		Proper Planning
		Communication
		User Involvement
LSF 8	Alignment of projects with the strategy of the organization	Aligning projects with business and strategy objectives
		Choosing the appropriate or right technology
		Approaching the project in a holistic way
		Organizational structure

		Project complexity
		Available Funds
		Project type
LSF 9	The use of project management principles	Project scheduling
		Quality management
		Risk management
		Time management
		Client management
		Human resource management
		Change management
		Project monitoring and control
		Minimized Scope
		Planning
		Formal Methodology
		Firm Basic Requirements
		Scope management

Table N: Project delays from meeting minutes

Source	Success factor category	Project delays obtained from meeting minutes
Documents: Meeting minutes	**Managing project constraints**	Delays [redacted] plans Stock [redacted] Site not built according to [redacted] Oustanding [redacted] documents [redacted] oustanding Revising [redacted] causing delays Faulty site [redacted] Project delays caused by [redacted] Lack of [redacted] Project delays caused by [redacted] Site build [redacted] Outstanding [redacted] [redacted] equipment [redacted] Outstanding [redacted] documents [redacted] High cost of site [redacted] [redacted] find altenative site solutions Not completing [redacted] on time Site [redacted] cancelled [redacted] of new site additions and [redacted] [redacted] Delays caused by [redacted] documents Oustanding [redacted] [redacted] delaying project
	Managing external factors	Rejection of site owners of [redacted] External vendor [redacted] reports External factors such as [redacted] delaying project completion [redacted] delaying project [redacted] delaying site build approval Vendor [redacted] issue Delays caused by [redacted] Project delays caused by [redacted] upgrades Site [redacted] delays Competitors taking long [redacted] [redacted] performance delaying project [redacted] required from [redacted] delaying project

Appendix B

Consent Form

My name is Irfaan Hamdulay. I am an Engineering Management student from the Mechanical Engineering faculty of the University of Cape Town. The title of my research project is: **INVESTIGATING CRITICAL SUCCESS FACTORS FOR SUCCESSFUL PROJECT COMPLETION IN A SOUTH AFRICAN TELECOMMUNICATIONS COMPANY**.

I am doing research into project success by examining critical success factors in the context of the South African telecommunications industry. I intend to gain important insights into these critical success factors during the interview and survey process.

All data gathered from participants in the research into critical success factors is completely confidential and the identity of all participants will remain anonymous.

Please indicate whether you would be a willing participant in the survey bearing in mind that your participation is not compulsory. Furthermore, you have the right to answer or not answer any question that may be posed to you.

Survey Questions

1. How many years work experience do you have in the telecommunications industry?
2. How would you define a successful project?
3. How important is the project mission as a critical success factor?
4. How important is support from senior management in successfully completing projects?
5. How important is the competency of the project team to the successful completion of the project?
6. How critical to the success of the project is the competency of the project manager?
7. How do you view the effect of external factors including social, economic and political factors in contributing to successful project completion?
8. What is your opinion on the importance of having a project champion involved in implementing projects?
9. How important is learning from past projects in order to contribute to the successful completion of projects?
10. How important is the alignment of projects with the strategy of the organization?
11. How important are the Project Management bodies of knowledge which includes Scope Management, Time Management, Cost Management, Quality Management, Human Resource Management, Communications Management, Risk Management, Procurement Management, Stakeholder Management and Integration Management to the success of the project?
12. What Project Management areas do you view as most critical to the successful completion of telecommunications projects?

Ethics Approval

EBE Faculty: Assessment of Ethics in Research Projects

Any person planning to undertake research in the Faculty of Engineering and the Built Environment at the University of Cape Town is required to complete this form before collecting or analysing data. When completed it should be submitted to the supervisor (where applicable) and from there to the Head of Department and then to the Faculty Office.

If you have answered YES to any of the above questions you will need to make an online submission to the EBE Ethics in Research Committee, via the following link: https://universityofcapetown.submittable.com/submit/39349. Please note that this form must still be filled out, signed and uploaded onto the online ethics application site.

Students must include a copy of the completed form with the dissertation/thesis when it is submitted for examination.

Name of Principal Researcher/Student: **Irfaan Hamdulay** Department: **Mechanical Engineering**

If a Student: Degree: **Mphil Engineering Management** Supervisor: **Dr Corrinne Shaw**

If a Research Contract indicate source of funding/sponsorship: **N/A**

Research Project Title: **INVESTIGATING CRITICAL SUCCESS FACTORS FOR SUCCESSFUL PROJECT COMPLETION IN A SOUTH AFRICAN TELECOMMUNICATIONS COMPANY**

Overview of ethics issues in your research project:

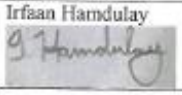
Question 1: Is there a possibility that your research could cause harm to a third party (i.e. a person not involved in your project)?	YES	NO **X**
Question 2: Is your research making use of human subjects as sources of data? If your answer is YES, please complete Addendum 2.	YES **X**	NO
Question 3: Does your research involve the participation of or provision of services to communities? If your answer is YES, please complete Addendum 3.	YES	NO **X**
Question 4: If your research is sponsored, is there any potential for conflicts of interest? If your answer is YES, please complete Addendum 4.	YES	NO **X**

If you have answered YES to any of the above questions, please append a copy of your research proposal, as well as any interview schedules or questionnaires (Addendum 1) and please complete make an online submission to the EBE Ethics in Research Committee, via the following link: https://universityofcapetown.submittable.com/submit/39349.

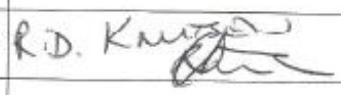
I hereby undertake to carry out my research in such a way that

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

Signed by:

	Full name and signature	Date
Principal Researcher/Student:	Irfaan Hamdulay 	12/10/2015

This application is approved by:

Supervisor (if applicable):		
HOD (or delegated nominee): Final authority for all assessments with NO to all questions and for all undergraduate research.		21/10/2015
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.		

ADDENDUM 1:
Please append a copy of the research proposal here, as well as any interview schedules or questionnaires:

ADDENDUM 2: To be completed if you answered YES to Question 2:

It is assumed that you have read the UCT Code for Research involving Human Subjects (available at http://web.uct.ac.za/depts/educate/download/uctcodeforresearchinvolvinghumansubjects.pdf) in order to be able to answer the questions in this addendum.

2.1 Does the research discriminate against participation by individuals, or differentiate between participants, on the grounds of gender, race or ethnic group, age range, religion, income, handicap, illness or any similar classification?	YES	NO X
2.2 Does the research require the participation of socially or physically vulnerable people (children, aged, disabled, etc) or legally restricted groups?	YES	NO X
2.3 Will you not be able to secure the informed consent of all participants in the research? (In the case of children, will you not be able to obtain the consent of their guardians or parents?)	YES	NO X
2.4 Will any confidential data be collected or will identifiable records of individuals be kept?	YES	NO **X**
2.5 In reporting on this research is there any possibility that you will not be able to keep the identities of the individuals involved anonymous?	YES	NO **X**
2.6 Are there any foreseeable risks of physical, psychological or social harm to participants that might occur in the course of the research?	YES	NO **X**
2.7 Does the research include making payments or giving gifts to any participants?	YES	NO **X**

If you have answered YES to any of these questions, please describe how you plan to address these issues (append to form):

ADDENDUM 3: To be completed if you answered YES to Question 3:

3.1 Is the community expected to make decisions for, during or based on the research?	YES	NO
3.2 At the end of the research will any economic or social process be terminated or left unsupported, or equipment or facilities used in the research be recovered from the participants or community?	YES	NO
3.3 Will any service be provided at a level below the generally accepted standards?	YES	NO

If you have answered YES to any of these questions, please describe how you plan to address these issues (append to form)

ADDENDUM 4: To be completed if you answered YES to Question 4

4.1 Is there any existing or potential conflict of interest between a research sponsor, academic supervisor, other researchers or participants?	YES	NO
4.2 Will information that reveals the identity of participants be supplied to a research sponsor, other than with the permission of the individuals?	YES	NO
4.3 Does the proposed research potentially conflict with the research of any other individual or group within the University?	YES	NO

If you have answered YES to any of these questions, please describe how you plan to address these issues(append to form)