THE ROLE OF MANAGEMENT IN THE CAUSES, EFFECTS AND INCIDENCE OF CONSTRUCTION PROJECT DELAYS

by

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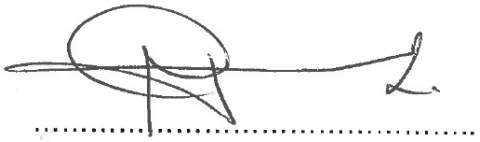

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ABSTRACT

The construction industry is known as a very highly-fragmented industry with a large number of activities involving different parties and professionals such as project managers, architects, engineers, quantity surveyors, contractors, suppliers and financiers. As it is a fragmented industry, management efficiency and competency in the industry is needed to gain a higher level of competitiveness. Although it is often clear what the causes and effects of construction projects delays are, little attention has been given to the role of management in the causes, effects and incidence of construction project delays. This research fills this gap in the literature.

For the study, a theoretical framework to investigate the role of management in the causes, effects and incidence of construction project delays was developed. The framework showed how four management functions predicted the causes, effects and incidence of construction project delays. Nine factors were identified as the causes of construction project delays, namely, clients, contractors, labour, equipment, materials, consultants, community, contract and external issues. For the study, three effects of delays were proposed, namely, finance related delays, human related delays and legal related delays. In addition, the incidence of delays included the frequency of delays and duration of delays.

This framework was empirically tested, and partial correlations were used to test the four hypotheses of the study. Three of the four hypotheses were accepted while the forth one was only partially-accepted. It was determined that demographics significantly predicted organising and leading of contractor managers in construction project delays. More specifically, demographics influenced how contractors with different educational levels executed organising and leading in managing construction project delays. The results further showed that management functions employed in construction projects, predicted five of the nine causes of construction delays. Further, the causes of construction project delays predicted both frequency and duration representing the incidence of construction delays. Lastly, the causes of construction project delays predicted the financial, human and legal effects of construction delays.

The empirically-tested framework produced only two factors causing construction project delays. Factor one included variables relating to contractor and consultant related issues, and factor two included community, contractual and external issues. The factors for the effects of construction project delays and incidence of construction project delays remained the same. Respondent contractors in this study indicated that education was important as it influenced both leadership and organising functions of these contractors. Age, sex and other demographics did not influence the management functions for these contractors.

Although much has been written on the causes, effects and incidence of construction project delays, very little attention has focussed on the role of management in these. For the respondent contractors who were included in the research, the two management functions that would influence the causes, effects and incidence of construction project delays, included organising and leadership. It further showed that these contractors were adequately dealing with planning and controlling, but needed to pay attention to organising and leadership.

TABLE OF CONTENTS

DECLARATION ..... **i**

ACKNOWLEDGEMENTS ..... **ii**

ABSTRACT ..... **iii**

LIST OF ANNEXURES ..... **xi**

LIST OF TABLES ..... **xii**

LIST OF FIGURES ..... **xiv**

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION 1

1.2 BACKGROUND TO THE STUDY 1

1.3 PROBLEM STATEMENT 2

1.4 RESEARCH OBJECTIVES 3

1.4.1 Primary research objective 3

1.4.2 Secondary research objectives 3

1.4.3 Research questions 4

1.5 LITERATURE OVERVIEW 4

1.5.1 Definitions and role players in construction 4

1.5.1.1 Construction Industry Development Board 4

1.5.1.2 Construction 5

1.5.1.3 Construction delays 5

1.5.1.4 Role-players in construction 5

1.5.2 Previous research on construction project delays 6

1.5.3 Factors causing construction project delays 7

1.5.4 Effects of construction project delays 13

1.5.5 Managerial activities in construction projects 14

1.6 PROPOSED THEORETICAL FRAMEWORK 15
1.7 RESEARCH DESIGN AND METHODOLOGY 17
1.7.1 Secondary research 17
1.7.2 Primary research 18
1.7.2.1 Study sample 18
1.7.2.2 Research Instruments 19
1.7.2.3 Data collection 20
1.7.2.4 Ethical considerations 20
1.7.2.5 Data analysis 21
1.8 SCOPE OF THE STUDY 24
1.9 CONTRIBUTION OF THE STUDY 24
1.10 STRUCTURE OF THE RESEARCH 24
1.11 SUMMARY 26

CHAPTER TWO

MANAGEMENT OF CONSTRUCTION PROJECTS

2.1 INTRODUCTION 27
2.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 27
2.3 DEFINING A CONSTRUCTION PROJECT AND CLARIFYING ROLE PLAYERS 29
2.3.1 Construction project process 30
2.3.2 Role players in a construction project 30
2.4 PREVIOUS RESEARCH ON CONSTRUCTION BUSINESSES AND MANAGEMENT 31
2.5 THE CONSTRUCTION INDUSTRY 36
2.5.1 Construction industry in the global context 37
2.5.1.1 Construction industry in Europe 37
2.5.1.2 Construction Industry in Hong Kong 37

2.5.1.3 Construction industry in Malaysia 38

2.5.1.4 Construction industry in Australia 38

2.5.1.5 Construction industry in United Arab Emirates 38

2.5.1.6 Construction industry in Portugal 39

2.5.1.7 Construction industry in Nigeria, Africa 39

2.5.2 South African construction industry 40

2.6 THE FUNCTIONS OF MANAGERS IN CONSTRUCTION 45

2.7 FACTORS AFFECTING THE SUCCESS OF A CONSTRUCTION PROJECT 46

2.8 MANAGING ERRORS IN CONSTRUCTION PROJECTS 51

2.9 COMPETENCIES OF MANAGERS IN CONSTRUCTION 51

2.10 SUMMARY 61

CHAPTER THREE

CONSTRUCTION PROJECT DELAY CAUSES, EFFECTS AND INCIDENCE

3.1 INTRODUCTION 63

3.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 63

3.3 DEFINING A CONSTRUCTION PROJECT DELAY 65

3.4 INTERNATIONAL RESEARCH ON CONSTRUCTION PROJECT DELAYS CAUSES 65

3.5 SOUTH AFRICAN RESEARCH ON CONSTRUCTION PROJECT DELAY CAUSES 73

3.6 EFFECTS OF DELAYS IN CONSTRUCTION PROJECTS 75

3.7 INCIDENCE OF DELAYS IN CONSTRUCTION PROJECTS 78

3.8 SUMMARY 79

CHAPTER FOUR

A FRAMEWORK FOR THE ROLE OF MANAGEMENT IN THE CAUSES, EFFECTS AND INCIDENCE OF CONSTRUCTION PROJECT DELAYS

4.1 INTRODUCTION 81

4.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 81

4.3 PROPOSED THEORETICAL FRAMEWORK AND HYPOTHESES 83

4.4 COMPONENTS OF THE PROPOSED THEORETICAL FRAMEWORK 86

4.4.1 Demographics 86

4.4.2 Management factors 87

4.4.3 Factors causing construction project delays 87

4.4.4 Effects of construction project delays 88

4.4.5 Incidence of construction project delays 90

4.5 SUMMARY 90

CHAPTER FIVE

RESEARCH DESIGN

5.1 INTRODUCTION 92

5.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 92

5.3 RESEARCH PARADIGM 94

5.4 RESEARCH DESIGN 95

5.4.1 Population 95

5.4.2 Sample unit and sampling method 96

5.4.3 Method of data collection 97

5.4.4 Pilot survey 99

5.4.5 Administration of measuring instrument 99

5.4.6 Method of analysis 99

5.5 SUMMARY OF THE CHAPTER 103

CHAPTER SIX

RESULTS OF THE EMPIRICAL SURVEY

6.1 INTRODUCTION 104

6.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 104

6.3 DEMOGRAPHIC AND SAMPLE DESCRIPTION 106

6.4 FREQUENCIES AND DESCRIPTIVE STATISTICS OF QUESTIONNAIRE SECTIONS 2, 3 AND 4 110

6.4.1 Frequencies of the responses 110

6.4.2 Descriptive statistics 111

6.5 RESULTS OF VALIDITY OF THE QUESTIONNAIRE 113

6.6 RELIABILITY RESULTS OF THE QUESTIONNAIRE 113

6.7 CORRELATION ANALYSIS 115

6.8 RESULTS OF THE EXPLORATORY FACTOR ANALYSIS 118

6.9 REGRESSION ANALYSIS 119

6.10 PARTIAL CORRELATIONS AND TESTING THE HYPOTHESES 124

6.10.1 Relationship between demographics and managing functions in construction projects 125

6.10.2 Relationship between causes of construction project delays and management functions in construction projects 129

6.10.3 Relationship between causes of construction project delays and Incidence of construction project delays 134

6.10.4 Relationship between causes of construction project delays and effects of construction project delays 136

6.11 SUMMARY 141

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION 143

7.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS 143
7.3 SUMMARY OF CHAPTERS 145
7.3.1 Summary of chapter one 145
7.3.2 Summary of chapter two 145
7.3.3 Summary of chapter three 146
7.3.4 Summary of chapter four 146
7.3.5 Summary of chapter five 147
7.3.6 Summary of chapter six 147
7.4 ACHIEVEMENT OF RESEARCH OBJECTIVES 148
7.4.1 Achievement of primary and secondary objectives 148
7.4.2 Addressing the research questions 149
7.5 MAJOR FINDINGS BASED ON EMPIRICAL RESULTS 153
7.5.1 Demographic profile of the respondents 153
7.5.2 Hypotheses testing 154
7.6 RECOMMENDATIONS AND PRACTICAL IMPLICATIONS OF THIS STUDY 155
7.7 CONTRIBUTIONS OF THE STUDY 156
7.8 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH AREAS 157
7.8.1 Limitations of the study 157
7.8.2 Future research areas 158
7.9 CONCLUDING REMARKS 159

REFERENCE LIST 160

LIST OF ANNEXURES

Annexure A: Copy of the questionnaire used in the online study 175

Annexure B: Cover Letter 182

Annexure C: Frequencies 183

Annexure D: Confirmation ethical clearance 188

Annexure E: Language Editors letter 189

LIST OF TABLES

Table 1.1: Previous research on delays in construction projects 7

Table 1.2: Critical delay causes for consultants, contractors and owners 9

Table 1.3: Factors causing construction delays 10

Table 1.4: Research process used in the study 21

Table 1.5: Research questions and objectives and chapter of the study 25

Table 2.1: Summary of previous research in construction management 35

Table 2.2: Summary of the Construction Industry 45

Table 2.3: Summary of the management of construction projects 61

Table 3.1: Summary of international research on construction project delay causes 66

Table 3.2: Summary of the effects of constructions project delays 77

Table 5.1: Differences between qualitative and quantitative research 94

Table 6.1: Mean and standard deviation of constructs in the causes and effects in construction delays and constructs measuring management in construction projects 111

Table 6.2: Cronbach alpha coefficients for the factors 114

Table 6.3: Correlation coefficients for the four constructs 116

Table 6.4: Pearson moment correlations of management functions 117

Table 6.5: Results of exploratory factor analysis for the delay causes 118

Table 6.6: Regression results for financial delay effects 119

Table 6.7 Regression results for human delay effects 120

Table 6.8: Regression results for legal delay effects 121

Table 6.9: Regression results for delay incidence frequency 122

Table 6.10: Regression results for delay incidence duration 123

Table 6.11: Partial correlations of education and years employed and management functions in construction projects 126

Table 6.12: Partial correlations of management functions employed and causes of construction project delays 129

Table 6.13: Partial correlations of causes of construction project delays and incidence of the delay 135

Table 6.14: Partial correlations of causes of construction delays and the effects of construction delays 137

Table 6.15: Results of the testing the study's research hypotheses 139

Table 7.1: Achievement of research objectives 149

Table 7.2: Summary of the hypotheses testing 154

LIST OF FIGURES

Figure 1.1: Role of management in the causes, effects and incidence of construction project delays 16
Figure 1.2: Conceptual framework of the research process 23
Figure 2.1: Conceptual framework of the research process 28
Figure 3.1: Conceptual framework of the research process 64
Figure 4.1: Conceptual framework of the research process 82
Figure 4.2: Role of management in the causes, effects and incidence of construction project delays 85
Figure 5.1: Conceptual framework of the research process 93
Figure 6.1: Conceptual framework of the research process 105
Figure 6.2: Respondent gender composition 106
Figure 6.3: Respondent age distribution 107
Figure 6.4: Respondent education level 107
Figure 6.5: Respondent number of years employed 108
Figure 6.6: Respondent home languages 109
Figure 6.7: Respondent BBBEE level of contribution 109
Figure 6.8: Empirically tested model for the role of management in the causes, effects and incidence of construction project delays 141
Figure 7.1: Conceptual framework of the research process 144

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

A measure of success in the management of construction projects is whether the project was completed within the prescribed time, cost and quality. Causes of delays are factors or events that occur before and during the construction process that will affect the time, cost and quality of completing a construction project. There have been many studies that have investigated the causes of construction delays and these are well-documented and researched. For example, Motaleb and Kishk (2010), Sambasivan and Soon (2007) as well as Assaf and Al-Heijji (2006).

Effects of delays are the consequences that will occur when the causes of delays are not identified and worked on effectively. Studies such as Pourrostam and Ismail (2011) identified and ranked the effects of construction delays. Although most of these studies proposed some solutions or remedies, these were seldom tested to be effective. Very little research has focused on the role of management that could influence the causes, effects and incidence of construction delays. In this study, a framework to investigate the causes, effects and incidence of construction delays was developed, which was then empirically-tested.

1.2 BACKGROUND TO THE STUDY

The Construction Industry Development Board (CIDB, 2011b) report first presented an overview of the state of construction quality in South Africa, from which it was shown that clients were neutral or dissatisfied with the quality of construction for about 20% of all projects. In addition, about 12% of the projects surveyed had levels of defects, which were regarded as inappropriate. It is argued that clients should not be complacent with these levels of dissatisfaction, and that clients should strive to get better value for money.

On the other hand, the CIDB (2011a) survey showed that many contractors did not have the requisite formal qualification or the experience. In addition, the CIDB (2011a) survey on the skills of contractors showed that for grade 2 to 4 contractors, about 34%

of Owners / Directors had less than five years' experience in the construction industry, and about 65% had no formal qualifications. Grade 5 and 6 contractors had better experience as less than 10% of Owners / Directors had less than five years' experience in the construction industry, but 45% had no formal qualifications.

The construction industry has been exhaustively studied in the area of delays in projects internationally and locally. A list of possible causes and effects in delays has evolved over the past 10 years that covers all major causes and effects of delays in this industry. The most extensive list is that of Kao and Yang (2009) which listed eighty possible delays. Aiyetan (2010) has studied project delays in the South African context. Knowing the cause of any particular delay in a construction project would help avoiding the same in the future. From an overview of the literature, many delays have occurred because of the failure to anticipate problems in the first place and to solve the problems when they have arisen (Toor & Ogulana, 2008; Odeh & Battaineh, 2002). Therefore, developing countries need to invest in attracting more talent and develop existing human resources to cope with mounting construction demands. From studying the major suggestions on how to mitigate the effects of construction delays, most suggestions revolved around the four management functions (Partington, 2002), namely:

- Planning/forecasting
- Organising/staffing
- Leading/commanding
- Controlling/ coordinating

1.3 PROBLEM STATEMENT

The construction industry is known as a very highly-fragmented industry with a large number of activities involving different parties and professionals such as architects, engineers, quantity surveyors, contractor teams, suppliers, financiers and others. As the construction industry is a fragmented industry, management efficiency and competency in the industry is needed to gain a higher level of competitiveness. The need for such an approach has become more important and more pronounced, not only due to the increased size and complexity of building projects, but also as a result of growing participation by international contractors (CIDB, 2015).

The demand of construction clients for the timely delivery of construction projects and the susceptibility of projects to delays and cost overruns has attracted the attention of researchers all over the world, most of whom have tried to identify the immediate as well as the root causes of project delays. However, despite the various studies and investigations into the causes of delays, it is still a major problem in the construction industry.

Although it is often clear what the causes and effects of construction project delays are, little attention has been given to the role of management in the causes, effects and incidence of construction project delays. This research thus aimed to fill this gap in literature.

More specifically, the research focused on the perceptions of construction contractors on a proposed framework indicating the role of management in the causes, effects and incidence of construction project delays. The intention is to assess the management factors that would predict the causes, effects and incidence of construction projects delays.

1.4 RESEARCH OBJECTIVES

To address the purpose of the research as highlighted in paragraph 1.3, this section sets out the primary and secondary objectives of this study.

1.4.1 Primary research objective

The primary objective of this research was to investigate the role of management in the causes, effects and incidence of construction project delays.

1.4.2 Secondary research objectives

To help achieve the primary objectives, the following secondary objectives were formulated:

- To describe the factors that cause construction project delays
- To examine the effects of construction project delays
- To investigate the incidence of construction delays
- To identify management activities that may predict the causes, effects and incidence of construction project delays

- To develop a framework showing the role of management in predicting the causes, effects and incidence of construction project delays
- To describe the appropriate research design for the study
- To empirically test the framework so as to propose managerial activities that may predict the causes, effects and incidence of construction delays

1.4.3 Research questions

The following research questions were investigated in this research:

- Which factors are the main causes of construction project delays?
- What are the primary effects of construction delays?
- What are the incidence (frequency and duration) of construction delays?
- Which management activities can predict the causes, effects and incidence of construction delays?
- What framework can show the role of management in predicting the causes, effects and incidence of construction project delays?
- What is the appropriate research design for this study?
- Can this framework be tested empirically?

1.5 LITERATURE OVERVIEW

The literature overview to inform this study is provided in this section.

1.5.1 Definitions and role players in construction

To understand the research, it is important to define and explain certain concepts that were used in the study.

1.5.1.1 Construction Industry Development Board

The Construction Industry Development Board (CIDB) is a Schedule 3A public entity established in terms of the Construction Industry Development Board Act, 2000 (Act 38 of 2000), to provide leadership to stakeholders for sustainable growth, reform and improvement of the construction sector and the industry's enhanced role in the country's economy. This Act mandates the CIDB to promote improved performance and best practice of both public and private sector clients, contractors and other participants.

1.5.1.2 Construction

Davies and Erkki (2008:5) define building construction as a process of preparing for erecting buildings. It starts with planning, design, financing and continues until the structure is ready for occupancy.

1.5.1.3 Construction delays

Williams (2003) concluded that the delays can be a result of the contractor or the client or both, which can result in claims. The list of delays has become comprehensive in the construction industry.

1.5.1.4 Role-players in construction

The main role players in construction include the following participants:

a) Client

The client is the person who requires a building to be constructed, and when it is finished, is prepared to pay for it. Clients usually employ a number of consultants.

b) Consultants

Consultants are usually employed for their professional expertise in a particular field, for example, planning regulations, design of a project, occupational health and safety regulations or costing. While traditionally employed by the client, consultants are increasingly recruited by contractors as part of their design team. Consultants who are commonly involved in construction projects include architects, engineers and quantity surveyors.

c) Contractor

The contractor is the business who is responsible to execute the construction work. The main task of the contractor is to complete the project within the prescribed time, cost and quality.

d) Subcontractor

Main contractors are responsible for the whole of a project and rarely have all of the skills necessary to build every part of a complicated building or structure.

Subcontractors are employed by the main contractor for parts of the project such as reinforced concrete works, structural steelwork, foundation piling, roofing, cladding, plumbing and electrical work.

1.5.2 Previous research on construction project delays

Literature has revealed that the causes of delays have occurred at different levels ranging from those caused by the client or owner to those caused by other external factors (Youngjae, Kyungrai & Dongwoo, 2006; Kim, 2009; Al-Humaidia & Tan, 2010). Literature has also shown that each category of delay has different factors that could lead to delays on construction projects.

There are numerous studies on the causes and effects of project delays in literature, for example, Aiyetan, Smallwood and Shakantu (2011), Makuka, Aigbavboa and Thwala (2013). However, the effects of delays were only linked in some cases. Most of the literature focused on the delays in projects in the construction industry while project delays in other industries were also available.

Odeh and Battaineh (2002) focussed on owners, contractors and consultants when investigating construction project delays. Owners, contractors and consultants in many projects disliked the experience of extensive delays which had a negative impact on the initial cost and time estimates (Odeh & Battaineh, 2002).

Delays are generally acknowledged as the most common, costly, complex and risky problems encountered in construction projects. The overriding importance of time for both the owner (in terms of performance) and the contractor (in terms of money) make it the source of frequent disputes and claims leading to lawsuits.

Table 1.1 outlines previous research conducted on the causes of construction project delays.

Table 1.1: Previous research on delays in construction projects

Author	Research conducted
Youngjae, *et al.* (2006)	Focused on the construction contract and completion time of the project.
Kim (2009)	Developed various delay analysis techniques to analyse the time and cost impacts caused by schedule changes. Focused on the critical path method to address delays.
Al-Humaidia and Tan (2010)	Found that project delay was a result of uncertainty encountered from plan and actual work deviations. Such uncertainty could arise due to many factors, including task duration, resources, and interdependency of logically-related tasks. Uncertainty could also arise from non-controllable factors such as weather, natural disasters, resource limitations and managerial actions or inactions, which could cause alterations in the planned schedule and result in delays, especially if the task is part of the critical path.
Odeh and Battaineh (2002)	Focussed on owners, contractors and consultants when investigating construction project delays. Owners, contractors and consultants in many projects dislike the experience of extensive delays, which have a negative impact on the initial cost and time estimates.
Aiyetan, *et al.* (2011)	Identified seven stages of construction project delivery and various activities in these stages that could reduce the negative influence of delay factors on project delivery time.
Makuka, *et al.* (2013)	Examined previous literature on construction project delays. The study explored the causes and effects of construction project delays and presented a robust background on the theories of construction project delays.

Source: Researcher's own compilation

1.5.3 Factors causing construction project delays

A comprehensive list of construction delays across varying countries was developed by Toor and Ogunlana (2008), which showed the difference in construction delays prior to the year 2000 and post-2000. Their study identified additional factors that caused delays in developing countries, including lack of finance, technically-incompetent and less-experienced local companies, an underdeveloped business environment, complexities in legal and regulatory systems and distinct socio-cultural

issues (Toor & Ogunlana, 2008). They concluded that factors causing delays in construction across developing countries in the world were mostly identical. Toor and Ogunlana (2008) also identified 75 factors causing construction delays, which they categorised into 10 categories, namely:

- Delays related to clients
- Delays related to designers
- Delays related to project management or consultants
- Delays related to contractors
- Delays related to labour
- Delays related to finance
- Delays related to contract
- Delays related to communications
- Delays related to site and environment
- Other miscellaneous factors

Wei (2010) states that the classification of delays is dependent upon the type and magnitude of the effect that an activity will have on the project, and who is responsible for the delay among the stakeholders. On the other hand, Theodore (2009) categorised delays into four groups, namely, critical or noncritical, excusable or non-excusable, compensable or non-compensable and concurrent or non-concurrent.

Makuka, *et al.* (2013) categorised the causes of construction delays into seven groups, namely, owner related, contractor related, consultant related, material related, equipment related, labour related and causes by eternal factors.

Odeh and Battaineh (2002) grouped their delay factors based on the client, contractor, consultants, material, labour and equipment, external factors, contract and contractual relationships. The authors' agreed significant factors of delay were inadequate contractor experience, owner interference, financing of work, delays caused by subcontractors, slow decision-making by owners, improper planning and labour productivity.

Sweis, Sweis, Hammad and Shboul (2008) listed the three most critical delay causes in the Jordanian construction industry as shown in Table 1.2 based on the views of consultants, contractors and owners in residential construction projects.

Table 1.2: Critical delay causes for consultants, contractors and owners

Consultants	Contractors	Owners
Poor planning and scheduling of the project by the contractor	Financial difficulties faced by the contractor	Poor planning and scheduling of the project by the contractor
Financial difficulties faced by the contractor	Too many change orders from owner	Financial difficulties faced by the contractor
Too many change orders from owner	Shortage of manpower (skilled, semi-skilled, unskilled labour)	Incompetent technical staff assigned to the project

Source: Researcher's own compilation

Assaf and Al-Hejji (2006) investigated the causes of delays based on the perception of owners, contractors and consultants in the construction industry in Saudi Arabia, and listed 73 possible causes of construction delays.

Kao and Yang (2009) classified construction delays in the following four broad categories according to how they operated contractually:

- Non-excusable delays
- Excusable non-compensable delays
- Excusable compensable delays
- Concurrent delays

Sambasivan and Soon (2007) identified the 10 most important causes of delay from a list of 28 different causes in the Malaysian construction industry. These ten most important causes were:

- Contractor's improper planning
- Contractor's poor site management
- Inadequate contractor experience
- Inadequate client's finance and payments for completed work
- Problems with subcontractors
- Shortage of material
- Labour supply
- Equipment availability and failure
- Lack of communication between parties

- Mistakes during the construction stage

Yang and Ou (2008) identified six causes for construction delays, namely:

- Contract related factors
- Management related factors
- Human related factors
- Non-human related factors
- Design related factors
- Finance related factors

Table 1.3 provides a brief summary of the factors identified for causing construction delays.

Table 1.3: Factors causing construction delays

Author	Country	Delay factors identified
Makuka, *et al.* (2013)	Not Specified	Reviewed theories on delays and suggested seven groups of delays: • Owner related • Contractor related • Consultant related • Material related • Equipment related • Labour related • External factor causes
Wei (2010)	Malaysia	Delays were dependent upon the type of activity and who was responsible for the delay
Kao and Yang (2009)	Not specified	Classified construction delays in the following four broad categories according to how they operated contractually: • Non-excusable delays • Excusable non-compensable delays • Excusable compensable delays • Concurrent delays

Author	Country	Delay factors identified
Theodore (2009)	Not specified	Four groups were mentioned, namely: • Critical /Noncritical • Excusable/ Non-excusable • Compensable / non-compensable • Concurrent/non-concurrent
Sweis, *et al.* (2008)	Jordan	Listed the three most critical delay causes based on the views of consultants, contractors and owners in residential construction projects
Toor and Ogunlana (2008)	Thailand	Identified 75 factors grouped into ten categories, namely: • Delays related to clients • Delays related to designers • Delays related to project management or consultants • Delays related to contractors • Delays related to labour • Delays related to finance • Delays related to contract • Delays related to communications • Delays related to site and environment • Other miscellaneous factors
Yang and Ou (2008)	Taiwan	Identified six causes for construction delays, namely: • Contract related factors • Management related factors • Human related factors • Non-human related factors • Design related factors • Finance related factors

Author	Country	Delay factors identified
Sambasivan and Soon (2007)	Malaysia	Identified the 10 most important causes of delay from a list of 28 different causes, namely: • Contractor's improper planning • Contractor's poor site management • Inadequate contractor experience • Inadequate client's finance and payments for completed work • Problems with subcontractors • Shortage of material • Labour supply • Equipment availability and failure • Lack of communication between parties • Mistakes during the construction stage
Assaf and Al-Hejji (2006)	Saudi Arabia	Listed 73 possible causes of construction delays
Odeh and Battaineh (2002)	Not specified	Grouped their delay factors based on the client, contractor, consultants, material, labour and equipment, external factors, contract and contractual relationships

Source: Researcher's own compilation

Considering the factors as listed in Table 1.3, it is evident that most of the identified factors are similar. For the purposes of this study, the following categorisation of the factors causing delays were used:

- Delays related to clients
- Delays related to contractors
- Delays related to labour
- Delays related to finance
- Delays related to equipment
- Delays related to consultants
- Delays related to community
- Delays related to the contract
- Delays related to external issues (human or natural)

1.5.4 Effects of construction project delays

The effects of delays are consequences that occur when the causes of delays are not identified and worked on effectively. Makuka, *et al.* (2013) identified a total of 14 effects of delays of construction projects, namely, time overrun, cost overrun, negative social impact, idling resources, disputes, arbitration, delaying by the client to return the loans, poor quality of work owing to hurrying the projects, delaying in getting profit by clients, bankruptcy, litigation, create stress on contractors, total abandonment and acceleration losses.

Alwi and Hampson (2003) also suggest that the main effects of delay on a project are in the form of time and cost. They also concluded that the delay causes researched were also applicable to similar building construction projects in other developing countries.

Sambasivan and Soon (2007) identified six different effects of construction delays in the Malaysian construction industry, namely:

- Time overrun
- Cost overrun
- Disputes
- Arbitration
- Litigation
- Total abandonment

These six effects were also identified by Aibinu and Jagboro (2002) in their study of construction delays in Nigeria.

The delay analysis in South Africa (SA) seems to be very limited. South Africa has pertinent issues that can affect any project particularly when it comes to labour-related issues.

For the purposes of this study, the following effects of construction delays were included:

- Time overrun
- Cost overrun
- Negative social impact

- Idling resources
- Disputes
- Arbitration
- Client delays to repay loans
- Poor quality of work owing to hurried projects
- Delays in clients generating profits
- Bankruptcy
- Litigation
- Contractor pressures (stress)
- Total abandonment and acceleration losses

1.5.5 Managerial activities in construction projects

Delays can be minimised only when their causes are identified. Knowing the cause of any particular delay in a construction project would help avoiding the same in the future.

Odeh and Battaineh (2002) suggest four recommendations to reduce the costly delays experienced, namely:

- Enforce liquidated damage clauses and propose incentives for early completion of projects
- Provide proper training and classification of labour (trades)
- Approach contract award procedure from a capabilities perspective and not a lowest cost perspective.
- Establish new approaches to contracts such as the design, build and construction management type

In order to overcome the problems causing construction delays in developing countries, Toor and Ogunlana (2008**)** suggest that fundamental and large-scale reforms are required in procurement systems, value chain management and stakeholder management.

The majority of the interviewees in Toor and Ogunlana's (2008) study agreed that innovative procurement systems and the involvement of designers and contractors

right from the project conception stage could avoid many overwhelming issues at later stages of the projects. Other common suggestions to avoid problems included:

- Comprehensive design preparation Adoption of realistic and agreed-upon time schedules by all parties
- Minimisation of change orders
- Provision of adequate compensation to contractors and consultants
- Formulation of a robust risk mitigation plan
- Continuous involvement of stakeholders in constructive dialogue
- More frequent site meetings involving all parties
- Thorough resource planning and development of the project concept

Discussions with project managers further suggested all construction stakeholders (client, consultants, designers and contractors) should form an independent commission for performance evaluation on major construction projects. The role of such a commission should be purely advisory and it should hold regular meetings to present its impartial reports.

Many delays occur because of the failure to anticipate problems in the first place and to solve the problems when they have arisen. Therefore, developing countries need to invest in attracting more talent and develop the existing human resources to cope with mounting construction demand.

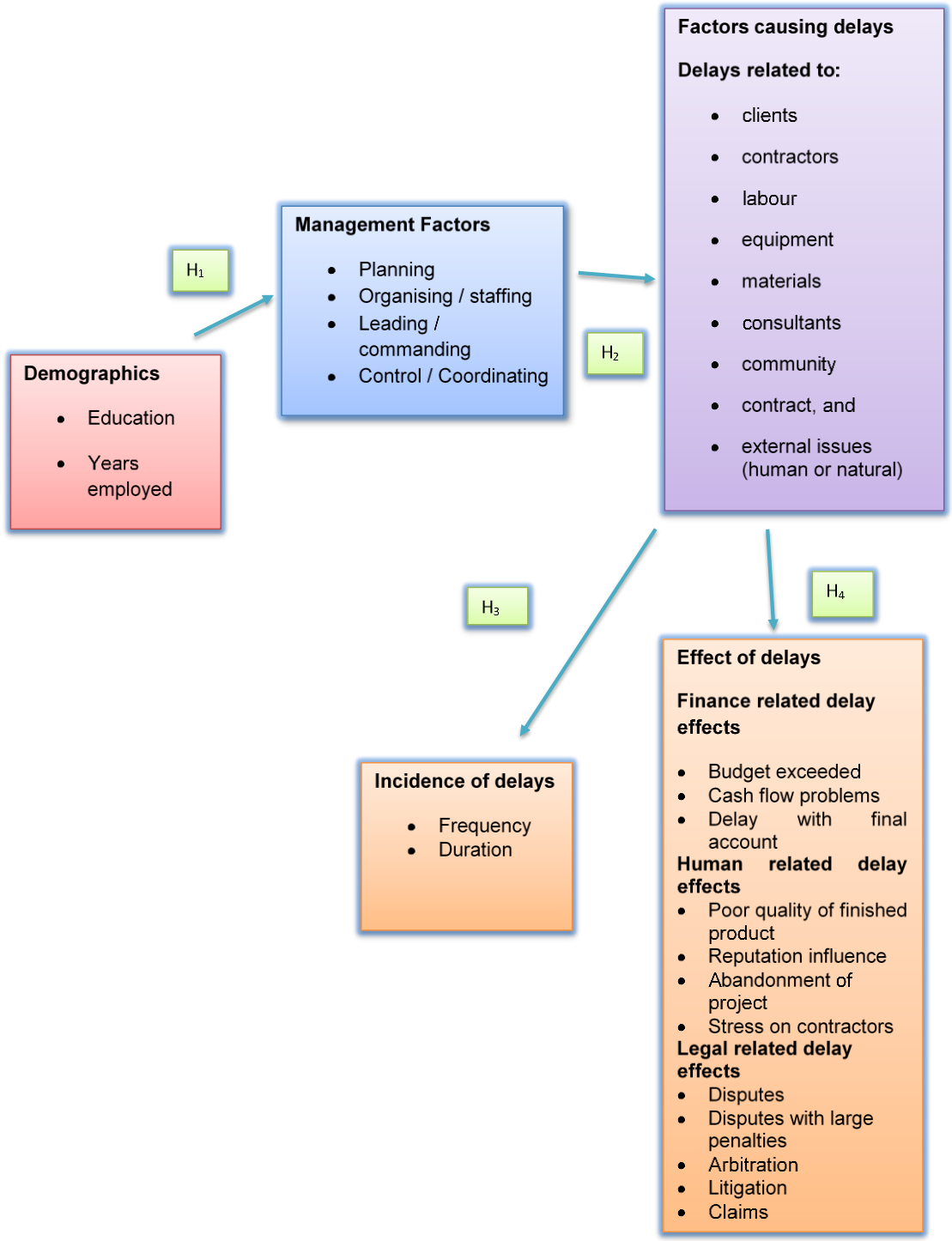
From studying the major suggestions on how to mitigate the effects of construction delays, most suggestions revolved around the four management functions (Partington, 2002), namely:

- Planning/forecasting
- Organising/staffing
- Leading/commanding
- Control/coordinating

1.6 PROPOSED THEORETICAL FRAMEWORK

Figure 1.1 represents the theoretical model that was tested in this study. The initial literature study revealed a number of factors causing construction delays (see Table 1.3). In section 1.5.4, the effects of construction delays were briefly outlined and

Section 1.5.5 discussed the managerial activities. Based on this, the theoretical framework is proposed as depicted in Figure 1.1.



Source: Researcher's own compilation

Figure 1.1: Role of management in the causes, effects and incidence of construction project delays

For the purposes of this study, the following hypotheses were formulated to test the relationships proposed in the theoretical framework:

H_1 : Demographics predict the management factors employed in construction project delays

H_2 : Management factors employed in construction project delays predict the causes of construction project delays

H_3 : Construction project delays predict the incidence of construction project delays

H_4 : Construction project delays predict the effects of construction project delays

These hypotheses were tested by means of an empirical survey.

1.7 RESEARCH DESIGN AND METHODOLOGY

This study made use of a quantitative research paradigm to achieve the research objectives. Quantitative research is used to determine the relationships among measured variables to "explain, predict and control phenomena" (Jonker & Pennink, 2009:66-67). The aim of quantitative research is to determine the relationship between an independent variable and a dependent variable in a population (Sekaran & Bougie, 2010:12). In investigating the role of management in the causes, effects and incidence of construction project delays, the research method included collecting and analysing data in a numerical form and investigating relationships between the role of management (construct 1), the causes of construction delays (construct 2), the effect of construction delays (construct 3) and the incidence of construction delays (construct 4). For this reason, the quantitative approach to research was judged to be most suitable for this study.

1.7.1 Secondary research

A comprehensive literature search was conducted to identify as many factors as possible that could cause construction delays as well as determine the effect of construction delays. International and national data searches were conducted to source secondary data by the Library of the Nelson Mandela Metropolitan University and to date included: Sabinet databases, ISAP (National library of South Africa) and

SAe Publications, EBSCO: MasterFile premier, Business Source premier, Academic Source premier, FS Articles First, Kovsidex, SA Cat and FS Worldcat, ScienceDirect, UPECAT, Google searches, Dialog, Dissertation Abstracts database and the database of Emerald Publishers.

Data was also accessed from other international and national libraries by means of the inter-library loan facilities at the Nelson Mandela Metropolitan University. As far as can be ascertained, no similar research study has been previously undertaken in South Africa which focuses on the moderating factors of the causes and effects of construction delays.

1.7.2 Primary research

The secondary research was used to build a comprehensive theoretical framework indicating the role of management in the causes, effects and incidence of construction project delays. A positivistic research paradigm was adopted and the theoretical framework was tested by means of a large-scale empirical study.

1.7.2.1 Study sample

In quantitative studies a representative or good sample is one in which the results obtained for the sample can be taken to be true for the whole population, in other words, the researcher will be able to generalise from the results. For this reason, and because of the need to conduct statistical analyses, a quantitative approach needs to be used with large samples (Hoy, 2010:51). As a result of the sampling technique and procedure implemented, the sample size for this study was 150 units.

In this study, the non-probability sampling technique known as criterion-related sampling was used to select respondents. To be included in the sample, the respondents had to meet specific criteria. In the case of this study, the contractors needed to be a CIDB grade 7 contractor or higher. This meant that the contractor's tender range was above R6 500 000. A contractor exposed to larger projects would experience construction delays and effects in a different manner to a contractor who is of a lower CIDB grade. For example, a higher CIDB grade contractor, amongst others, has a higher value of resources and their client base is different (larger projects).

1.7.2.2 Research Instruments

The framework developed to investigate the role of management in the causes, effects and incidence of construction project delays, served as basis to develop the questionnaire. As relationships in this framework needed to be tested, the five constructs, namely, demographics, management factors, factors causing delays, effect of delays and incidence of delays had to be included in the measuring instrument

The measuring instrument used in this study consisted of a covering letter and four sections (see Annexures A & B). In the cover letter, an explanation of the purpose of the study and the type of information requested was provided. The cover letter also included a promise of confidentiality and instructions on how to complete and return the questionnaire. The survey was conducted by a research solutions business.

Section 1 of the questionnaire requested demographic information relating to both the respondents and the contactor businesses. The demographic information requested from the respondent included his/her gender, age and education level. The information requested that related to the contractor business included the CIDB grade of the contractor and their BBBEE status.

Section 2 of the questionnaire consisted of five-point Likert-type questions investigating the causes of delays in construction. Section 3 of the questionnaires also consisted of the five-point Likert-type questions on the effects of delays in construction and also the incidence of construction delays. Section 4 of the questionnaire related to questions concerning management in construction and also consisted of five-point Likert-type questions. Questions were derived from literature.

To establish whether the measuring instrument was usable and valid, a pilot study was conducted. The researcher approached 20 contractors to complete the questionnaire. During this process of getting contractors to complete the questionnaires, the researcher realised the time-consuming process of getting one questionnaire completed. It was then decided to rather approach a research business to assist in collecting the data.

1.7.2.3 Data collection

Data collection entails fieldwork. A researcher can use their own organisation or a survey agency to collect data (Malhotra, 2010:286). Data collection for this research project was outsourced to a survey company with extensive experience in obtaining data from building contractors in South Africa.

The business collecting the data was instructed to ensure a sample return of 150 questionnaires. Only 133 questionnaires were useable and included in the study. Data was collected by the company using an electronic survey.

1.7.2.4 Ethical considerations

Ethics are broad-based principles and rules of conduct that guide social scientists when doing their research (Maduku, 2013:87). Many ethical issues apply to survey research, such as the respondents right to privacy, the use of deception, the respondents right to be informed about the purpose of the research, the need for confidentiality, the need for honesty in collecting data, and the need for objectivity in reporting data (Sekaran & Bougie, 2013:162; Zikmund, Babin, Carr & Griffen 2010).

In dealing with ethical issues, Sekaran and Bougie (2013:162) suggested that researchers adhere to the following principals:

- Information given by respondents should be treated strictly confidentially, and guarding the privacy of the respondent should be the primary responsibility of the researcher.
- Personal, sensitive, and intrusive information should not be solicited from respondents. If it is crucially necessary to do so, researchers should display the highest degree of sensitivity to the respondent when seeking such information, and should offer specific reasons for seeking it.
- Regardless of the data collection method to be pursued, the self-esteem and self-respect of the respondents should never be violated.
- No potential respondent should be forced to respond to a survey; and if a potential respondent does not want to participate in the study, his/her wish should be respected.
- There should be absolutely no misrepresentation or distortion in reporting data collected during the study.

Consistent with the preceding principles on research ethics, addressing ethical concerns was central to the planning and implementation of this research. The researcher addressed these concerns by taking the following steps:

- Each questionnaire contained a cover letter explaining the purpose of the study; this letter also indicated that responses would be treated confidentially.
- Participants were recruited of their own free will, and were free to withdraw at any time during the data collection process.
- Contact details of the researcher and supervisor were given in the cover letter in case respondents had any questions about the study or ethical concerns.

1.7.2.5 Data analysis

The statistical methods adopted in the quantitative survey included descriptive statistics, factor analysis, Analysis of Variance (ANOVA) and multivariate regression analysis. Tests were also be performed to measure the reliability of the study. Table 1.4 outlines the research process followed in the study.

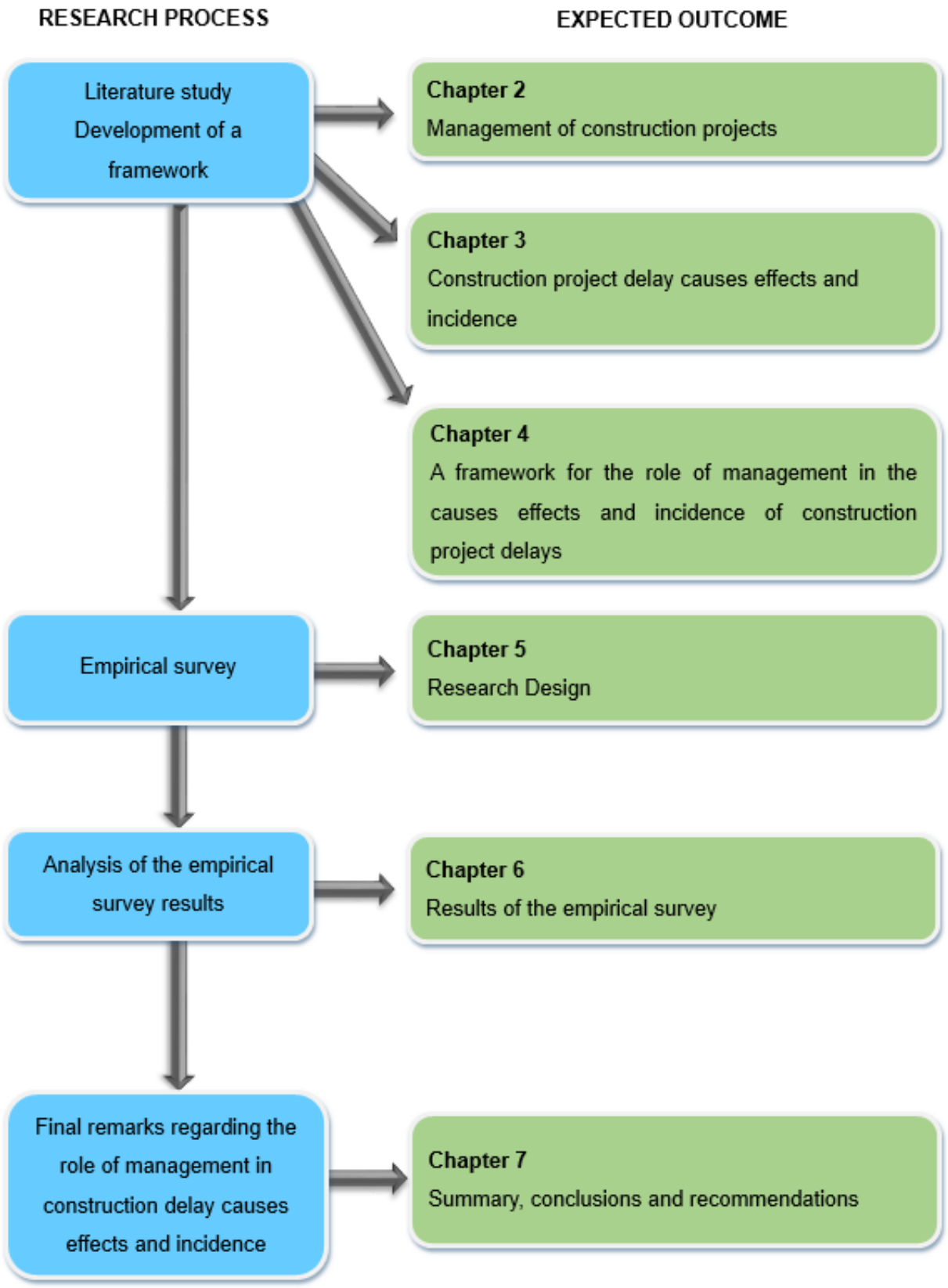
Table 1.4: Research process used in the study

Step	Description
Step 1: Select the sample	Criterion-related sample – respondents needed to be of specific CIDB grade to be included in the study. The sample size was 150
Step 2: Develop the research instrument	Questionnaire consisted of four sections. Section 1 of the questionnaire requested demographic information relating to both the respondents and the contactor businesses. Section 2 of the questionnaire consisted of five-point Likert-type questions investigating the causes of delays in construction. Section 3 of the questionnaire also consisted of the five-point Likert-type questions on the effects of delays in construction and also the incidence of construction delays. Section 4 of the questionnaire related to questions concerning management. A pilot study was conducted to ensure the measuring instrument was valid.
Step 3: Data collection	Data collection for this research project was outsourced to a survey company with extensive experience in obtaining data from building contractors in South Africa.

Step	Description
Step 4: Ethical considerations	Addressing ethical concerns was central to the planning and implementation of this research. The researcher addressed these concerns by taking the following steps: • Each questionnaire contained a cover letter explaining the purpose of the study; this letter also indicated that responses would be treated confidentially. • Participants were recruited of their own free will, and were free to withdraw at any time during the data collection process. • Contact details of the researcher and supervisor were given in the cover letter in case respondents had any questions about the study or ethical concerns.
Step 5: Data analysis	The statistical methods adopted in the quantitative survey included descriptive statistics, factor analysis, Analysis of Variance (ANOVA) and multivariate regression analysis. Tests were also performed to measure the reliability of the study.

Source: Researcher's own compilation

A summary of the conceptual framework of the research process in this study is provided in Figure1.2.



Source: Researcher's own compilation

Figure 1.2: Conceptual framework of the research process

1.8 SCOPE OF THE STUDY

The study only included South African Construction business owners registered at the Construction Industry Development Board who dealt with contracts in excess of R6 500 000. The reason for this selection was to ensure that the respondent was busy with projects of substantial nature and, therefore, they would be more suitable to respond to the questionnaire.

1.9 CONTRIBUTION OF THE STUDY

The main contribution of this study was that it would investigate the role of management in the causes, effects and incidence of construction project delays. It would further provide the construction owners with guidelines and ways to deal and mitigate construction delays. The development of the framework would make a huge theoretical contribution as the managerial aspects were mostly ignored in previous literature. The framework developed in this study would be useful to construction businesses, academia in developing learning material and policy makers to understand the process. In chapter seven, a detailed discussion of the contribution of this study is provided

1.10 STRUCTURE OF THE RESEARCH

This thesis consists of seven chapters. Chapter one focuses on the introduction and background to the study, the primary objective, the secondary objectives, research questions, the initial theoretical framework and study hypotheses, brief literature overview and research design.

Chapter two presents an overview of the management of construction projects. The specific focus of the chapter is defining a construction project and clarifying the role-players. After discussing the construction industry, the functions of management in construction are outlined.

Chapter three presents an overview of construction project delays and incidence. The chapter also reviews the definitions of construction project delays, the effects of construction project delays and the incidence of construction project delays. The chapter also reviews international and South African research about construction project delay causes.

Chapter four proposes a theoretical framework that explains the management of construction project relationships, the causes of construction project delays, the effects and incidences of construction project delays. The chapter further clarifies the components in this framework.

Chapter five discusses the research design used in the study. It also provides a description of the population, the selected sample, the research instruments and procedure used to collect data as well as an overview of the data analysis methods employed to analyse the data.

Chapter six presents and discusses the results of empirical survey. This chapter is structured according to the objectives and hypotheses of the study.

Chapter seven is the final chapter of the study. It contains a summary of the results, the conclusions drawn from the study, and recommendations based on the study.

Table 1.5 shows how the research objectives relate to the research questions and the related chapter that addresses this.

Table 1.5: Research questions and objectives and chapter of the study

Research Question	Research objective	Chapter
Which factors are the main causes of construction project delays?	To describe the factors that cause construction project delays	Chapter three
What are the primary effects of construction delays?	To examine the effects of construction project delays	Chapter three
What are the incidence (frequency and duration) of construction delays?	To investigate the incidence of construction delays	Chapter three
Which management activities can predict the causes, effects and incidence of construction delays?	To identify management activities that may predict the causes, effects and incidence of construction project delays	Chapter two
What framework can show the role of management in predicting the causes, effects and incidence of construction project delays?	To develop a framework showing the role of management in predicting the causes, effects and incidence of construction project delays	Chapter four
What is the appropriate research design for the study?	To describe the appropriate research design for the study	Chapter five

Research Question	Research objective	Chapter
Can this framework be tested empirically?	To empirically test the framework so as to propose managerial activities that may predict the causes, effects and incidence of construction delays	Chapter six

Source: Researcher's own compilation

1.11 SUMMARY

This chapter presented the introduction and background of the research. The research problem statements, purpose of the study as well as the research objectives were briefly explained. Research questions were provided to give direction to the course of the study. A literature review of the main concepts central to the study, namely, management in construction projects as well as the delays and incidence of construction projects was given. A proposed theoretical framework with research hypotheses was designed, followed by a brief description of the scope and demarcation of the study. A brief overview of the research design was presented and, lastly, the content of subsequent chapters was explained. In chapter two the management of construction projects will be expanded on.

CHAPTER TWO

MANAGEMENT OF CONSTRUCTION PROJECTS

2.1 INTRODUCTION

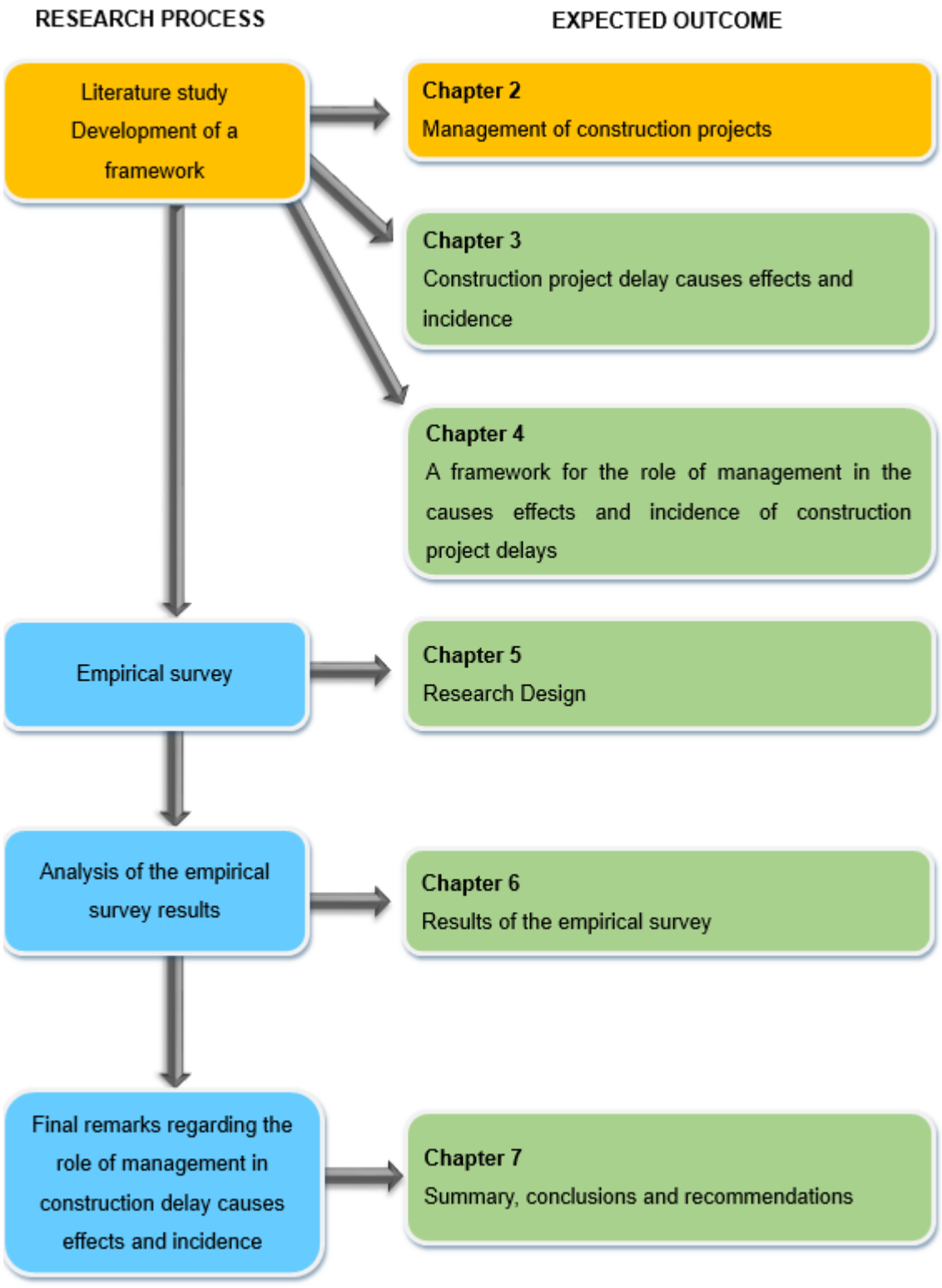
The primary objective of this study is to determine the role of management in the causes, effects and incidence of construction project delays. It is thus important to understand management in construction projects. Performance in the construction industry has long been regarded as unsatisfactory (SA construction, 2016). Despite a number of reviews and policy initiatives to produce productivity, quality and competitiveness gains, the industry could not produce the desired results. Organisation and management in the construction industry, both in their practical and research aspects, have been undergoing rapid changes over the last decade.

Management theory evolves with a continuous stream of ideas that come from attempts to transform theory into practice and vice versa. A review of existing management literature reveals that most of the literature is written entirely from a Western perspective without any references to practices in Africa. In the construction market of Africa, contractors from the West need to pay special attention to African management practices.

In this chapter, a construction project is first defined, then the construction industry is discussed in the South African and international contexts. This is followed by an explanation of previous construction research and then functions of managers in construction are outlined. To conclude, managerial functions and competencies are discussed.

2.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 2.1 is a reproduction of Figure 1.2 and illustrates the positioning of chapter two within the research process.



Source: Researcher's own compilation

Figure 2.1: Conceptual framework of the research process

2.3 DEFINING A CONSTRUCTION PROJECT AND CLARIFYING ROLE PLAYERS

The Project Management Body of Knowledge (PMBOK, 2000) defines a project as a temporary endeavour undertaken to create a unique product of service. A temporary endeavour has a definite beginning and a definite end. Unique, on the other hand, indicates that it can be distinguished from other products in some way.

All projects are unique in respect of their content and scope, but there are certain inherent risks that pertain to them all, and unexpected changes can occur with any project (Motaleb & Kishk, 2014)

According to various authors (PMI, 2008; Lewis, 2007), a project can be defined as a unique effort or undertaking with well-defined starting and ending dates. It aims at meeting predefined objectives related to schedules, costs and specifications. This is achieved through a set of non-repetitive activities, following a plan and requiring specific resources.

Project management involves the use of several processes to optimise resources and methods, based on an integrated system of actions designed to achieve specific objectives (TSO, 2009). The use of project management tools has been spreading throughout the industrial and services sectors, and is used by more and more companies in all fields, including the construction sector (Kerzner, 2009).

Asce, Abdel-Monem, Saad and Rashedi (2013) state that construction projects are complex and involve different parties with different needs. To enable the successful completion of a construction project requires the analysis of challenging situations.

Nguyen, Ogunlana and Lan (2004) see a successful construction project as completed on time, within budget and according to specifications and stakeholder satisfaction.

This study uses the definition by the Social Housing Foundation (2006) who see construction as the conversion of resource inputs into defined functioning outputs by means of a managed process. To understand the role players in a construction project, it is first important to understand the construction project process.

2.3.1 Construction project process

Method 123 (2003) indicates that a project consists of four phases, namely:

a) Project initiation

The business case that provides various solutions options are defined. A feasibility study is then conducted and a final recommended solution is proposed. The terms of reference is then completed, which outlines the objectives, scope and structure of the new project. Finally, a project manager is appointed.

b) Project planning

This phase involve the determination of the project plan, resource plan, financial plan, quality plan, risk plan, acceptance plan, communications plan and procurement plan. A project team is normally appointed during this phase. This project team involves various role players.

c) Project execution

This phase involves the execution of each activity listed in the project plan by the project team.

d) Project closure

This involves final delivery to the customer and final closure of the project to all stakeholders.

2.3.2 Role players in a construction project

The purpose of construction project management is to control a construction *project's* time, cost and quality. The duties and responsibilities for a construction project manager include those from hiring the contractors to responding to citizen calls concerning the project's compliance with zoning laws. Project managers oversee all elements of a project, which could include manufacturing, construction and marketing. In a large business, one might have a multiphase construction project. The project manager would oversee the administrative needs of the project, including funding, but would have an on-site contractor executing the project. The project manager becomes the "face" of the project. On the other hand, the contractor directly overseas the day-

to-day construction activities, whereas the project manager overseas the contractor activities (Method123, 2003).

The main difference between the roles of project manager and contractor is the level of authority. The project manager has more authority and responsibility than the contractor and overseas a project from inception to completion.

The contractors, on the other hand, are responsible to execute the scope of works defined in the contract and appoint their own construction managers. Although there are many other role-players such as consultants (architects, engineers, quantity surveyors) these are not discussed as they will not be researched in this study.

2.4 PREVIOUS RESEARCH ON CONSTRUCTION BUSINESSES AND MANAGEMENT

Egbu (1999) concluded in his study that of the 75 management skill types and knowledge, the six most important are leadership, communication (oral/written), motivation of others, health and safety, decision-making, forecasting and planning.

In research conducted by Pheng and Keong (1999), they used 16 strategies and applied it to the construction industry. Pheng and Keong (1999) concluded that not all the strategic fundamentals were applicable to the construction industry.

Homer's (2001) value skills is vitally important in any business. According to Homer (2001), if people can manage their skills, they can manage their business. It is further indicated that people skills are probably the most important foundation for any business.

Leadership styles of managers in construction projects were investigated by Bossink (2004). To explore the effectiveness of the four leadership styles in innovative construction projects, four comparable construction projects with the aim to innovate in the field of ecology were observed, are described and analysed. Bossink's (2004) research concluded that a manager's consistent performance of a leadership style, *with* an effort of the manager to eliminate the ecological information, knowledge and competence deficiency of the construction project, has a *positive* effect on the ecological innovativeness of the project. In addition, a manager's consistent

performance of a leadership style, *without* an effort of the manager to eliminate the ecological information, knowledge and competence deficiency of the construction project, has *no positive effect* on the ecological innovativeness of the project.

Cheleshe and Haupt (2007) conducted research in South Africa where 37 skills and attributes of construction graduates were evaluated by academic staff and industry. The results showed that “Trust and Honesty” were ranked as the most important skills and attributes expected of construction graduates by both the industry and academics. The “acceptance of responsibility”, “time management” and “worker safety and health awareness” followed in order. The “ability to conduct research” was considered insignificant by the industry group in this study, and it was ranked 37th in order of importance.

Hashim and Chileshe (2012) explored the major challenges to managing multiple project environments in Australia. The views from Australian project management practitioners indicated that “commitment and responsibility”, “leading projects”, “planning”, and “conflict and communication” were perceived as the four challenges of most importance. Furthermore, the 22 challenges could be classified into 11 sub-groupings, namely, project management processes, competencies of project managers, project assignments, human resource allocation, resource availability, organisational culture, problem-solving, competition among projects, information sharing, management of a single project and project location.

Mahamid’s (2012: 278) research identified 14 factors that are reasons for project business failure, namely:

- Project management techniques
- Replacement of key personnel
- Labour productivity and improvement
- Documentation system use
- Fraud
- Incompetent consultation
- Procurement practices
- Lack of managerial development as the company grows
- One man rule

- Owner involvement in the construction phase
- Increasing size of projects
- Internal company problems
- Company organisation
- Commitment

Asche, *et al.* (2013) conducted research among construction students to track the skills they acquired during a project exercise. The hands-on exercise was introduced to enhance student construction skills through active learning. Focus was on the construction planning and construction documents, tracking construction progress, finishing the project on time, using computerised tools, reducing construction waste and preparing final reports.

Motaleb and Kishk (2014) developed a framework for construction project success in the United Arab Emirates (UAE). They identified 15 key success factors related to mitigation measures in construction projects in the UAE. They concluded that there had been some large disagreements between construction project stakeholders in the UAE, and problems in achieving a fair resolution in respect of incomplete/on-hold projects/delayed projects still persisted.

Kärnä and Junnonen (2016) indicated that construction businesses were rethinking their business and project processes under growing competitive pressure. Many initiatives aimed at improving productivity, quality and client satisfaction require information on operational and industrial performance. Construction projects should be considered as a process where all customers must be satisfied. These customers include internal customers (employees, units, departments within an organisation) and external customers (owner, designer and contractor). To achieve sustained success, an organisation needs to develop and improve their people, partnerships and processes to deliver value-adding products to their external customers.

CMG3 (2016) discussed the many sources of risk in a construction project, which may be categorised as follows:

- Client - client delays payment or does not pay for work done
- Commercial - tendered amount is insufficient to cover costs
- Community - community is opposed to the project

- Construction - heavy rains delay the construction programme
- Contractual - inflation adjustments provided for in the contract are insufficient to cover the real cost of inflation
- Environmental - raw sewerage spills into the water course
- Financial - bank will not provide sufficient bridging finance
- Labour - labour strikes during the project
- Market - tender is awarded to another contractor owing to high levels of competition in the market
- Natural - site is susceptible to flooding
- Occupational health and safety - worker is killed during construction
- Quality - labour is insufficiently skilled to achieve required quality
- Safety - criminal acts and acts of vandalism occur
- Transport - vehicles cannot access the site in the raining season

Terouhid and Ries (2016) aimed to find out how construction organisations can achieve excellence and enhance excellence through knowledge and workforce management. Based on the outcomes of the model, human resource development and training is the most important enabling factor that enhances organisational capabilities. Both workforce management and knowledge management are key components of people capability, and they play crucial roles in the performance of construction firms, and there is a high degree of dependence on these two components.

Human resource development and training affect all capability areas and are key to the effective implementation of capability building programs.

Terouhid and Ries's (2016) study (developed a framework to demonstrate how modelling can be used to investigate the dynamics of knowledge and workforce management as they relate to organisational excellence. It was shown how the EFQM model of excellence can be used as a starting point for the modelling of organisational capabilities. It further shows that the system dynamics model consists of a structure, a set of components, variables, relations and feedback loops that adequately model important factors as well as their interdependencies that shape the performance of construction organisations. This model can be used as a decision support tool to

investigate the dynamics of organisational excellence for construction firms. In other words, it can be used as an aid in evaluating organisational capabilities and their potential impacts on the performance of construction organisations. Table 2.1 summarises the development of previous research in construction management.

Table 2.1: Summary of previous research in construction management

AUTHOR	MAIN RESEARCH FOCUS
Egbu (1999)	Identified 75 types of management skill and knowledge, the six most important were leadership, communication (oral/written), motivation of others, health and safety, decision-making, forecasting and planning
Pheng and Keong (1999)	Applied 16 strategies from Zhuge Liang's art of management to the construction industry
Homer (2001)	Identified that skills are vitally important in any business
Bossink (2004)	Explored the effectiveness of four leadership styles in innovative construction projects
Cheleshe and Haupt 2007	Evaluated 37 skills and attributes of construction management graduates by academic staff and industry. Trust and honesty were the most important attributes
Toor and Ogunlana (2009)	Construction professional perceptions of critical success factors for large-scale construction projects
Hashim and Chileshe (2012)	Explored the major challenges to managing multiple project environments
Mahamid (2012)	Identified 14 factors that were reasons for project business failure
Asche, *et al.* (2013)	Tracked the skills of construction students during a project exercise
Motaleb and Kishk (2014)	Developed a framework for construction project success
Kärnä and Junnonen (2016)	Found that construction businesses were rethinking their business and project processes under growing competitive pressure
CMG3 (2016) discussed the many sources of risk	Discussed 14 sources of risk such as client, contractual, labour and others

AUTHOR	MAIN RESEARCH FOCUS
Terouhid and Ries (2016)	Researched how construction businesses can achieve excellence and enhance excellence through knowledge and workforce management

Source: Researcher's own compilation

2.5 THE CONSTRUCTION INDUSTRY

The construction industry in the 21st century has become so diversified and unique that is has ultimately created an environment for continuous co-operation and expertise from each party involved. Construction projects within the industry have also become more complex, and client expectation is that of bigger and better, but to be completed in a fraction of the time that similar projects had previously been completed.

Gustavsson and Gohary (2012) pointed out that most activities in the construction industry are organised in projects, for example, as temporary undertakings, including a vast number of different stakeholders and professions. It is thus a major challenge for the construction industry to integrate stakeholders and professions (Winch, 2010). Besides this challenge, it is also difficult to integrate the early design process with the later production process into one construction project process, and take an overall perspective, from initiation of a specific project to handing over the building (Winch, 2010).

The construction industry that is to a large extent project-based, has a reputation of poor quality, bad service and a history of broken promises (Wood, McDermott & Swan, 2002). These issues, which are result of lack of co-operation, lack of trust, ineffective communication and adversarial relationships between stakeholders (Kadefors, 2004) require attention.

Ofari (2015) states that the construction industry is not well understood. There is no common definition, and there are even arguments about whether it is an industry or a sector that comprises many industries. The contribution of the construction industry to economic growth and long-term national development is widely-acknowledged, highlighting its importance, particularly to developing countries such as South Africa.

The literature shows that the construction industry is an important sector of the economy and plays a key role in national social and economic development (Lopes, 2011). However, the construction industry has peculiar features that need to be understood if it is to be able to perform effectively and efficiently.

In addition, the construction industry has been described as dirty, difficult, and dangerous (International Labour Organization, 2001), and is also viewed as a high-risk industry. Labour shortages occur when employment has nearly reached its full capacity and employers face a difficulty in finding suitable workers to fill available vacancies.

Skill shortages occur when there are an insufficient number of workers with the required qualifications, skills or experience necessary to carry out a particular job.

2.5.1 Construction industry in the global context

This section discusses the construction industry in the global context.

2.5.1.1 Construction industry in Europe

The construction industry is vital for the development of any nation and the physical development of construction projects such as buildings, roads, and bridges is the measure of their economic growth. According to Ye, Hassan, Carter and Kemp (2009), the construction industry is one of the most significant industrial contributors to the European economy in terms of gross product and employment.

2.5.1.2 Construction Industry in Hong Kong

Although many initiatives have been taken, the Hong Kong's construction industry is still experiencing difficulties in recruiting skilled workers. Hong Kong's construction industry is facing the issues of an aging workforce, shortage of young skilled workers and skills mismatch. Although the government and industry's stakeholders have taken many initiatives to tackle this labour problem, the industry continues to experience difficulties in recruiting local skilled workers (Ho, 2016).

2.5.1.3 Construction industry in Malaysia

The construction industry in Malaysia plays a major role in generating wealth through a constant growth in GDP contribution and influenced in the development of social economic infrastructures and buildings. Malaysia has provided job opportunities for almost 1.03 million people which represented 8% of total workforce. The industry growth at the rate of 5.3% and contributed for almost 6% of the country's GDP in 2008. Estimation demand for construction is projected at RM 280 billion in the average of RM 56 billion per year. The projection based on estimation of RM 180 billion of government funded projects, RM 140 billion of private funded and RM 20 billion Public Finance Initiatives (PFI) in this stipulated time frame (Idris, Ismail & Hashim, 2015).

2.5.1.4 Construction industry in Australia

Turner and Mariani (2015) indicate that the construction industry is one of the largest industries in Australia. In 2015, 1.05 million people were employed in the construction industry, representing 9% of the total workforce (Australian Bureau of Statistics, 2015). However, the construction industry is a male-dominated industry with males making up 88.8% of the workforce compared with 54.1% across other industries (Department of Employment, 2015), whereby a discriminatory "macho" culture commonly operates (Ness & Green, 2012). In relation to the male-dominated culture, traditional work patterns remain prevalent in the industry whereby male time is allocated to work and female time is allocated to managing the home and family.

2.5.1.5 Construction industry in United Arab Emirates

Risk are an important issue within the United Arab Emirates (UAE) since the costs associated with delays in construction projects have reached $767 billion, and 60% of such projects are on hold as a result of the recession that began in 2008-2009 (Motaleb & Kishk, 2014). The area of risk response is still neglected and this is a situation that should be redeemed since reduction, protection, contingency, acceptance and transfer types are all known to affect the overall strategy of the project, albeit in limited areas of risk.

There have been some large disagreements between construction project stakeholders in the UAE, and problems in achieving a fair resolution in respect of

incomplete / on-hold projects / delayed projects, which still persist. In an effort to address this problem, Motaleb and Kishk (2014) have carried out an investigation into the use of the participative methodology in a new community, to add knowledge of how to embody the ideas, perspectives, prejudices, language, culture and practices of that community. There has been benefit deriving from this investigation, despite the fact that the developing ideas contradicted professionals in the discipline. This has assisted in the development of best recommendations associated with the problem.

2.5.1.6 Construction industry in Portugal

The construction industry plays a very important role in the Portuguese economy. In 2009, it was among the top five economic sectors, representing 13% of total employment (Ribeiro, Paiva, Varajoa & Dominquez, 2013). Nevertheless, project failures are still frequent mainly owing to inadequate management practices and to the intrinsic characteristics of projects of the construction industry. Even though Portuguese construction has improved, cost and schedule overruns, low productivity and final product quality problems are still common. Construction companies need to constantly adapt to new/market requirements, increase competition and technological innovation. However, construction has an inherent set of characteristics which makes the implementation of efficient management systems more difficult.

2.5.1.7 Construction industry in Nigeria, Africa

Oladokun, Adelakun and Ashimolowo (2016) state that construction in developing countries tend to attract high risks owing to various uncertainties and unrest which affect the industry negatively. In a bid to curtail the havoc caused by various uncertainties and unrest which affects the industry negatively, proper risk management is essential. In order to properly manage the risk, it should be noted that construction activities require conformity with many laws, codes and regulations as well as coordinating with multiple parties such as clients, contractors, subcontractors, different consultants, planning authorities and, in some cases, the end users of the project or where necessary, the general public among others. The stakeholders often have different conflicting goals and conflicting risk attitude towards the project. This suggests that construction activities are indeed risk prone activities and, as a result, require the attention of all parties and stakeholders in the construction industry

2.5.2 South African construction industry

Selected indicators in the CIDB (2015) report shows that in South Africa:

- Clients were neutral or dissatisfied with the performance of contractors on 18% of the projects surveyed in 2015, which reflects a noticeable increase in dissatisfaction over the period 2013 to 2015.
- Around 13% of the projects surveyed had levels of defects which are regarded as inappropriate, which reflects a noticeable increase in levels of defects over the period 2012 to 2015.
- Contractors were neutral or dissatisfied with the performance of clients on 18% of the projects surveyed.
- Contractors were neutral or dissatisfied with the quality of tender documents and specifications obtained from clients on around 17% of the projects surveyed.
- Contractors were neutral or dissatisfied with the management of variation orders on 24% of the projects surveyed.
- 60% of payments to contractors were delayed for longer than 30 days after invoicing. This reflects a noticeable deterioration in prompt payment practices over the period 2012 to 2015.
- Quality (or functionality) was not taken into account in the adjudication on around 12% of tenders evaluated.
- Recommendations of the tender committee were overruled in the award of around 9% of public sector projects, with overruling of tender recommendations highest in the North West and the Eastern Cape.
- Profitability of contractors on projects increased over the period 2013 to 2015, with profit margins of greater than 10% being achieved on 43% of the projects survey in 2015.
- Safety on building and construction sites as well as transportation to the sites remains a concern.
- Client satisfaction is a key factor in determining client loyalty and repeat business in the private sector. Quality is also increasingly being taken into account in the tender adjudication process in the public sector.
- While the overall results for 2015 client satisfaction are encouraging, clients remain neutral or dissatisfied with the performance of the client's agents and contractors on around 18% of projects surveyed. Significantly, client

dissatisfaction with the performance of contractors reflects a noticeable increase over the period 2013 to 2015.

- Contractors were neutral or dissatisfied with the performance of the client on 18% of the projects surveyed. This dissatisfaction of contractors with the performance of the client is reflected in dissatisfaction with the quality of documentation and the management of variation orders.
- 60% of payments to contractors were delayed for longer than 30 days after invoicing, which reflects a noticeable deterioration in prompt payment practices over the period 2012 to 2015. 52% of payments to the client's agent were delayed for longer than 30 days after invoicing.
- Profitability of contractors on projects increased over the period 2013 to 2015, with profit margins of greater than 10% being achieved on 43% of the projects survey in 2015.

The CIDB (2011a) highlighted two potential areas of concern impacting on construction quality in South Africa, namely:

- Indications of a deteriorating capacity necessary to develop and maintain technical standards, codes and specifications
- Quality of client documentation on larger projects in particular appears to be negatively impacting on construction quality, and concerns are being raised that the quality of client documentation could deteriorate further in the future

The CIDB (2011a) reported on an empirical study undertaken in 2005 that indicated significant areas of concern developing with regard to ethical standards practiced within the South African construction industry. The range of ethical problems identified include collusion, bribery, negligence, fraud, dishonesty and unfair practices of which significant parts of the issues resided with contractors among other identified participants in the construction process. It is notable that architects (100%), quantity surveyors (94%), consulting engineers (67%), and contractors (60%) all stated that they had observed/experienced professional negligence in South African construction with poor material quality and poor workmanship indicated as the most frequent professional negligence.

The report (CIDB, 2011b) further mentioned that corruption in the construction industry in South Africa was further identified as being a growing and major concern, which was ranked as one of the most significant barriers to the attainment of quality in construction by contractors and project managers. Corruption, however, does not necessarily result in the paying of financial bribes, but also often takes the form of political interference in the tender process, or cronyism and nepotism. Such political interference is also of growing concern in the construction industry, and frequently results in the appointment of contractors that do not have the necessary abilities to deliver the required quality.

While the issues of poor construction quality can be identified across all sectors, the CIDB (2011b) report has shown that poor quality of construction is most prevalent in the residential building sector, in both the public and the private residential building sectors. While South Africa has a well-developed set of technical standards that can be used to describe the standards of materials and workmanship for construction works, these technical standards are in many cases outdated. Furthermore, it is noted that there are strong indications of a deteriorating capacity necessary to develop and maintain technical standards, codes and specifications, specifically at the SABS and the CSIR, but also at some client bodies and industry associations. It is, therefore, important that this formal capability for the development and maintenance of technical standards and specifications is retained and strengthened for the future. The major contributors to poor quality of construction in South Africa are likely to be procurement related barriers. Such procurement related barriers include:

- Fraud and corruption, or ’political interference‘ (including cronyism and nepotism)
- Procurement and delivery model (such as the ’design by employer‘ model)
- Procurement systems use based on price and preference only, and not taking into account functionality (or quality)
- Insufficient information to be able to select professional services and/or contractors based on quality criteria

According to Labour and Work Conditions (2015), the construction industry is an important employer of labour in South Africa, accounting for about 8% of total formal employment and 17% of total informal employment. In addition, 70% of the labour employed in the construction industry is semi-, low- and un-skilled (Labour and Work

Conditions, 2015). However, deteriorating labour productivity, arising from labour unrest, is having a negative impact on the cost and quality of construction as well as on the livelihood and morale of the workers themselves. In this regard, construction contributed 8% to the total productivity losses across all economic sectors arising from industrial action in 2013.

Employers in the Labour and Work Conditions (2015) study reported that they paid their employees at rates higher than the legislated sectoral rates for both the civil engineering and building bargaining councils. The negative impact of the Community Liaison Officers (CLOs) and Ward Councillors were, however, identified as an issue of concern regarding wage rates and community reaction to wages.

In this regard, employers recommended that the CLOs and Ward Councillor roles and responsibilities on community projects should be more clearly-defined, and must not encroach on the contractor employment relationships with employees. It was further recommended that the definition of local labour in community projects be more clearly-defined using either geographic reach, ward boundaries, or a simple radius.

Recruitment of semi-skilled and unskilled workers is predominantly through personal contacts and other informal recruitment methods, with the most common method of recruitment by word-of-mouth. The study identified that the use of labour brokers in the industry is negligible. As the industry is project-based and employers can only provide employment when they have active projects, most of the labourers are employed on short-term duration contracts with limited tangible benefits. Further benefits are, however, provided by the bargaining councils including the Bargaining Council for the Civil Engineering Industry (BCCEI), which provides for a range of benefits including pension funds and medical aid. The knowledge of workers of these benefits is, however, likely to be limited.

The study also noted that many public sector projects contained contract participation goals (CPGs) for local socio-economic development, and that there were significant disparities in CPGs between clients. Furthermore, the study noted that CPGs often created labour problems where the CLO and Councillors used their power to buy influence in the community. This often lead to significant disruptions on site when local

communities did not allow skilled people access to the site, usually resulting in lockouts, destruction to property and criminal acts.

The study further indicated that employers provided a wide range of benefits to employees, including leave, bonuses, accommodation and transport. Employees largely expressed satisfaction with the benefits, but expressed dissatisfaction with bonus and incentives, wages and leave provision. Training and up-skilling of labour was a key factor in enhancing construction productivity, both technical know-how and soft skills. However, training and skills development of semi-skilled and unskilled workers that takes place is largely to meet the operational requirements of the contractor, and seldom results in accredited, recognised outcomes. When this is assessed in conjunction with the informal employment practices in the industry, it becomes clear that there is a need to provide standardised, accredited training to assist workers build their competence and have portable skills beyond the life of their project (Labour and Work Conditions, 2015).

There are very limited unionisation within the industry, which is attributed to the short-term nature of employment in a project-based industry. However, collective bargaining is largely a norm in the industry, under several area-specific Building Industry Bargaining Councils (BIBCs) and the Bargaining Council for the Civil Engineering Industry (BCCEI).

The most predominant type of strikes by number is unprotected strikes by non-unionised members, which can have a significant impact on the project profitability. On the other hand, the largest number of worker days lost is associated with protected strikes. Legal, union initiated strikes are usually more protracted leading to significant production delays owing to the number of man-days lost. Employers on public sector projects reported that most of their unscheduled work stoppages and labour issues were due to unrealistic community expectations, or to other community based political issues. Furthermore, discrepancies in wages between members of different unions operating together on the same construction site often lead to unprotected industrial action (Labour and Work Conditions, 2015). Table 2.2 provides a summary of the construction industry in the global and South African context.

Table 2.2: Summary of the Construction Industry

COUNTRY	DESCRIPTION OF CONSTRUCTION INDUSTRY
Europe	One of the most significant industrial contributors to the European economy in terms of gross product and employment.
Hong Kong	Hong Kong's construction industry is facing the issues of an aging workforce, shortage of young skilled workers and skills mismatch.
Malaysia	Construction industry is a major contributor in generating wealth through a constant growth in GDP. It further influence the development of social economic infrastructures and buildings.
Australia	The construction industry is one of the largest industries in Australia. It is male-dominated industry.
United Arab Emirates	Large disagreements between construction project stakeholders in the UAE, and problems in achieving a fair resolution in respect of incomplete / on-hold projects / delayed projects still persist.
Portugal	Among the top five economic sectors although frequent project failures occur.
Nigeria	Construction in developing countries tends to attract high risks owing to various uncertainties and unrest which affects the industry negatively.
South Africa	Four potential areas of concern impacting on construction quality in South Africa, namely: • indications of a deteriorating capacity necessary to develop and maintain technical standards, codes and specifications • quality of client documentation on larger projects in particular appears to be negatively impacting on construction quality • concern developing with regard to ethical standards practiced within the South African construction industry • corruption in the construction industry in South Africa growing and a major concern

Source: Researcher's own compilation

2.6 THE FUNCTIONS OF MANAGERS IN CONSTRUCTION

Managers in construction plan, organise, direct, control and evaluate the activities of a construction business or a construction project within a business, under the direction of a project manager. They are employed by residential, commercial and industrial

construction businesses and by construction departments of businesses outside the construction industry (Ontario, 2013).

Turner and Mariani (2015) identified that in comparison to managers of other disciplines, the work conditions leading to stress is significantly higher for construction project managers. The demanding project-based environment consists of longer than average work hours compared to other industries (Lingard & Francis, 2004). Professionals and managers commonly work well above their contracted work hours and unpaid overtime is the norm (Bradley, Brown, Lingard, Townsend & Bailey, 2010). Construction-based projects consist of tight project deadlines and severe financial penalties, which apply if targets are not met (Leung, Skitmore & Chan, 2007), and the construction industry is known as a high-conflict work place (Whitfield, 2012). Long working hours and work overload have been linked to stress for construction project managers. Haynes and Love (2004) found that after work hours and overload, insufficient time spent in the family and home environment was the third highest stressor for construction project managers.

Turner (2007) states that there appear to be two beliefs in the project management community. The first is that the project manager's competence makes no contribution to project success. As long as he or she uses the right tools and techniques, the project will be successful. The second is that as long as a given project manager has learnt to apply those tools and techniques well, he or she can apply them to any type of project, regardless of technology, discipline or domain.

2.7 FACTORS AFFECTING THE SUCCESS OF A CONSTRUCTION PROJECT

Projects differ in size, uniqueness and complexity, thus the criteria for measuring success vary from project to project making it unlikely that a universal set of project success criteria exist (Mir & Pinnington, 2014). Individuals and stakeholders often interpret project success in different ways and viewpoints about performance also vary across industries. They further assert that perceptions of success and the relative importance of success dimensions differ 'by individual personality, nationality, project type, and contract type'.

The Social Housing Foundation (2006) found that the following factors determine success in construction:

- Organising and leadership ability of those in charge project manager, construction manager, site agent)
- Planning and allocation of adequate resources at the right times
- Maintaining accuracy and timely availability of professional documentation and guidance
- Providing field experience
- Planning
- Ensuring realistic programming of the work, regular monitoring of progress, and corrective action (including re-programming, additional resource allocation) when deviation occurs
- Providing timely ordering of materials and labour
- Having the ability to motivate the trades
- Ensuring effective co-ordination of trades
- Insisting on quality
- Maintaining good labour relations
- Coping with unforeseeable factors (for example, inclement weather, shortage of materials)
- Meeting critical deadlines
- Satisfying the local authority inspectors and the NHBRC
- Supporting the developer/employer and the professional team

In research conducted by Mir and Pinnington (2014), key performance indicators was observed to be the most significant individual variable contributing towards the success of any project. This is evidence for the necessity of performance measurement in an organisation to enhance project success. This research further concluded that the staff variable also had an important role in achieving success in projects. Businesses must thus ensure that project-related training is imparted to staff. The Mir and Pinnington's (2014) study also showed that some macro-managed components of an organisation's governance framework influence project success, but these were usually ranked lower in terms of influencing project success owing to perhaps these components being less visible to the project staff.

In modern construction projects there are significant challenges for both clients and contractors to deliver the project successfully owing to increasing complexity in design and the involvement of a multitude of stakeholders (Doloi, 2009). In addition to this complexity of construction projects, defining project success itself is a complex issue (Toor & Ogunlana, 2010). Alzahrani and Emsley (2013) reported that the concept of project success is developed to set criteria and standards to aid project participants to complete projects with the most desirable outcomes. There is considerable debate in project management research practice about what determines project success. While the topic has been discussed for a long period of time, an agreement has not been reached. In addition, when it comes to a definition of project success, there is no single list that is totally comprehensive. However, the concept of critical success factors (CSFs) presents a smarter way to identify certain factors, which when present or absent in a project are likely to make the project successful. These critical success factors (CSFs) include:

a) Financial attributes
    - Turn over history
    - Credit history
    - Bonding capacity
    - Cash flow forecast

b) Management attributes
    - Staff qualification
    - Management capability
    - Site organisation
    - Documentation

c) Technical attributes
    - Contractor's IT knowledge
    - Knowledge of particular construction method
    - Work programming
    - Experience of technical personnel

d) Past experience attribute
    - Type of past project completed

- Size of past project completed
- Length of time in business
- Experience in the region

e) Past performance attributes
- Failure to have completed a contract
- Contract time overruns
- Contract cost overruns
- Past record of conflict and disputes

f) Organisation attributes
- Size of the company
- Company image
- Age in business
- Litigation tendency

g) Environmental attributes
- Waste disposal during construction
- Environmental plan during construction
- Materials and substances used in the project

h) Health and safety attributes
- Health and safety records
- Occupational safety and health administration rate (OSHAIR)
- Experience modification rating (EMR)

i) Quality attributes
- Quality control
- Quality policy
- Quality assurance

j) Resources attributes
- Adequacy of labour resources
- Adequacy of plant resources

Construction projects and their success are closely-related to contractors. They start their main duties when the project reaches the construction or execution stage where the actual work of the project is accomplished. In addition, identifying what went right and what went wrong in a post construction evaluation before moving to the next project, proved to be a valuable exercise in construction projects.

Abd-Hamid, Azizan and Sorooshian (2015) found that success and survival were the foremost-targeted objectives for all businesses including construction enterprise. To gain success and survive, construction businesses must continually improve their performance. One way that they can sustain competition in this industry is to identify their success factors. This may have a direct impact on business success, not only in the short-term but also, the long-term. In other words, construction businesses need to balance their short-term success and their long-term success in order to succeed.

It is suggested by Abd-Hamid, *et al.* (2015) that entrepreneurial-oriented construction businesses are able to position themselves to take advantage of market opportunities. They proposed that the success and survival of a construction business can be achieved through corporate entrepreneurship. Rather than viewing construction business success from the results of executed projects, predictors for success and survival of entrepreneurs in the construction industry can be derived from entrepreneurial activities, which are implemented within an organization.

The study of Abd-Hamid, *et al.* (2015) highlights the vital dimensions of corporate entrepreneurship and suggests that entrepreneurial orientation, entrepreneurial organisation, entrepreneurial competencies and entrepreneurial environments are the keys elements to predict the success and survival of construction entrepreneurs. To succeed, a construction entrepreneurial business should focus on entrepreneurial orientation, which is enabled by appropriate entrepreneurial organisation, driven by entrepreneurial competencies, and is the foundation of the absorptive capacity of an entrepreneurial environment. No construction business success factors can be comprehensively described, nor can its complexity be adequately accounted for, unless all of its four dimensions are investigated. This is because these dimensions are the primary functions of a construction business existence, and an attempt was be made to discover how the variables from each dimension interacted with the variables from other dimensions in this study. Therefore, to succeed and survive, a construction

entrepreneurial business should focus on entrepreneurial orientation, which is enabled by an appropriate entrepreneurial organisation. It should be driven by entrepreneurial competencies and its foundation should stem from entrepreneurial environments.

2.8 MANAGING ERRORS IN CONSTRUCTION PROJECTS

Every organisation involved with the delivery of construction projects will invariably be subjected to a variety of errors that are committed by people. Errors are, therefore, almost inevitable and total elimination is a difficult task within construction. However, in an environment that is complex, dynamic and changing, such as construction, it is difficult to control all errors in advance, and the effectiveness of lean production as a mechanism for error reduction and containment is questionable. The concept of error management, however, focuses not the error itself, but avoidance of its negative consequences. Error management thus recognises that despite the considerable effort that may go into avoiding errors, they will occur, and their negative consequences are the primary threat to a project and the construction organisation (Love & Smith, 2016). However, error consequences can be avoided by engaging in an 'error process' comprising of *detection*, *explanation*, *handling* and *recovery.*

Errors are a distinct feature of construction, yet there has been a reluctance to acknowledge their existence openly. If quality and safety performance within projects is to improve, then construction businesses and their management need to openly acknowledge their presence so that learning from errors can form an integral part of an organisation's fabric. This will require the institutionalisation of error reporting and an organisational (shared) responsibility for their occurrence. However, for this to happen, issues surrounding the design and nature of the work environment may need to change to make it possible for people to learn from mistakes and to collectively avoid making the same ones in the future.

2.9 COMPETENCIES OF MANAGERS IN CONSTRUCTION

Essential personal attributes sought by employers of construction management graduates include intelligence, flexibility, adaptability and the ability to deal with uncertainty and rapid change (Chileshe & Haupt, 2007). Chileshe and Haupt (2007) further argue that these graduates need to possess critical skills to enable them to work effectively with other participants in the construction process. Contractors acquire

skills through education and training. The present pedagogic approach of co-operative education followed by universities of technology embodies the notion that both education and training are equally essential (Haupt, 2003). Construction management graduates need to possess three essential skills, namely, practical experience, management tools and techniques as well as interpersonal skills.

Several other skills such as academic achievement, acceptance of responsibility, adaptability to changing work environments, computer literacy, time management, leadership capability, numeracy, communication, problem-solving, environmental awareness, teamwork as well as trust and honesty are required.

In addition, graduates need specialist knowledge, an understanding of information and communication technologies (ICT), the ability to communicate, and problem-solving skills. Construction management practitioners need to possess a body of knowledge or expertise, hold appropriate professional qualifications, provide a service to the public and hold mutual recognition of other disciplines.

According to Bredillet, Tywoniak and Dwivedula (2015), a competent project manager is the one who possesses some attributes to fulfil her/his role and will demonstrate a certain level of performance. Defining what a competent project manager is, or what s(he) does, and its assessment is foremost an ethical matter in conjunction to professionalism. The assessment perspective is directly subject to underlying ethical questions such as should the focus be on the right action, the duty, to be performed or rather on the good or best possible outcome to be produced? Harrison (2004) aptly notes that two main approaches of normative ethics are usually considered, namely, deontology (right action, duty) and consequentialism (good or best possible outcome).

Bredillet, *et al.* (2015) identified two categories of fundamental tensions within and between assessment approaches and standards. First, ethical tensions between means and ends, that is between deontological and consequentialist approaches, namely, between duty and outcome. It focus on output competencies and considers outcome. As part of the ethical tensions, there are another conflict namely “competing duties” (for example, duty to society versus duty to client). A tension between facts and values, that is between performance-based approaches (GAPPS) rooted in practice, in what one “is” or “does”, emphasising relevance, and attribute-based

approaches (IPMA, PMI) grounded on in theory and “universal” best practices, in what one “ought to” be, or “ought to do” and highlighting rigor.

Suninidijo (2015) states that construction projects offer recurring challenges and uncertainty that test the competence of project managers. Every project is unique in many dimensions and constrained by varying requirements, which are often changed throughout the project life cycle. The construction industry is also naturally-fragmented and has a long supply chain. Within one project, numerous stakeholders, such as the client, consultants, contractors, government officials, community, labourers and project team members, may influence the project or its outcome. Therefore, project managers need to work with a large and diverse set of people despite having little direct control over many of them. Within this complex and unpredictable environment, project managers have an important role to be the hub that integrates all project components and propels them towards successful delivery of the project. A set of skills are needed for project managers to undertake such complex, but important responsibility. Studies have also been conducted to propose the essential skills of successful project managers.

Project managers have multifaceted responsibilities that significantly affect project success. Previous research has identified four skills of effective project managers, namely, conceptual, human, political, and technical skills, along with their 16 skill components (Suninidijo, 2015).

First, there is an indication that project managers should have a high level of conceptual skill and its visioning component. As conceptual skill is the ability to see a construction project as a whole and the relationship among its components, work experience should have an important role in the conceptual skill development. Such an experience enables project management personnel to learn the process of managing various project components and stakeholders.

Suninidijo (2015) further concluded that there were significant correlations between years of work experience in the construction industry and the conceptual skill components. This signifies that the higher the years of work experience of project management personnel, the higher their conceptual skill, thus indicating that

experience or learning by doing may be the most effective way to develop the conceptual skill of project managers.

Second, project managers should have a high level of transformational leadership. The dynamic and people-centred characteristics of construction projects may compel project managers to be transformational leaders who motivate and inspire others to meet project demands. Prabhakar (2005) suggested that project managers must become strong transformational role models and use a relationship-oriented approach towards their project team to achieve project success.

Project managers, thirdly, do not spend much time in developing their social networks, which may be due to the nature of construction projects. Project managers are always being chased by deadlines, providing them with limited spare time to do networking activities. On the contrary, the high level of apparent sincerity may be due to a lack of authority and positional power of project managers. As a result, they need to appear sincere in convincing and influencing others to do what needs to be done for project success.

Fourth, in terms of technical skill, the construction industry is a high-risk industry, thus it is necessary for project managers to have sufficient understanding of risk management to manage project risks throughout the lifecycle of the project.

The skill components of project managers (referring also to construction and site managers) and project performance are indicated in terms of time, cost and quality.

- Time performance

Interpersonal influence is the only skill component that has an impact on project time performance. Flexibility is a key factor in interpersonal influence as it allows project managers to adapt their behaviour to different situations to elicit the desired responses from others. Although there are some overlapping qualities, interpersonal skill is different from interpersonal influence. Where the latter is about building relationships and getting along with others, interpersonal influence is a tool to manipulate interpersonal relationships to ensure project success. Therefore, people with high interpersonal influence are not only being perceived as pleasant and productive, but

also have the ability to control their environment (Ferris, Perrewé, Anthony & Gilmore, 2005).

- Cost performance

There are four project manager skill components, namely, emotional intelligence, interpersonal skill, apparent sincerity and budgeting, which have positive relationships with project cost performance. Similar to time performance, project cost performance can also be affected by many factors, such as geographical locations, types of contract, design changes, completeness of design documents, cost control mechanisms, quality of estimates, project management and the external environmental factors. The influence of these factors may cause project budget to be revised over time, thus requiring regular communication to accommodate the expectations of all the stakeholders affected (Memon, Rahman, Abdullah & Azis, 2014; Meng, 2012). This explains the need for project managers to exercise their interpersonal skill to facilitate effective and continuous communication among project stakeholders. Furthermore, Sunindijo and Zou (2013) found that emotional intelligence is a foundation that supports the manifestation of interpersonal skill, which allows project managers to be effective in relationship management. This demonstrates the importance of emotional intelligence and interpersonal skill for project managers to improve project cost performance.

Another important skill component is apparent sincerity, which is needed to create favourable impressions so that others perceive that there are no concealed motives behind any behaviour exhibited (Ferris, *et al*. 2005). Such perception is crucial in negotiation scenarios involving a sensitive issue such as costs, especially considering the fragmented nature of the construction industry where different parties are compelled to work together in a project, but often have differing agendas and expectations. Meng (2012) argues that a no-blame culture is essential for reducing cost overruns in the typical confrontational nature of construction projects. Apparent sincerity, therefore, allows project managers to exert influence in a way that does not create ill-will or undue influence, thus others do not question their motives nor react negatively (Ferris, *et al.* 2005).

Despite the important *soft* skill components, successful project cost performance also depends on the budgeting skill of project managers. Without this skill, project managers would not be able to evaluate the impacts of alternative solutions on project costs, thus hindering their effectiveness to be effective negotiators and decision makers.

- Quality performance

Human skills, consisting of emotional intelligence, interpersonal skill and transformational leadership, is a major factor that influences project quality performance (Sunindijo, 2015). Emotional intelligence is useful in communication, conflict management and team work, which are common interpersonal issues in construction projects (Goleman, 2001). In turn, effective interpersonal interactions are a precursor of successful transformational leadership because, after all, without interactions there would be no leadership (Sunindijo & Zou, 2013). Since quality is fundamentally about delivering performance that meets or exceeds the standards, project managers should become transformational leaders who provide a strong aura of vision and contagious enthusiasm that substantially raises the confidence, aspirations and commitments of people to meet high-performance demands (Avolio & Bass, 2002; Bass & Riggio, 2006). This relationship-oriented leadership style has been considered more important for project managers than the task-oriented style (Ogunlana Siddiqui, Yisa & Olomolaiye, 2002). In addition, as in the case of time and cost performance, apparent sincerity is needed to create an impression that project managers genuinely considered quality as an important aspect in the project, while interpersonal influence is needed to convince others to do what necessary to be done to meet the desired quality. Meng (2012) found that project quality performance is influenced by trust, collaboration among parties, mutual objectives and open communication. These factors are the outcomes of positive emotional intelligence, interpersonal skill and transformational leadership (Bass & Riggio, 2006; Nixon, Harrington & Parker, 2012; Sunindijo, Hadikusumo & Ogunlana, 2007).

Visioning is another factor that affects project quality performance. This skill component allows project managers to see a project from a big picture perspective. It encourages project managers not to lose track and remain focused on meeting the required quality in all project aspects because poor performance in one aspect may

have significant consequences towards overall performance. Lack of visioning has led to many project failures owing to the inability of project managers to prioritise among competing objectives, to organise available resources and to take corrective actions to improve performance (Ogunlana, *et al.* 2002). Creating a vision and motivating change are also characteristics of effective transformational leaders (Nixon, *et al*. 2012), which further highlights its importance for improving project quality performance.

Finally, some degree of technical skill proficiency is also needed to ensure project quality performance. Quality management is understandably needed to manage the whole quality management process. Document and contract administration is important to record changes as well as their causes and impacts to ensure that all concerned parties meet the performance that is expected from them.

Sunindijo (2015) tested 16 skill components to determine their influence on improving project performance in terms of time, cost and quality. The findings show that interpersonal influence has a positive impact on project time performance, emotional intelligence, interpersonal skill, apparent sincerity and budgeting influence project cost performance as well as visioning, emotional intelligence, interpersonal skill, transformational leadership, interpersonal influence, apparent sincerity, quality management, while document and contract administration influence project quality performance. As such, project managers should focus on the development of these skills so that they are better equipped to meet project objectives.

The project management professional societies throughout the world take several different approaches to defining the competence required to manage projects. For Turner (2007), these approaches include:

a) Focus on required knowledge and skills. This is the approach taken by the Project Management Institute (PMI®, www.pmi.org), a global organisation based in North America, through its body of knowledge and certification programme (PMI®, 2004). This is an input-based approach to competence.
b) Focus on what project managers have to be able to do to manage projects, what functions they have to perform. This is the approach taken by the Association for Project Management (APM, www.apm.org.uk), the UK's

national association, through its body of knowledge and certification program (APM, 2006), and by the International Project Management Association, (IPMA, www.ipma.ch), a global federation of 36 national associations of which APM is the largest (IPMA, 2006). This is a performance-based approach to competence.

c) Focus on what project managers must deliver. This is the approach adopted in the UK by the Engineering Construction Industry Training Board (ECITB, www.ecitb.org.uk), in its National Occupational Standards for Project Management, and by the Australian Institute for Project Management (AIPM, www.aipm.com.au), in its National Competency Standards for Project Management (AIPM, 2004).

Turner (2007) further explains that competence is the ability to perform according to defined standards. Those standards can take different forms, namely:

a) Standards may be global. The PMI® Guide to the Project Management Body of Knowledge, PMBoK® (PMI®, 2004) is often presented as a global standard. The International Standards Organisation has produced a standard for Project Management, ISO 10,006 (ISO, 2004).
b) Standards may be national. The PMI® Guide to the PMBoK® (PMI®, 2004) is also an American national (ANSI) standard. In the UK, the ECITB has produced the National Occupation Standards for Project Management (ECITB, 2003) and in Australia, AIPM has produced the National Competency Framework for Project Management (AIPM, 2004).
c) Standards can be produced by professional associations. For example, the PMI® Guide to the PMBoK® (PMI®, 2004), the APM Body of Knowledge (APM, 2006) and the IPMA Competency Baseline, ICB. These can also be job descriptions produced by individual businesses for specific jobs within the organisation.

The CIDB (2011a) survey of the barriers to construction quality showed that the top 15 factors under the influence of the contractor, as viewed by contractors and by project managers, include:

- Poor site management
- Time and cost

- Skills and competence issues
- Lack of quality improvement processes
- Lack of worker participation

Similarly, internal areas that would improve construction quality that were identified by contractors and by project managers in the same study (CIDB, 2011a). These include:

- Management commitment
- Worker participation
- Design procedure
- Education and training in quality
- Quality management systems and standard operating procedures

The survey undertaken by the CIDB (2011a) on construction quality clearly highlights the importance of skills, education and training, in attaining quality. Furthermore, the acute shortages of trained artisans and first level supervisory staff impact on the demands for quality control, standard operating procedures and training. These skills shortages are further exacerbated by the aging profile of artisans in South Africa, for which the average age of the country's artisans is reportedly around 55 years old.

The study by the CIDB (2011a) showed the following attributes for successful contractors:

- Motivate their workforce to produce the correct quality of work in as short a time as possible (for example, they have high levels of productivity)
- Satisfy their customers' expectations
- Pay their suppliers on time to increase their credit rating and to obtain any discounts that are offered
- Have the confidence of their bank manager
- Pay their taxes on time
- Comply with statutory requirements
- Identify opportunities and take maximum advantage of them
- Have the respect of their clients, their customers and their peers (colleagues and competitors)
- Make a good profit every year

A successful contractor has, or can obtain, various management skills such as (CIDB, 2011a):

- Setting of appropriate targets (goals and objectives) for achievement and against which the business can measure itself
- Marketing the business effectively
- Pricing products and services correctly
- Buying and/or hiring plant, equipment and materials at competitive prices
- Managing profits and losses and the business cash flow
- Keeping records of all business transactions
- Managing the workforce
- Planning ahead
- Managing time effectively
- Interacting effectively with clients and their professional teams
- Having the ability to know what their rights in business and how to negotiate these
- Making decisions based on all the available information and then, once they are made, standing by those decisions and doing whatever is necessary to achieve the required outcomes relating to those decisions
- Being prepared to work long hours as the projects may demand and managing overtime to suit personal commitments outside of the business
- Completing the project on time to the required quality and within budget

Table 2.3 summarises the management of construction projects as discussed in this chapter.

Table 2.3: Summary of the management of construction projects

CONCEPT	SUMMARY
Definition of construction project	Construction is the conversion of resource inputs into defined functioning outputs by means of a managed process.
Role players in a construction project	Project manager who oversees the construction manager. A construction manager is involved in personnel management at the construction site and ensures that materials are delivered on time and that tools are available on the work site. The main difference between these two roles of project manager and construction manager is the level of authority. The construction manager directly oversees the day-to-day construction activities, while the project manager might supervise the construction manager.
Functions of contractors	Mangers in construction plan, organise, direct, control and evaluate the activities of a construction business or a construction project within a business, under the direction of a project manager.
Factors affecting success of a construction project	Projects differ in size, uniqueness and complexity, thus the criteria for measuring success vary from project to project making it unlikely that a universal set of project success criteria exist.
Managing errors in construction projects	Every organisation involved with the delivery of construction projects will invariably be subjected to a variety of errors that are committed by people.
Competencies of construction project managers	Skill components of project managers (referring also to contractors and their site managers) are measured by means of project performance in terms of time, cost and quality.

Source: Researcher's own compilation

2.10 SUMMARY

This chapter first considered the definition of a construction project and concluded that a construction project is seen as the conversion of resource inputs into defined functioning outputs by means of a managed process. It also clarifies the role players in a construction project and showed the main difference between a project manager and a construction manager. It was further indicated that the main management

functions of contractors included the planning, organising, directing and controlling of the activities in a construction.

Previous research in construction management were elaborated on showing how research has evolved from identifying 75 managerial skills in 1999 to how excellence is achieved in construction businesses in 2016. An overview of the construction industry in the global context showed the main issues in the various countries. In the South African construction industry context, the focus was on ethical standards and corruption.

Factors affecting the success of construction projects were also discussed and the competencies of construction project managers identified. In chapter three, construction project causes, delays and incidences are discussed.

CHAPTER THREE

CONSTRUCTION PROJECT DELAY CAUSES, EFFECTS AND INCIDENCE

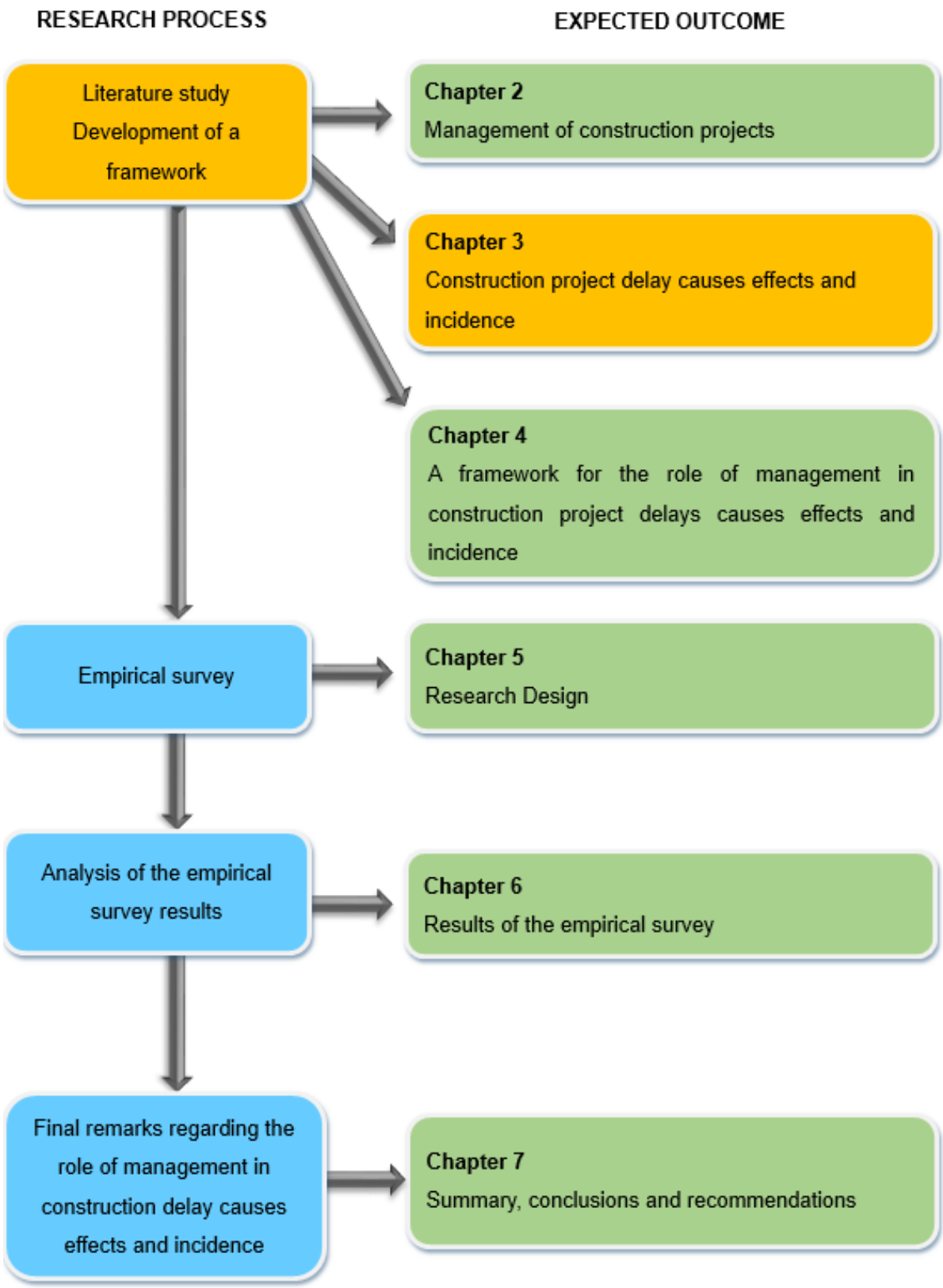
3.1 INTRODUCTION

The primary objective of this study is to investigate the role of management in the causes, effects and incidence of construction project delays. Chapter two explained the role of management in construction projects. This chapter focuses on the causes, effects and incidence of construction project delays.

Construction is a complex array of interdependent activities that some would say is at best organised chaos. The very nature of construction introduces challenges typically not encountered in other industries. Construction projects often undergo project delays, cost overruns and non-conformance to quality, leading to poor performance and dissatisfied parties. This chapter focuses on the causes, effects and incidence of delays in construction projects. A construction project delay is first defined where after international research on construction project delay causes are discussed followed by South African research on construction project delay causes. The effects of delays in construction project are also examined. To conclude, the incidence of construction project delays are reviewed.

3.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 3.1 is a reproduction of Figure 1.2 and illustrates the positioning of chapter three within the research process.



Source: Researcher's own compilation

Figure 3.1: Conceptual framework of the research process

3.3 DEFINING A CONSTRUCTION PROJECT DELAY

A delay is common in every construction project. As a result, delays and cost overruns are common in most construction projects. Hamzah, Roshana and Wong (2009:226) explained that a delay means a time overrun beyond the contract date agreed upon for the delivery of the project. A construction delay can be described as the time during which some part of the construction project has been extended or not performed owing to unanticipated circumstances (Andi, Lalitan & Loanata, 2010:8). Owing to the complexity and uncertainty in many construction projects, Kim (2009:295) argues that frequent adjustments in the baseline construction project schedule are unavoidable.

Delay is a pervasive phenomenon in construction project delivery. It is branded as the most common, costly and risky problem encountered in construction projects with a debilitating effect on the parties to a contract (Akinsiku & Akinsulire, 2012). Makuka, Aigbavboa & Thwala (2013) concur that projects or construction works that are not delivered on time to the client are referred to as delayed projects.

In construction, the term “delay” refers to something happening at a later time than planned, expected and specified in a contract or beyond the date agreed upon for the delivery of a project. Lo, Fung and Tung (2006) define delay as the slowing down of work without stopping construction entirely, which can lead to time over-run either beyond the contract date or beyond the date that project parties have agreed upon for the delivery of the project. Sadi and Sadiq (2006) explain that a construction delay could be defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery of a project.

These definitions confirm that a project delay occurs when a project is not delivered on time, on cost and correct quality.

3.4 INTERNATIONAL RESEARCH ON CONSTRUCTION PROJECT DELAYS CAUSES

The literature shows that the causes of delays occur at different levels, ranging from those caused by the client or owner to those caused by other external factors (Youngjae, Kyungrai & Dongwoo, 2006; Kim, 2009; Al-Humaidia & Tan, 2010). The literature also shows that each category of delay causes has different factors that can

lead to delays on construction projects. Delays are generally acknowledged as the most common, costly, complex and risky problem encountered in construction projects. The overriding importance of time, for both the owner (in terms of performance) and the contractor (in terms of money), makes it the source of frequent disputes and claims that lead to lawsuits.

Owing to its detrimental impacts, many studies have been conducted to investigate the causes of delay in the construction industry. Table 3.1 provides a summary of international research on construction project delay causes.

Table 3.1: Summary of international research on construction project delay causes

Country	Author(s)	Main focus
Jordan	Odeh and Battaineh (2002)	Assessed construction project delay causes with traditional types of contracts from the perspectives of contractors and consultants. The results obtained indicated that owner interference, inadequate contractor experience, financing and payments, labour productivity, slow decision-making, improper planning and subcontractor problems were among the top ten important factors, as agreed on by both contractors and consultants.
Saudi Arabia	Assaf and Al-Hejji (2006)	Conducted a survey on the time performance of different Saudi Arabian construction project types, aiming to determine delay causes and the importance of these causes according to the viewpoint of each project participant, including the owner, consultant and contractor. The questionnaire identified 73 delay causes. The study indicated that the most common delay cause agreed on by all three personnel was “change order”.

Country	Author(s)	Main focus
Hong Kong	Lo, *et al.* (2006)	Identified seven categories of delay causes, namely: • Client related • Contractor related • Project related • External factor • Human behaviour related • Resources related • Consultant related
Malaysia	Sambasivan and Soon (2007)	Presented the ten most important delay causes in the Malaysian construction industry to identify both delay factors and the effect of these factors on the project completion, namely, contractor's improper planning, contractor's poor site management, inadequate contractor experience, client inadequate finance and payments for completed work, problems with subcontractors, shortage in the material, labour supply, equipment availability and failure, lack of communication among parties and mistakes made during construction.
Vietnam	Long, Lee and Lee (2008)	Identified causes of construction project delays, namely: • Poor site management • Poor project management • Financial difficulties • Design changes

Country	Author(s)	Main focus
Thailand	Toor and Ogunlana (2008)	Identified 75 factors in ten categories, namely: • Delays related to clients • Delays related to designers • Delays related to project management or consultants • Delays related to contractors • Delays related to labour • Delays related to finance • Delays related to the contract • Delays related to communications • Delays related to the site and the environment • Other miscellaneous factors
Taiwan	Yang and Ou (2008)	Identified six causes for construction delays, namely: • Contract related factors • Management related factors • Human related factors • Non-human related factors • Design related factors • Finance related factors
United Kingdom	Olawale and Sun (2010)	Identified the most important causes of construction project delays, namely: • Poor site management • Poor project management • Financial difficulties • Design changes

Country	Author(s)	Main focus
Ghana	Fugar and Agyakwah-Baah (2010)	Categorised delay factors into nine major groups in a questionnaire to key project participants, namely, clients, consultants and contractors. The overall results obtained from the study indicated that the respondents generally agreed that financial group factors ranked the highest among the major factors that caused delays in construction projects in Ghana. Financial group factors caused delays in terms of honouring payment certificates, difficulty in accessing credit and fluctuation in prices, material group factors were ranked second, followed by scheduling and controlling factors.
Malaysia	Wei (2010)	Found that delays dependent on the type of activity, and on who was responsible for the delay.
Pakistan	Haseeb Lu, Bibi, Maloof-ud-Dyian and Rabbani (2011)	Indicated the time performance of a construction project in Pakistan, and that the most common delay factors were natural disasters, such as floods and earthquakes. The study also acknowledged other factors, such as financial and payment problems, improper planning, poor site management, insufficient experience and the shortage of materials and equipment.

Country	Author(s)	Main focus
Egypt	Abd-El Razek, Bassioni and Mobarak (2008)	Identified the ten most important causes of construction project delays, namely: • Financing by contractor during construction • Contractor's payment by owner delays • Design changes by owner or his/her agent during construction • Partial payments during construction • Non-utilisation of professional construction management • Slow delivery of materials • Difficulty in coordinating between various parties • Slowness of owner decision-making process • Relationship between different subcontractors schedules • Preparation of shop drawings and material samples
Egypt	Aziz (2013)	Identified relative importance indices and determined the influence ranks of 99 factors causing delays in construction projects in Egypt. It addressed the most significant factors and groups causing delays, especially after the Egyptian revolution. The explored factors were classified under the following nine primary classifications namely, consultant related delay factors, contractor related delay factors, design related delay factors; equipment related delay factors, external related delay factors, labour related delay factors, material related delay factors, owner related delay factors and project related delay factors.
Turkey	Gunduz, Nielsen and Ozdemir (2013)	Determined of the 83 different factors studied, the planning and scheduling, fluctuation of prices, rework caused by errors, late delivery of materials, owner's demand, poor site management and project complexity were the major delay causes.

Country	Author(s)	Main focus
Singapore	Hwang, Zhao and Ng (2013)	Identified factors that caused construction delays as lack of site management coordination, design changes by owners and availability of labourers, materials and project managers.
Ireland	McCord, McCord, Davis, Haran and Rodgers (2015)	Identified the following categories of delay causes, namely: • Management related • Material related • Project related • Equipment related • External related • Labour related • Client related • Consultant related • Contractor related • Design related
Nigeria	Alade, Lawal, Omonori and Olowokere (2016)	Considered the major causes and effects of delay in the execution of construction projects in Nigeria. Using literatures, a total number of 30 causes of construction delays were identified. The analyses of the primary data revealed that the three most important causes of delay in construction projects were poor site management and supervision, contractor inexperience and client financial difficulties.
Qatar	Hassan (2016)	Included a list of 42 delay attributes in a questionnaire survey to identify the most influential delay attributes affecting the construction industry. The top five ranked influential delay attributes by experts included (1) low productivity of labour, (2) delay in decision-making, (3) changes to the project by owner, (4) delays related to sub-contractors work, and (5) unqualified workforce.

Country	Author(s)	Main focus
India	Rao (2016)	Identified the major causes of construction delays in India, in particular, the Manipal Town. A questionnaire was designed based on the 42 factors of delays under six distinct categories targeting the contractors, clients and consultants. The major cause of delay out of 42 causes were identified in the category of owner related factors which was due to delays in payments.
Saudi Arabia	Alzara, Kashiwagi, Kashiwagi and Al-Tassan (2016)	Identified the major causes of project delays in northern Saudi Arabia. The delay factors were collected from the University Projects Director, and were then compared to Saudi construction projects. It provided a solution to minimise delay factors and improve performance using a Performance Information Procurement System.
Gaza Strip	Enshassi Al-Najjar and Kumaraswamy (2016)	Assessed the factors leading to time and cost overruns in construction projects in the Gaza Strip. The survey included 110 delay factors and 42 cost overrun factors. This study concluded that the major causes could be removed by better management practices.

Source: Researcher's own compilation

A comprehensive list of construction delays across varying countries was developed by Toor and Ogunlana (2008), which showed the difference in construction delays before the year 2000, compared with those after 2000. Their study identified additional factors that caused delays in developing countries. These included, lack of finance, technically-incompetent and less-experienced local companies, an underdeveloped business environment, complexities in legal and regulatory systems and distinct socio-cultural issues (Toor & Ogunlana, 2008). Toor and Ogunlana (2008) concluded that the factors that caused delays in construction in developing countries were mostly identical. They identified 75 such factors, arranged in 10 categories.

Although construction delays are a global phenomenon, factors causing construction delays in construction projects differ from country to country, owing to different prevailing conditions. The prevailing conditions that could exert an influence on project

delivery time are political, economic and physical factors as well as level of technological development, management style and construction techniques. Many projects experience extensive delays and thereby exceed initial time and cost estimates.

3.5 SOUTH AFRICAN RESEARCH ON CONSTRUCTION PROJECT DELAY CAUSES

Although there is not much research into the causes and effects of construction project delays in South Africa, Aiyetan, *et al.* (2011) and Makuka, *et al.*(2013) focused on the causes and effects of construction delays.

The study by Aiyetan, *et al.* (2011) identified seven stages of construction project delivery and the various activities in these stages that could reduce the negative influence of delay factors on project delivery time. Makuka, *et al*. (2013) concluded that a number of important factors which caused project delays such as delay in progress payments, difficulties in financing projects by the contractor, delays in approving major changes in the scope of work, delays in material delivery, equipment breakdowns, low productivity level of workers and weather effect on construction activities.

Buys and Le Roux (2013) investigated the causes of defects in the South African housing construction industry, and found that the biggest contributing factor towards defects was inadequate artisan skills. The overall causes of defects could be attributed to design, construction, material and subsurface conditions. Ultimately, the origin of defects lies in inadequate management or inadequate technical skills.

Adugna (2015) referred to the following categories of delays:

- Excusable delays

Excusable delays are not attributable to the actions or inactions of a contractor, and basically include unforeseen events. These events are out of the contractor's control and are without negligence or fault on the contractor's part.

Excusable delays can be further classified into compensable delays and non-compensable delays. Whether a delay is compensable or not it depends primarily on

the agreement of the contract. In most cases, a contract specifies the kinds of delays that are non-compensable, in which the contractor does not attain any additional money but can be allowed a time extension. Compensable delay is a type of delay over which the client (or client's representative) has control.

Non-compensable delays are caused by an unforeseen event beyond the control of the contractor and the client. As a result, both parties can incur losses in terms of cost. The contractors admits these time overrun costs for taking more time in the project while the client absorbs its additional cost by giving additional time to the contractor and extending the contract. Causes for this type of delay cannot be controlled by any party to take the responsibility of extra cost resulting from it.

- Inexcusable delays

Inexcusable delays are delays over which the contractor has control or delays that are not accepted by the client. In contrast to excusable delay, a non-excusable delay offers no bases for recovery of either the monetary or the time impact of the delay. Accordingly, this type of delay grants no entitlement extension of time or delay damage to the contractors even if the delay affects the whole project. The owner, however, could be entitled to liquidate damages. For instance, a non-excusable delay could be when a contractor is not able to provide sufficient manpower to complete the work on time.

- Concurrent delays

Concurrent delays are delays that occur, at least to some degree, during the same period of time. In construction, the term concurrent delay refers to the situation when non-excusable delay and an excusable compensable delay occur during overlapping time periods or at the same time.

Adugna (2015) concludes his study by stating that the causes of delays can be categorised into nine major groups depending on the source of delay, namely:

- Design related delay causes
- Project related delay causes
- Client related delay causes

- Contractor related delay causes
- Consultant related delay causes
- Material related delay causes
- Equipment related delay causes
- Labour related delay causes
- External delay causes

3.6 EFFECTS OF DELAYS IN CONSTRUCTION PROJECTS

The effects of delays are the consequences when the causes of delays are not identified and worked on effectively. Makuka, *et al.* (2013) identified a total of 14 effects of delays in construction projects, namely, time overrun, cost overrun, negative social impact, idle resources, disputes, arbitration, delay by the client in returning loans, poor quality of work owing to hurrying the projects, bankruptcy, litigation, creating stress for contractors, total abandonment and acceleration losses.

Alwi and Hampson (2003) also suggested that the main effects of delay to a project are time and cost. They concluded that the delay causes researched are also applicable to similar building construction projects in other developing countries. Sambasivan and Soon (2007) identified six different effects of construction delays in the Malaysian construction industry. These six effects were also identified by Aibinu and Jagboro (2002) in their study of construction delays in Nigeria. These six delay effects included the following:

- Cost overrun
- Extension of time
- Late payment
- Rescheduling
- Affect company reputation
- Lost productivity and efficiency

The analysis of delay in South Africa seems to be very limited, yet it has pertinent issues that can affect any project, particularly when it comes to labour-related issues. Makuka, *et al.* (2013) identified a total of 14 effects of delays of construction projects, namely, time overrun, cost overrun, negative social impact, idling resources,

disputes, arbitration, delaying by the client to return the loans, poor quality of work owing to hurrying the projects, delaying in getting profit by clients, bankruptcy, litigation, create stress on contractors, total abandonment and acceleration losses

Aibinu and Jagboro (2002) have evaluated the effects of delays in the Nigerian construction industry from the viewpoints of quantity surveyors, engineers and architects as well as contractors. This study reveals that the six effects of construction delays were time overruns, cost overruns, disputes, total abandonment, arbitration and litigation. Sambasivan and Soon (2007) have also disclosed the same effects of delays in the Malaysian industry.

Haseeb, *et al.* (2011) have highlighted the effect of delays in the Pakistan construction industry, including clashes, claims, total desertion and reduced growth of the construction industry. Moreover, Manavazhi and Adhikari (2002) have found that the actual effect of delays on project costs was only about 0.5% of the total budgeted project cost. This study investigated the material and equipment procurement delays in highway projects in Nepal, which were supposedly related to cost overruns because such delays always occurred in the construction projects of developing countries (Manavazhi & Adhikari, 2002).

Most of the studies investigating the delay factors in construction projects focused on either the causes or effects. However, some studies discuss the probable link between the causes and effects of delays. Assaf and Al-Hejji (2006) have associated contractor- and labour-related causes to probable time overruns in Saudi Arabian construction projects. Odeh and Battaineh (2002) have discussed the probable link between contract related causes to disputes in Jordanian construction projects.

The systematic analysis conducted by Sambasivan and Soon (2007) on both the causes and effects of delays in Malaysian construction projects shows an interesting association between the causes and effects on construction projects. Time overruns are majorly contributed to client- and contractor-related factors. Contractor-related factors, such as change orders and discrepancies in the contract document, were linked to the cost overruns of projects. Client, contract, contract relationship and external related factors were found to significantly affect probable disputes that occur during projects. Client and contract relationship-related factors have caused disputes

to be settled through an arbitration process. Client, labour, contract, contract relationship and external related factors have sent disputes to be settled through a litigation process. Additionally, client, consultant, labour, contract and external related factors have contributed to the total abandonment of projects.

Based on these selected reviews of previous studies, most studies evidently emphasised the critical delay causes in different countries from the perceptions of various parties involved in construction. However, few studies have also investigated the effects of delays on project performance.

Memon, *et al.* (2011) identified six effects of project delay effects, namely:

- Time overrun
- Cost overrun
- Arbitration
- Dispute
- Total abandonment
- Litigation

The study revealed that time over-run and cost-over run were the most significant effects of delays in construction projects.

Table 3.2 provides a summary of the effects of construction project delays.

Table 3.2: Summary of the effects of constructions project delays

Author	Effects of construction project delays
Makuka, *at al.*(2013)	Identified 14 effects of delays in construction projects, namely, time overrun, cost overrun, negative social impact, idle resources, disputes, arbitration, delay by the client in returning loans, poor quality of work owing to hurrying the projects, bankruptcy, litigation, creating stress for contractors, total abandonment and acceleration losses.

Author	Effects of construction project delays
Sambasivan and Soon (2007)	Identified six effects of construction delays identified, namely: • Cost overrun • Extension of time • Late payment • Rescheduling • Affect company reputation • Lost productivity and efficiency
Haseeb, *et al.* (2011)	Identified construction delay effects, namely: • Clashes • Claims • Total desertion • Reduced growth of the construction industry
Memon, *et al.* (2011)	Identified six effects of project delay effects, namely: • Time overrun • Cost overrun • Arbitration • Dispute • Total abandonment • Litigation

Source: Researcher's own compilation

3.7 INCIDENCE OF DELAYS IN CONSTRUCTION PROJECTS

Time is a factor that is essential in all activities that have to be carried out. In construction, the contract document contains a specific time phase for delivery of the project and if the time is being exceeded, more money is often spent which could lead to increase in final cost of project and also wastage and under-utilisation of man-power and resources.

The actual duration of a construction project often differs substantially from the estimates made before construction begin. Three factors can unexpectedly extend construction activities, namely, work delays, weather delays and productivity delays.

Braimah (2013) states that the duration of contract performance has a direct effect on the profitability of construction projects from the perspective of all stakeholders. For project owners, lost profits or benefits stem from being unable to make use of the project at the agreed date whilst to the contractor, extra cost will be incurred due to prolonged stay on site.

Shebob, Dawood and Xu (2011) conducted a survey where the aim was to estimate the frequency of occurrence and severity level of delay factors in construction projects. The results showed that a project might be delayed by 97 to 103 days for one block in comparison to the planned duration. The results will guide the construction manager to take necessary measures to reduce the impact on construction project.

Ballesteros-Pérez, Del Campo-Hitschfeld, González-Naranjo and González-Cruz (2015) found that project delays are relatively frequent in the construction industry and are associated with wasting natural, material and economic resources. The location and timing of construction projects affect project delays, and the exact location of a project cannot always be altered. However, the particular moment of time can frequently be modified.

The CDOT (2015) showed that the amount of time specified to complete a project or project phase may have an impact on cost and other factors. If the contract time is too short, bid prices may be higher, quality and safety requirements may be more difficult to enforce, and time related disputes or claims may increase. If the contract time is too long, the public may be subject to additional user delay costs, businesses may be affected, and costs for inspection may increase owing to lower contractor productivity. Contractors may also bid more work than they can handle and would not be under sufficient pressure to develop innovative ways to expedite the work.

3.8 SUMMARY

In this chapter, a construction project delay was first defined. Most of the definitions of what it entails are in agreement, and a construction project delay for the purposes of this study was that a project is not delivered on time, cost and quality. The causes of construction project delays in the international context were described using examples from twenty countries. Although the causes may differ from country to

country, large similarities exist, and the different factors can be grouped into categories. The ten delay categories most identified included delays related to clients, designers, project management or consultants, contractors, labour, finance, the contract, communications, the site and the environment and other miscellaneous factors.

South African research on construction project delay causes was scant. However, the causes do not differ much from the international context and include categories such as design related delay causes, project related delay causes, client related delay causes, contractor related delay causes, consultant related delay causes, material related delay causes, equipment related delay causes, labour related delay causes and external delay causes.

The effect of construction project delays shows a number of delay effects that revolve around time overrun, cost overrun, negative social impact, idle resources, disputes, arbitration, delay by the client in returning loans, poor quality of work owing to hurrying the projects, bankruptcy, litigation, creating stress for contractors, total abandonment and acceleration losses.

To conclude, the incidence of construction project delays refer to the duration of the delay and the frequency of the delay. In chapter four, a framework to investigate the role of management in the causes, effects and incidence of construction project delays, is developed.

CHAPTER FOUR

A FRAMEWORK FOR THE ROLE OF MANAGEMENT IN THE CAUSES, EFFECTS AND INCIDENCE OF CONSTRUCTION PROJECT DELAYS

4.1 INTRODUCTION

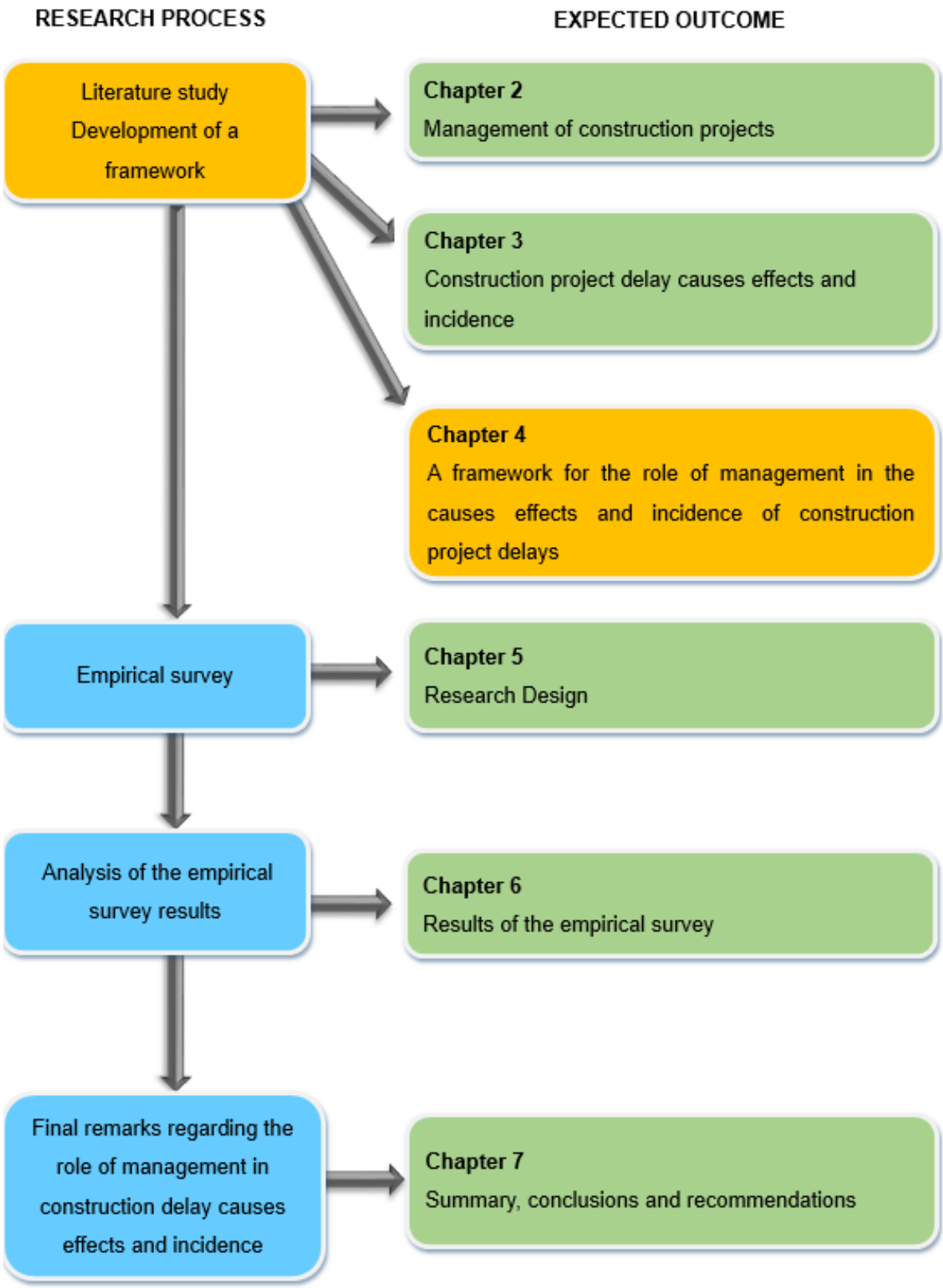
In chapter three, construction project delays causes, effects and incidence was discussed. A construction project delay occurs when a project is not delivered on time, cost and quality. Although the causes may differ from country to country, large similarities do exist. The effect of construction project delays shows a number of delay effects. The incidence of construction project delays refers to the duration of the delay and the frequency of the delay.

In chapter two, management of construction projects were outlined. Previous research in construction management were elaborated on showing how research has evolved from identifying 75 managerial skills in 1999 to how excellence is achieved in construction businesses in 2016. Factors affecting the success of construction projects were discussed and the competencies of contractors identified. It was further indicated that the main function of contractors included the planning, organising, directing and controlling of the activities in a construction business.

In this chapter, the literature overview of management in construction projects, project delays and incidence are analysed. The analysis provides the framework to investigate the role of management in the causes, effects and incidence of construction project delays. The components of the framework are then described briefly. The framework shows how the management factors can predict the factors causing construction project delays which, in turn, predicts the effect of delays and the incidence of delays. From the framework, the hypotheses are formulated to investigate the proposed relationships.

4.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 4.1 is a reproduction of Figure 1.2 and illustrates the positioning of chapter four within the research process.



Source: Researcher's own compilation

Figure 4.1: Conceptual framework of the research process

4.3 PROPOSED THEORETICAL FRAMEWORK AND HYPOTHESES

The literature study revealed a number of management skills and functions. Based on the summary provided in Table 2.3, the management functions in construction projects can be derived. It can be concluded that the main management functions of contractors include the planning, organising, directing and controlling of the activities in construction.

If the causes of construction project delays are considered, Table 3.1 provides an overview of delay causes in the international context and section 3.5 outlines the South African construction project delay causes. Based on this, the eight most identified delay categories include:

- Delays related to clients
- Delays related to contractors
- Delays related to labour and equipment
- Delays related to materials
- Delays related to consultants
- Delays related to community
- Delays related to the contract
- Delays related to external issues

In chapter 3, Table 3.2 provided a summary of the effects of construction project delays. Based on this for the purposes of this study, the following effects of construction delays are included:

Finance related delay effects, namely:

- Budget exceeded
- Cash flow problems
- Delay with final account

Human related delay effects, namely:

- Poor quality of finished product
- Reputation influence
- Abandonment of project

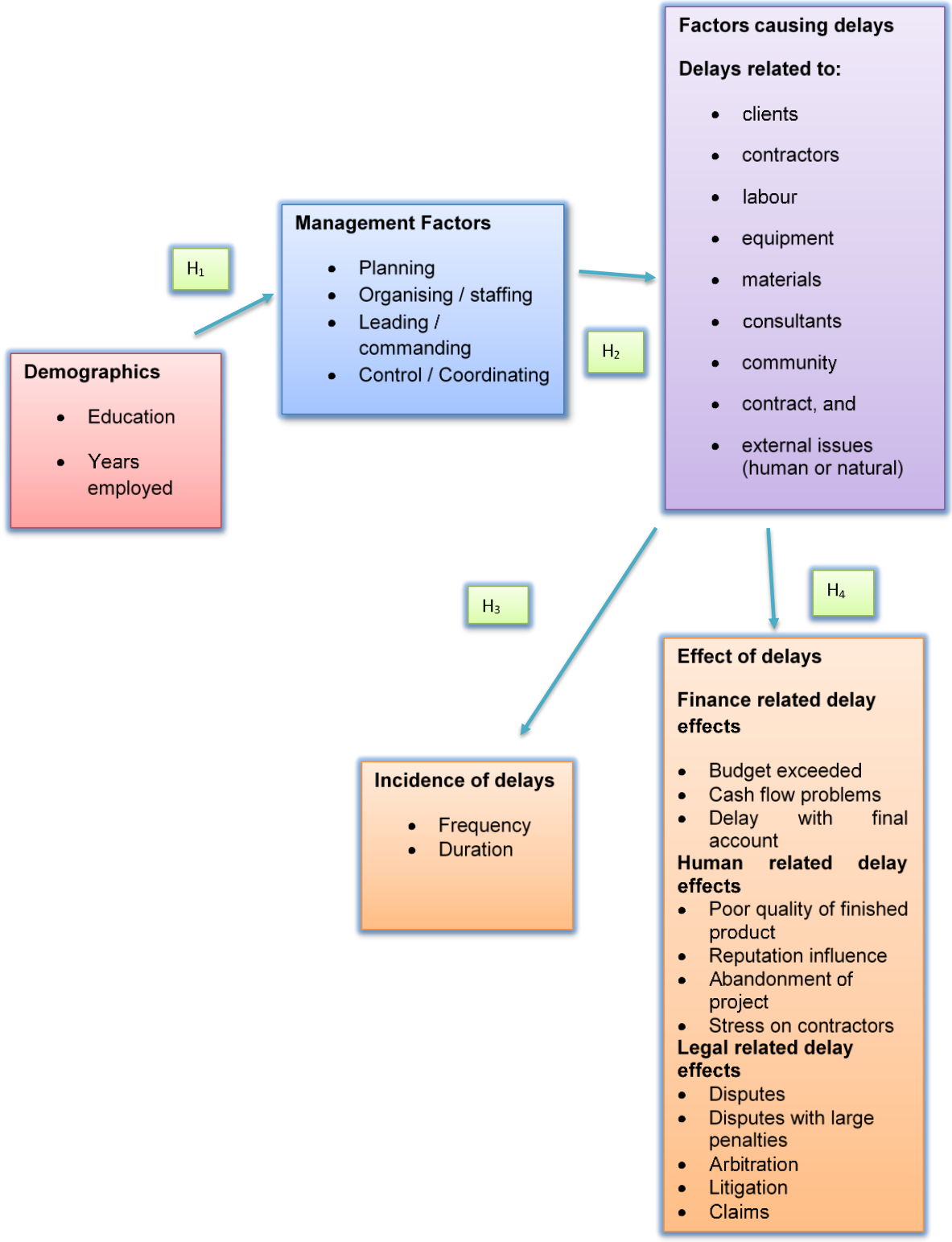
- Stress on contractors

Legal related delay effects, namely:

- Disputes
- Disputes with large penalties
- Arbitration
- Litigation
- Claims

In section 3.8, it is outlined that the incidence of construction project delays consist of the frequency of the construction project delays and the duration of the construction project delays.

Based on these discussions, a theoretical framework can be proposed as depicted in Figure 4.2.



Source: Researcher's own compilation

Figure 4.2: Role of management in the causes, effects and incidence of construction project delays

Figure 4.2 shows the role of management in the causes, effects and incidence of construction project delays. From this framework, the hypotheses can be formulated to test the proposed relationships:

H_1 : Demographics of contactors predict the management functions employed in construction project delays

H_2 : Management functions employed in construction project delays predict the causes of construction project delays

H_3 : The causes of construction project delays predict the incidence of construction project delays

H_4 : The causes of construction project delays predict the effects of construction project delays

4.4 COMPONENTS OF THE PROPOSED THEORETICAL FRAMEWORK

Sections 4.4.1 to 4.5.5 describe the main components of the proposed theoretical framework, namely, the demographics, the management factors, the factors causing delays in construction project, the effect of delays in construction projects and the incidence of construction project delays.

4.4.1 Demographics

This section provides a brief description of the demographics that may impact on management factors.

a) Education

It is expected that the more educated people are, the better they will be able to manage a construction project. However, this needed to be tested empirically.

b) Years employed

A contractor that has been employed for a long period is considered to perform management functions better than one that has not been employed for long. This needed to be tested.

4.4.2 Management factors

Each of four management factors is briefly discussed in this section.

a) Planning

Planning is also a management process, concerned with defining goals for a future direction and determining the missions and resources to achieve those targets. To meet objectives, managers may develop plans.

b) Organising /staffing

Organising is the function of management that involves developing an organisational structure and allocating human resources to ensure the accomplishment of objectives. The structure of the organisation is the framework within which effort is coordinated. Contractors need to ensure that they appoint the correct people to carry out their projects.

c) Leading / commanding

Leading is the third step in the management process and is accomplished by communicating, motivating, inspiring, and encouraging employees towards a higher level of productivity.

d) Control / coordinating

Controlling is the final function of management in which the manager, once a plan has been carried out, evaluates the results against the goals.

4.4.3 Factors causing construction project delays

For the purposes of this study, ten factors causing construction project delays are identified.

a) Delays related to clients

Client related causes of delays involve, amongst others, an unrealistic time period to complete the construction project, design and scope changes by the client and inadequate decision-making.

b) Delays related to contractors

Contractor related causes of delays often revolve around inadequate experience and poor coordination of activities.

c) Delays related to labour and equipment

Unskilled labour and labour disputes are one of the causes of construction project delays. Faulty equipment and improper equipment selection also lead to delays.

d) Delays related to materials

Poor quality material, material shortages, late ordering and late delivery of materials also cause construction project delays.

e) Delays related to consultants

Delays related to consultants revolve around incorrect communication, lack of information and inappropriate coordination of information.

f) Delays related to community

Lack of community buy-in to a construction project and community unrest cause construction project delays.

g) Delays related to the contract

Communication between parties, disputes and negotiations can cause construction project delays. Contracts are also sometimes not properly understood.

h) Delays related to external issues

External issues that can cause construction project delays relate to nature disasters as well as delays causes by humans such as political interference. So external issues can be either those related to natural causes and those related to human causes.

4.4.4 Effects of construction project delays

Twelve effects of construction project delays are identified for the purposes of this study and include:

a) Budget exceeded

A budget is exceeded if one spends more than anticipated on a construction project. It is also referred to a project overrun.

b) Cash flow problems

When contractors do not have enough cash to cover costs, cash flow problems can be experienced. This is normally the effect of a project delay that contractors run out of cash owing to late completion of a project.

c) Delay with final account

The longer the contractor take to finish a construction project, the longer it will take to get to the final account.

d) Poor quality of finished product

An effect of a construction project delay can be that contractors rush to finish the project and compromise quality of the end product.

e) Reputation influence

If a contractor does not deliver a project on time, it can influence their reputation.

f) Abandonment of project

When a project is delayed, it can lead to contractors abandoning the project owing to various reasons.

g) Stress on contractors

A project delay can cause an increase of stress on the contractor who has to perform tasks under pressure when projects are delayed.

h) Disputes

A project delay can lead to a dispute between various parties involved in the project.

i) Disputes with large penalties

A project delay can lead to a dispute with large penalties between various parties involved in the project.

j) Arbitration

A construction project delay can lead to the various parties following arbitration to resolve disputes.

k) Litigation

A construction project delay can lead to the various parties rather following litigation to resolve disputes.

l) Claims

Construction project delay disputes can lead to claims.

4.4.5 Incidence of construction project delays

This section provides a brief description of the incidence of construction project delays.

a) Frequency of delay

The frequency of the construction delay refers to the number of times a contractor experiences a delay in construction projects.

b) Duration of delay

The duration of the construction delay refers to how long the delay in the construction project takes.

4.5 SUMMARY

The purpose of Chapter four is to develop a framework for the role of management in the causes, effects and incidence of construction project delays. Secondary research relating to causes, effects and incidence of construction project delays was explored and various aspects of these components were investigated. Ten causes of construction project delays were identified and twelve effects of construction projects outlined.

A theoretical framework is proposed to describe the role of management in the causes, effects and incidence of construction project delays. The framework shows how the

four management functions predict the causes, effects and incidence of construction project delays.

In chapter five, the research methodology for this study is explained, and a detailed discussion of the research design and data analysis is presented.

CHAPTER FIVE

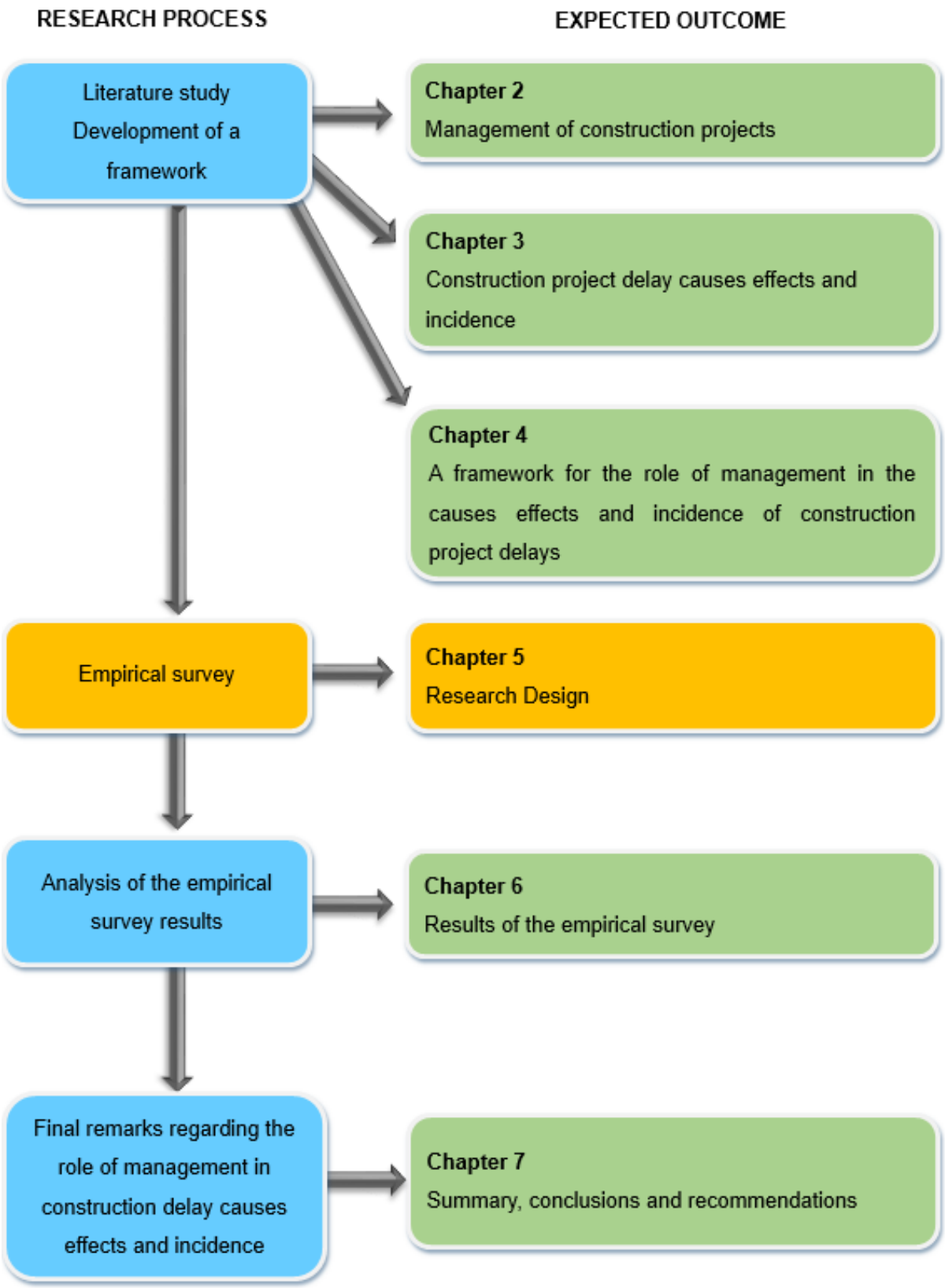
RESEARCH DESIGN

5.1 INTRODUCTION

In chapter four, a framework was developed to investigate the role of management in the causes, effects and incidence of construction delays. Chapter five discusses the research design adopted to collect and analyse the data needed to empirically test the proposed framework. The research design defines the logical link between the initial questions of the study and the data that needs to be collected during the study and clarifies the questions to be answered. In this chapter, the research design which includes the sample, data collection, measuring instrument and data analysis are outlined. The research paradigm is also outlined and clarified.

5.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 5.1 is reproduced to illustrate the place of chapter five within the research process.



Source: Researcher's own compilation

Figure 5.1: Conceptual framework of the research process

5.3 RESEARCH PARADIGM

Yin (2009:20) explains that the research design should guide researchers and, more importantly, ensure that evidence found corresponds with primary research questions and objectives.

In a research design, there are two types of research paradigms that can be followed, namely, a phenomenological paradigm, which entails pursuing a qualitative research approach, and a positivistic paradigm, which entails pursuing a quantitative research approach.

Partington (2002:109) defines a qualitative/phenomenological research design as an approach in which the necessary data to be used in the study is collected in the form of words and observations, not numbers. Qualitative research is concerned with qualitative phenomena (Collins & Hussey, 2014), and includes interpretative techniques, which seek to describe phenomena, and achieve an in-depth understanding of a situation (Cooper & Schindler, 2006:196).

Quantitative research determines the quantity of a phenomenon in the form of numbers. Table 5.1 summarises the differences between qualitative and quantitative research.

Table 5.1: Differences between qualitative and quantitative research

Qualitative Research	Quantitative Research
Research conducted in the natural setting of the respondent	Research conducted in a controlled setting
Focused on the process of the research	Focused on the outcome of the research
Primary aim is to formulate comprehensive descriptions and understanding of actions and events	Results are generalised to a theoretical population
Results are context-specific	Results are generalised to a theoretical population
Inductive approach – generation of new hypotheses and theories	Deductive approach – explanation of hypotheses and theories
Subjective in nature	Objective in nature

Source: Jackson (2012:86-90)

This study makes use of a quantitative research paradigm to achieve the research objectives. Quantitative research is used to determine the relationships among measured variables to "explain, predict and control phenomena" (Jonker & Pennink, 2009:66-67). The aim of quantitative research is to determine the relationship between an independent variable and a dependent variable in a population (Sekaran & Bougie, 2010:12). The end result of quantitative research is usually confirmation or disproving of the hypothesis being tested. Thomas (2003:1) suggests that quantitative methods "focus attention on measurements and amounts of characteristics displayed by people and events that the researcher studies."

In investigating the role of management in the causes, effects and incidence of construction project delays, the research method includes collecting and analysing data in a numerical form and investigating relationships between the role of management (construct 1), the causes of construction delays (construct 2), the effect of construction delays (construct 3) and the incidence of construction delays (construct 4). For this reason, the quantitative approach to research was judged to be most suitable for this study.

5.4 RESEARCH DESIGN

Given that this study makes use of a positivistic (quantitative) research paradigm, this section elaborates on the research design of this study.

5.4.1 Population

Cooper and Schindler (2006:402) suggest that a population is the total collection of elements about which one wishes to make inferences. Attributes of the population in which one has an interest must be described in terms that are accurate and clear to those involved in the research project (Webb, 2002:48). In order to define this population clearly, the following terms must be considered:

- Element – body concerned in the research, such as the person or factory
- Unit – way in which access to the element is acquired
- Extent – geographical boundaries where the research is to take place
- Time – timeframe in which the research is to take place

It is important not to make the population definition too narrow or too broad, as this could lead to unwanted errors or biased results (Webb, 2002:49). The population for this study included all building contractors in South Africa.

5.4.2 Sample unit and sampling method

A sample is a subset of a population, and should represent the main interest of the study (Hoy, 2010:51). Sampling is done to increase data collection speed, lower the cost of collecting data and to increase the availability of population elements (Hoy, 2010:52).

Restrictions of time, money and access often make it impossible to survey every member of the population. As a result, a sampling technique should be used to allow for the collection of data from a subgroup from which generalisations can be made (Sekran & Bougie, 2010:76). When selecting a sampling method, there are two main categories to choose from, namely, probability sampling and non-probability sampling.

According to Zikmund, Babin, Carr and Griffen (2010), probability sampling refers to methods of selecting individuals to participate in a study where each member of the population has an equal (non-zero) chance of being selected. Probability sampling includes simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage area sampling, whereas non-probability sampling includes convenience sampling, judgement (purposive) sampling, quota sampling and snowball sampling (Zikmund, *et al.* 2010; Leedy & Ormrod, 2005:199). Non-probability sampling occurs where the basis of selection is personal judgement or convenience, and the probability of an element in the population being selected is unknown (Lancaster, 2005:149).

In this study, the non-probability sampling technique known as criterion-related sampling was used to select respondents. The use of this sampling technique meant that the probability of each member of the population being selected was unknown (Jackson, 2012:99; Welman & Kruger, 2005:36). However, to be included in the sample, the respondents had to meet specific criteria. In the case of this study, the contractors needed to have a CIDB grade of at least 7. This meant that the contractor's tender range was above R6 500 000. A large-scale

contractor would be exposed to construction delays and effects in a different manner than a contractor who is small-scale.

According to Ruben and Babbie (2012:173), there are no rules regarding sample size when non-probability sampling techniques are used, and suggest that the sample size depends on the research questions and objectives. Saunders, *et al.* (2003:142) specifically state that the sample size is dependent on "what it is that needs to be found out, what will be useful, what will have credibility and what can be done with the available resources". Welman and Kruger (2005:86) point out that a sample should never have fewer than 25 units and preferably more than 50, depending on the size of the population. David and Sutton (2004:135-136) make reference to a "rule of thumb" method when determining the sample size, namely, that the sample size should never be fewer than 30 units.

In quantitative studies, a representative or good sample is one in which the results obtained for the sample can be taken to be true for the whole population, in other words, the researcher will be able to generalise from the results. For this reason and because of the need to conduct statistical analyses, a quantitative approach needs to be used with large samples (Hoy, 2010:51). As a result of the sampling technique and procedure implemented, the sample size for this study was 150 units.

5.4.3 Method of data collection

Surveys are a popular and common strategy to collect data in business and management research, and were used in this study. A survey is defined as a research technique where information is collected from a sample of people by means of a questionnaire (Struwig & Stead, 2013). Saunders, *et al.* (2003:47) state that "surveys allow the collection of a large amount of data from a sizeable population in a highly economical manner." The data is often based on a questionnaire, where data is standardised, which allows for easy comparison (Saunders, *et al.* 2003:47).

The advantages of using a questionnaire to collect data include:

- Less costly
- Completed at the respondent's convenience
- Respondent is assured of anonymity

- Questions are standard and are easy to analyse
- Respondents are not biased by the presence or opinion of the interviewer
- Easy to access people at any location

The disadvantages of using a questionnaire to collect data include:

- Lack of flexibility, as no explanation can be given if questions are not clear
- Response rate could be low
- Another person other than the intended respondent may complete the questionnaire
- Questions have to be simple and easy to understand
- Lack of representativeness because response rates may be low
- Incompleteness is a concern as certain questions may be left unanswered

In the present study, the researcher made use of a measuring instrument to collect the primary data from the sample group. Various aspects relating to the measuring instrument need to be discussed and outlined.

a) Measuring instrument development

The framework developed in chapter four (see Figure 4.2) served as basis to develop the questionnaire. As relationships in this framework needed to be tested, the five constructs, namely, demographics, management factors, factors causing delays, effect of delays and incidence of delays had to be included in the measuring instrument.

The measuring instrument used in this study consisted of a covering letter and three sections (see Annexure A). In the cover letter, an explanation of the purpose of the study and the type of information requested was provided. The cover letter also included a promise of confidentiality and instructions on how to complete and return the questionnaire. The survey was conducted by a research solutions business.

Sections 1 of the questionnaire requested demographic information relating to both the respondents and the contactor businesses. The information requested concerning the respondent included his/her gender, age and education level. The information

requested that related to the contractors business included the CIDB grade of the contractor and their BBBEE status.

Section 2 of the questionnaire consisted of five-point Likert-type questions investigating the causes of delays in construction. Section 3 of the questionnaires also consisted of the five-point Likert-type questions on the effects of delays in construction and also the incidence of construction delays. Section 4 of the questionnaire related to questions concerning management in construction and also consisted of five-point Likert-type questions.

5.4.4 Pilot survey

To establish whether the measuring instrument would be usable, a pilot study was conducted. The researcher approached 20 contractors to complete the questionnaire. During the process of getting contractors to complete the questionnaires, the researcher realised the time-consuming process of getting one questionnaire completed. It was then decided to use a research business to assist in collecting the data. No major changes to the questionnaire was necessary after the pilot survey.

5.4.5 Administration of measuring instrument

Data was collected using an outside research business. During the pilot survey, it became clear that it would be very time-consuming to collect data from building contractors personally. Therefore, it was decided to use an outside research business to collect the data online. The researcher, however, closely-monitored the collection of data and had a couple of sessions with the research business to ensure the success of the data collection.

5.4.6 Method of analysis

Once the primary data was collected, it was analysed using appropriate statistical methods. Data analysis refers to the application of reasoning to clarify the data that has been gathered (Zikmund, *et al.* 2010:70). It is a process where raw data which is directly indicated by the respondent is taken, edited, coded, filed and analysed. According to Jackson (2012:66), the integrity of the research results is

determined by the validity and reliability of that piece of work, and as such, it is important that the work should conform to the requirements of validity and reliability.

A brief discussion of these concepts and their relevance to the current study is discussed in this section. In addition, the statistical techniques used to analyse the data are elaborated on. The computer programme developed by NMMU statistician and performed in Excel was used to do the statistical analyses.

a**)** Validity of the measuring instrument

Validity can be referred to as the best available approximation of the truth of a given proposition, inference or conclusion (Trochim, 2006). The validity of a measuring instrument refers to whether it has measured what it intended to measure (Struwig & Stead, 2013:130). In other words, it is concerned with the effectiveness and soundness of the measuring device. According to Jackson (2012:71-73), different types of validity exist, namely:

- Face validity, which refers to a situation where the questions are scrutinised to establish their relation to the subject under discussion. Thus, validity ensures the appropriateness of questions.
- Content validity, which is related to face validity and gauges the accuracy of the instrument in measuring the factors of concern to the study.
- Construct validity, which refers to the degree to which the content of the study is measured by the questionnaire.
- Criterion validity occurs when a performance measure is related to another measure that may be set as a standard against which to measure results.
- External validity refers to the degree to which the conclusion reached in a study may be generalised.
- Internal validity refers to the freedom from bias in formulating conclusions reached in a study that may be generalised.

In this study, construct validity was the method of validity that was applied. Construct validity refers to the degree to which hypotheses that are created from theoretical concepts are measured and confirmed by the measuring instrument (Zikmund, *et al.* 2010). Construct validity relies on how well the results the researcher obtains when using the measuring instrument fit with theoretical expectations (Fabrigar &

Wegener, 2012:151). It has been suggested that construct validity encompasses both criterion and content validity (Salkind, 2010:324).

The validity of this study's instruments was also based on previous studies conducted (theory). The content validity was done by asking experts to judge the guidelines included in the questionnaire. In this study, content validity was used to quantity the degree to which the individual items of the questionnaire were relevant to the theoretical framework in terms of the research objectives. Academic experts in the field of construction management assisted with the questionnaire design, thereby ensuring content validity of the research instrument.

b) Reliability of the measuring instrument

Reliability differs from validity in that it measures the accuracy of results based on their consistency, as well as the probability that if the same research were conducted in the same setting, it would yield similar results (Jackson, 2012:66-69; Zikmund, *et al.* 2010). This means that apart from delivering accurate results, the measuring instrument must deliver similar results.

Reliability has different estimates, namely, stability, equivalence and internal consistency estimates. Stability is a characteristic of a measurement scale that provides consistent results with repeat measurements. Reliability through stability is administered twice to the same subjects over an interval of less than six months, and ensures that there is a correlation. Stability also deals with more difficult and observation studies that are not easily executed (Cooper & Schindler, 2006:348; Leedy & Ormrod, 2005:68).

Equivalence is concerned with variation at one point in time among observers and sample of items. It ensures that there is consistency in the results that are repeated through measurement by the researcher. A good way to test equivalence is to compare the different scorings of the same event. In addition, equivalence allows for the parallel forms of the same test to be administered to the same respondent simultaneously (Cooper & Schindler, 2006:348; Leedy & Omrod, 2005:68).

Internal consistency is based on the assumption that the individual items or indicators of a measurement scale should all measure the same construct and, therefore, be

highly-correlated (Cooper & Schindler, 2006:348; Leedy & Omrod, 2005:68). Cronbach's alpha coefficients are commonly used to assess the internal reliability of a measuring instrument. According to George and Mallery (2003:231), a Cronbach's alpha coefficient that is greater than 0.90 indicates the reliability of a scale to be excellent, and a coefficient of greater than 0.80 indicates the reliability of a scale to be good. If the Cronbach's alpha coefficient is greater than 0.70, the reliability of the scale is considered acceptable (Nunnnally & Bernstein, 1994). In this study, reliability was confirmed by calculating Cronbach's alpha coefficients, and coefficients of less than 0.7 were considered unacceptable.

c) Descriptive statistics

Descriptive statistics were calculated to summarise the data. According to Jackson (2010:216), descriptive statistics are used to organise and present numerical data in a more clear and concise manner. The construction of a frequency distribution is one of the most common ways of recording a set of data, and begins by recording the number of times a specific value of a variable occurs (Zikmund, *et al.* 2010). The descriptive statistics calculated in this study included the means, standard deviations and frequency distributions. The "mean" refers to the average of a set of numbers. In addition, the standard deviation is a statistic that indicates how tightly all the various examples are clustered around the mean in a set of data. The standard deviation is beneficial as it can help evaluate the worthiness of the studies at hand (Gravetter & Wallnau, 2011:91).

d) Pearson's product moment correlation

Pearson's product moment correlations were used to assess the associations between the variables under investigation in this study. A correlation coefficient is a statistical measure of covariance or association between at least two variables (Zikmund, *et al*. 2010:559). According to Choudhury (2009), the Pearson's product moment correlation coefficient illustrates the direction of the relationship between the variables, as well as the strength of the relationship between them. Pearson's product moment correlation is represented by the *r.* The correlation coefficient *(r)* is the sum of the products of the deviations of each score from the mean, divided by N, times the product of the two standard deviations (Coldwell & Herbst, 2004:93).

e) Advance statistical analysis

In this study, advance statistical analysis was used to investigate the relationships between variables and constructs. First, exploratory factor analysis was done to confirm the constructs, and, thereafter, regression analysis was used to investigate the relationships. Partial correlations were used to test the hypothesis.

5.5 SUMMARY OF THE CHAPTER

In this chapter, the research paradigm was first outlined. This study made use of a quantitative research paradigm to achieve the research objectives. Although the sample of this study was drawn from building contractors in South Africa, only building contractors with a CIDB grading of 7 and above were included in the sample. The business collecting the data used an electronic survey and were instructed to ensure a sample return of 150 questionnaires. Only 133 questionnaires were useable and included in the study.

The questionnaire was develop by considering the theoretical framework developed (see Figure 4.2). The questionnaire consisted of four sections. Section 1 requested demographic information relating to both the respondents and their contactor businesses. Section 2 of the questionnaire consisted of five-point Likert-type questions investigating the causes of delays in construction. Section 3 of the questionnaires also consisted of the five-point Likert-type questions on the effects of delays in construction, whereas Section 4 of the questionnaire related to questions concerning management in construction.

To conclude, this chapter outlines the method of data analysis and how the reliability and validity of the measuring instrument was ensured. In chapter six, the results of the empirical survey are outlined and discussed.

CHAPTER SIX

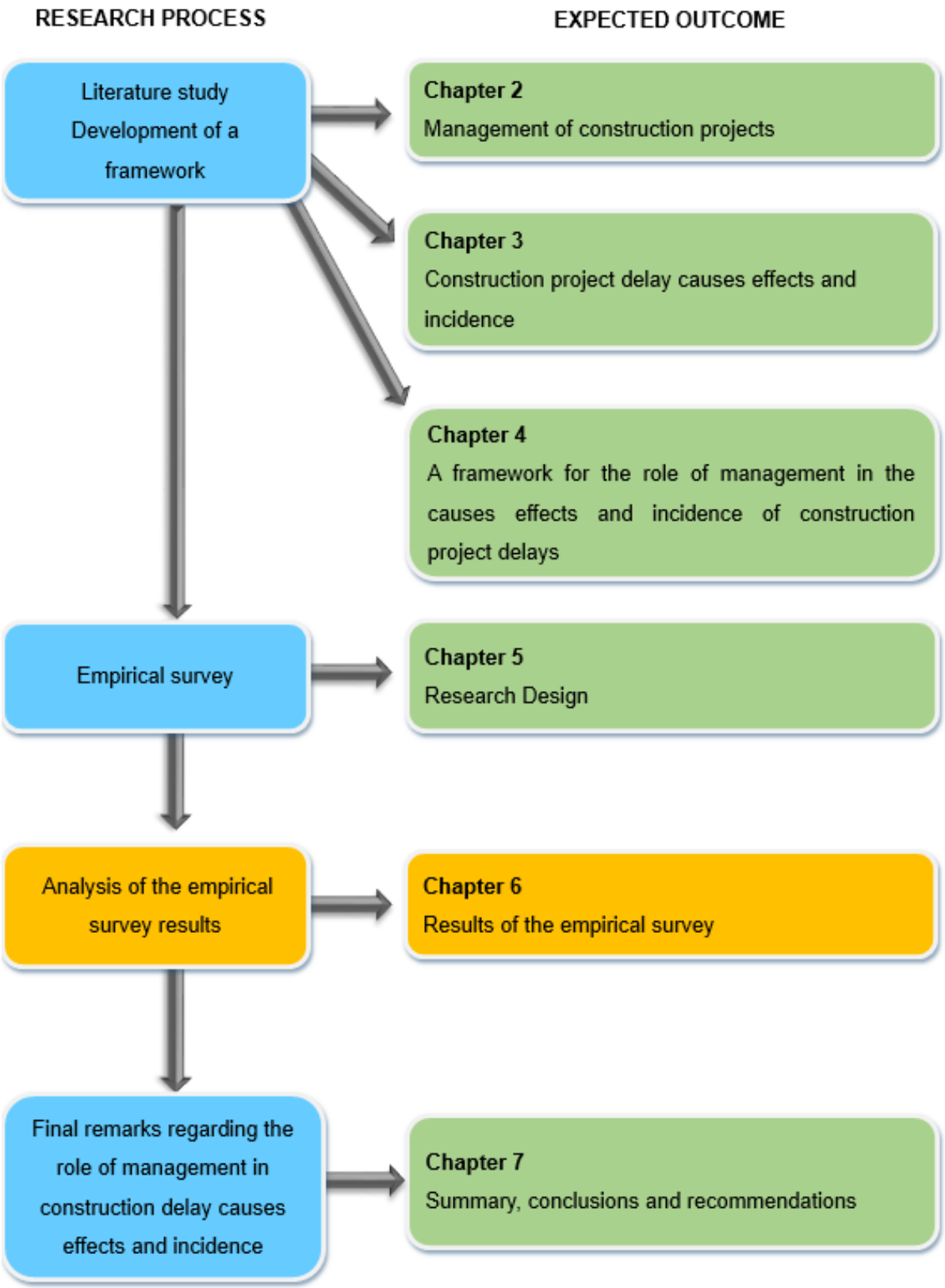
RESULTS OF THE EMPIRICAL SURVEY

6.1 INTRODUCTION

In chapter five, the research design and methods to obtain data to test the theoretical framework were outlined. This chapter outlines the results that were obtained from the empirical survey to investigate the perceptions of respondents on the role of management in the causes, effects and incidence of construction project delays. In the first section of the chapter, the demographic and sample description are discussed. Thereafter, the descriptive statistics of the questionnaire, namely, Section 2 (causes of delays in construction projects), Section 3 (effects of delays in construction projects and delay incidence) and Section 4 (management in construction projects) are outlined. The reliability and validity of the questionnaire and results of exploratory factor analysis are then provided. Thereafter, correlations, inferential ranking of factors and regression analysis results are discussed. To conclude, the hypothesis formulated in the proposed framework are tested by means of partial correlations analysis.

6.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 6.1 is reproduced to illustrate the place of chapter four within the research process.



Source: Researcher's own compilation

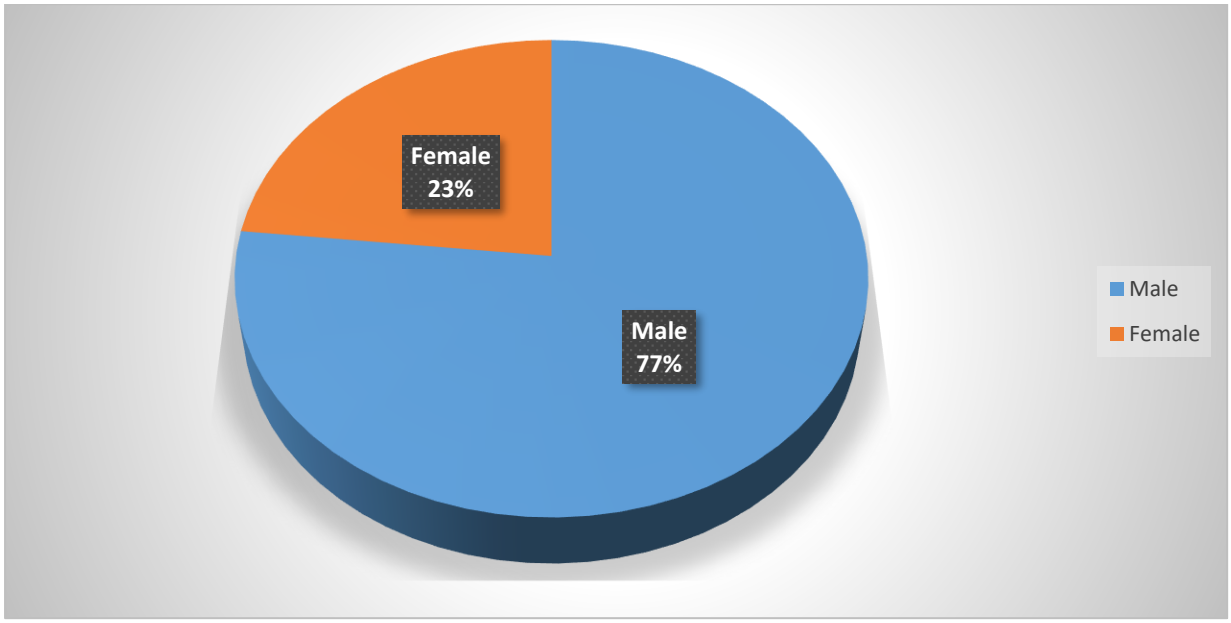
Figure 6.1: Conceptual framework of the research process

6.3 DEMOGRAPHIC AND SAMPLE DESCRIPTION

Annexure D provides a detailed outline of the frequencies of the responses in the questionnaire. The demographic and sample structure is described in terms of:

- gender
- age
- education
- how long the respondents were employed
- CIDB grade of contractor

Figure 6.1 illustrates the gender composition of the sample used in this survey.



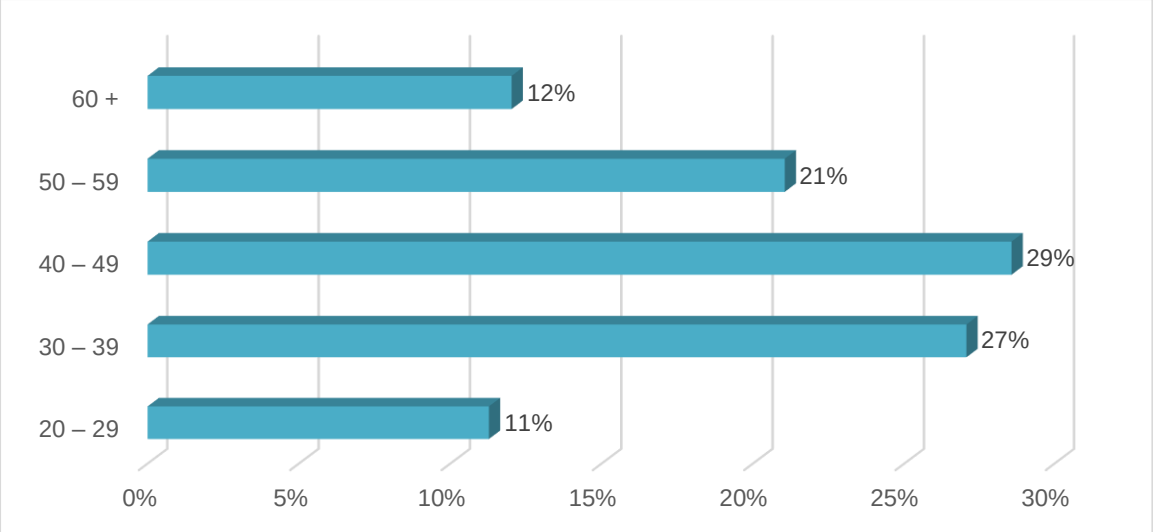
(n=133)

Source: Researcher's own compilation

Figure 6.2: Respondent gender composition

As indicated in Figure 6.2, 77% of the respondents were male, whereas 23% were female. The reason for the skewed sample might be the male-dominated orientation of the construction industry.

Figure 6.2 illustrates the age distribution of the sample used in this survey.

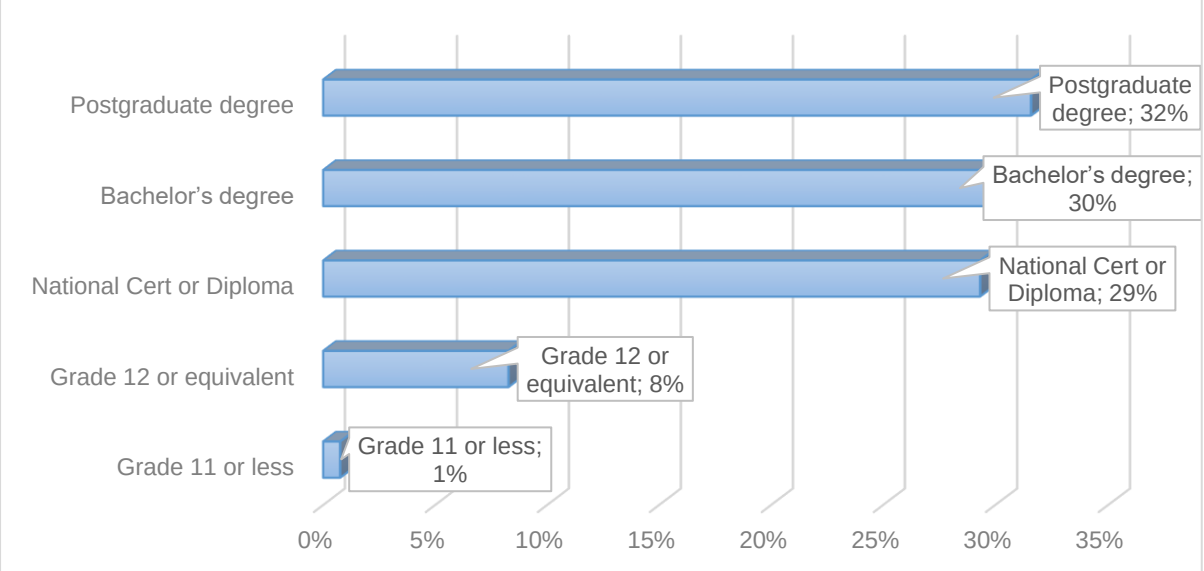


(n=133)

Source: Researcher's own compilation

Figure 6.3: Respondent age distribution

Figure 6.3 illustrates that the majority of the respondents or 29% were between the ages of 40 and 49 years. This shows that the respondents should be well-established in their careers. Figure 6.3 illustrates the education level of the sample respondents included in this survey.



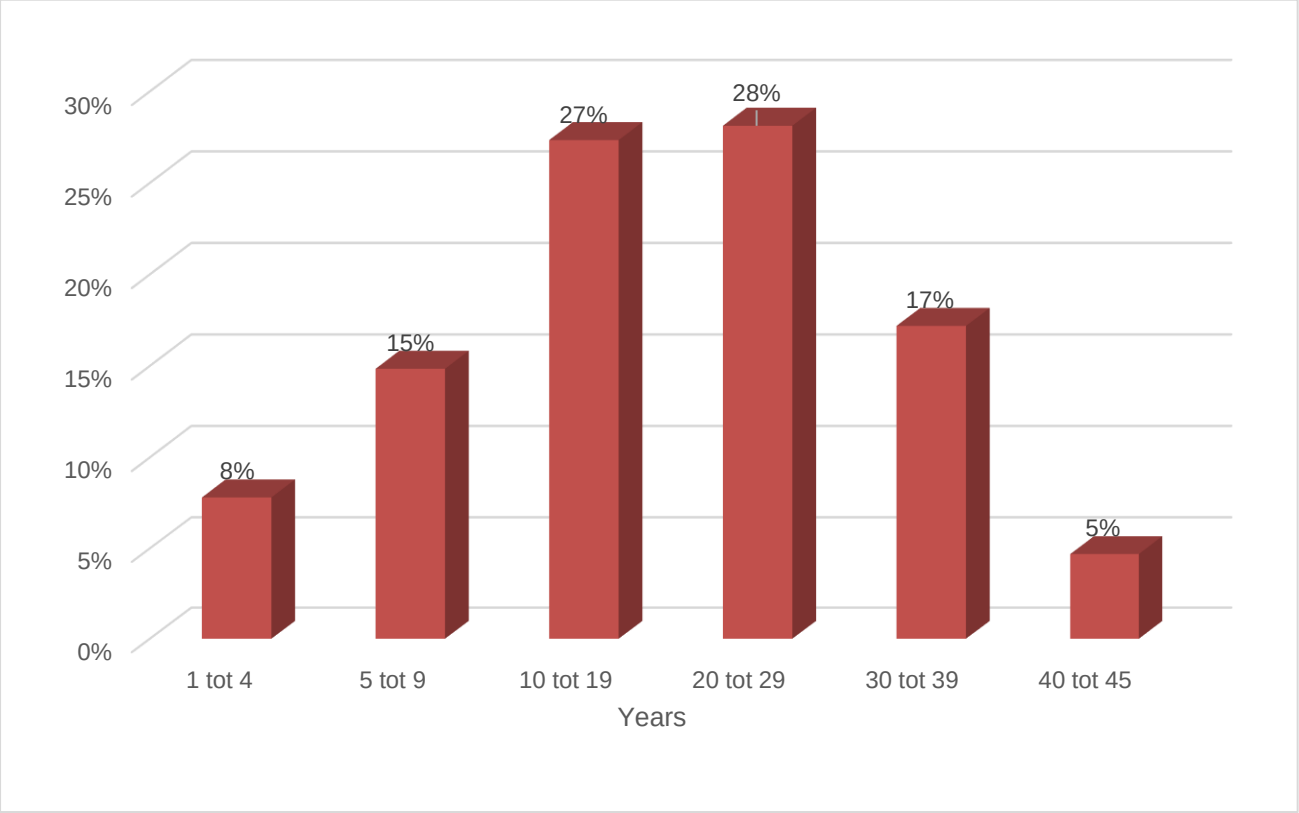
(n=133)

Source: Researcher's own compilation

Figure 6.4: Respondent education level

Figure 6.4 illustrates that the majority of the respondents had a degree or post-graduate degree (30% + 32% = 62%).

Figure 6.4 illustrates the years that the respondents were employed.



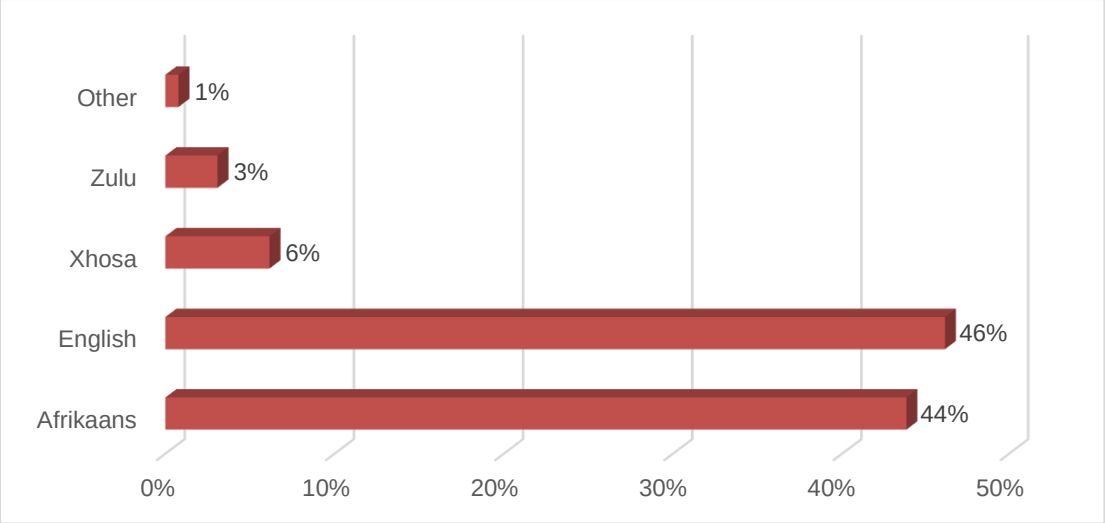
(n=133)

Source: Researcher's own compilation

Figure 6.5: Respondent number of years employed

Figure 6.5 shows that the majority of the respondents were employed for 10 years or more (27% +28%+17%+5% = 77%).

Figure 6.5 illustrates the home language of the respondents.

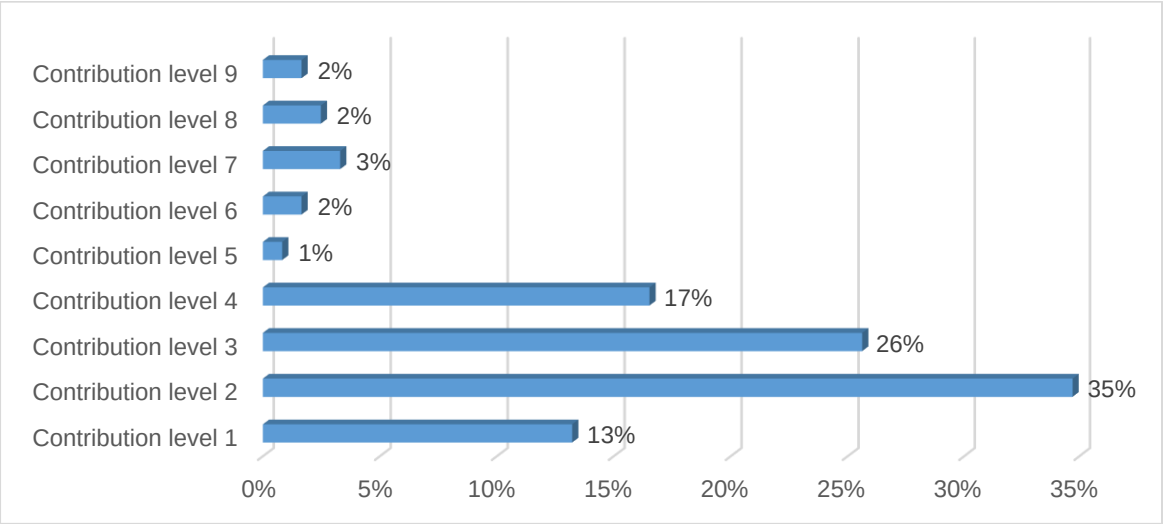


(n=133)

Source: Researcher's own compilation

Figure 6.6: Respondent home languages

Figure 6.6 shows that the home language of 44% of the respondents was Afrikaans, 46% were English and only 9% of the respondents' home language was an Indigenous language. Figure 6.6 illustrates the BBBEE Level of contribution of the respondents.



(n=133)

Source: Researcher's own compilation

Figure 6.7: Respondent BBBEE level of contribution

Figure 6.7 shows that the majority of respondents had a level 1 to 4 BBBEE contribution. BBBEE rating levels helped to categorise the BBBEE contributor status and thus compliance with the requirements in terms of Broad Based Black Economic Empowerment or BBBEE. Businesses with excellent BBBEE rating levels benefited from access to preferential procurement and government licenses. Level 4 to Level 1 are considered as fully-compliant (BBBEE rating levels, 2016).

6.4 FREQUENCIES AND DESCRIPTIVE STATISTICS OF QUESTIONNAIRE SECTIONS 2, 3 AND 4

This sections describes the results of the frequencies and descriptive statistics.

6.4.1 Frequencies of the responses

Annexure C provides detailed frequencies for the responses to the questionnaire. The important findings from the frequency distributions of the responses include causes, effects, incidence and management of construction delays.

a) Causes of delays in construction project

Respondents stated that the appointment of unsuitable contractors to projects followed by unrealistic period to complete the project and funds that were not adequately released during the phases in construction were the most frequent causes of construction delays. They further argued that client-related issues were the most important reasons for construction delays.

b) Effects of delays in construction projects

The most serious effect of construction project delays was that the original projected costs of the budget was exceeded, followed by a time extension.

c) Incidence of construction projects

The average duration of a construction delay reported by the respondents in the survey was 30 days. Respondents further stated that they experienced significant delays in 20% of their projects.

d) Management of construction projects

Respondents felt that monthly progress/technical meetings was the single most important management practice that prevented construction delays, The single most important management practice to mitigate construction delays was comprehensive design preparation. Thus, control would prevent construction delays whereas planning was perceived as the management practice that would lessen construction delays.

6.4.2 Descriptive statistics

Descriptive statistics provided summaries of the measures in the questionnaire. Since the summary describing the sample was provided in Section 6.2, this section outlines the descriptive results of the main constructs/factors (a number of variables), namely, Sections 2, 3 and 4 of the questionnaire. Table 6.1 provides the mean and standard deviation of Sections 2, 3 and 4 of the questionnaire.

Table 6.1: Mean and standard deviation of constructs in the causes and effects in construction delays and constructs measuring management in construction projects

CONSTRUCT	N	MEAN	S.D.	INFERENTIAL RANKING
Causes Of Construction Delays (Section 2)				
Client related causes	133	2.92	0.64	1
Contractor related causes	133	2.71	0.75	2
Labour/Equipment causes	133	2.53	0.67	3
Material related causes	133	2.49	0.59	3
Consultant related causes	133	2.66	0.56	2
Community related causes	133	2.21	0.77	4
Contractual related causes	133	2.43	0.64	3
External natural causes	133	2.80	0.96	1
External human causes	133	2.35	0.73	4
Delay causes	*133*	*2.57*	*0.43*	

CONSTRUCT	N	MEAN	S.D.	INFERENTIAL RANKING
Effects Of Construction Delays (Section 3)				
Financial effects	133	3.18	0.77	1
Human effects	132	2.55	0.64	2
Legal effects	132	2.36	0.75	3
Delay effects	*132*	*2.70*	*0.62*	
Construction Delay Incidence (Section 3)				
Frequency	132	3.02	0.83	2
Duration	133	3.40	0.59	1
Delay incidence	*133*	*3.21*	*0.59*	
Management of Construction projects (Section 4)				
Planning	131	3.10	0.77	2
Organising	131	2.84	0.82	3
Leading	131	2.88	0.83	3
Controlling	133	3.42	0.78	1
Management	*131*	*3.06*	*0.72*	

Source: Researcher's own compilation

The constructs in Table 6.1 were measured with five-point Likert-type scales. For the questionnaire, inferential ranking 1 and 2 represented that the respondents seldom or never experienced delays, 3 was that they regularly experienced delays and 4 and 5 meant that the respondents often or always experienced delays. In Section 2 of the questionnaire, a 1 would thus mean that the respondent had never been involved in construction delays whereas 5 would mean they were always involved in construction delays. In Section 3 of the questionnaire, a 1 would indicate that the projects the respondents had never been involved in the specified construction delay effect whereas 5 indicated that they had always had that effect. In Section 4 of the questionnaire, a 1 would mean that the specified management practice were never adopted to prevent or mitigate construction delays whereas 5 meant that it was always adopted.

The mean scores of the variables of Section 2 of the questionnaire as indicated in Table 6.1, therefore, indicated that overall, respondents had regularly experience most of the causes of construction delays (most mean values > 2.5). The results in

Table 6.1 for Section 3 of the questionnaire indicated that financial effects were most often the effect of construction delays (mean value highest 3.18). Controlling seemed to be the management function mostly adopted to manage the effect of construction delays.

6.5 RESULTS OF VALIDITY OF THE QUESTIONNAIRE

A questionnaire's scores were considered valid if the questionnaire measures what it purports to measure (Struwig & Stead, 2013:138). The validity of a measuring instrument's scores refers to the extent to which the instrument measures what it is intended to measure. Validity tests ensure that the instrument used to collect data actually measures what it sets out to measure (Struwig & Stead, 2013).

Face and content validity were used to ensure the validity of the study's questionnaire. To ensure face validity, the researcher checked that items related to the topic. To further ensure face validity, a pilot study was conducted to pre-test the questionnaire (See section 5.3.4 for description of the pilot study).

6.6 RELIABILITY RESULTS OF THE QUESTIONNAIRE

Before more advance statistics were used, reliability tests were conducted to ensure that errors to measure variables were absent or minimal. Reliability tests specifically ensure that a questionnaire can be consistently interpreted across different samples and situations. Saunders, Lewis and Thornhill (2007) state that reliability in research can be measured by answering the following questions:

- Will the questionnaire yield similar results in different instances?
- Will similar observations be made by different researchers?
- Is the process of data analysis clear and objectively performed?

Statistica 10 was used to test for internal reliability of the questionnaire to determine the degree to which the test scores were accurate and consistent. The test scores were assessed for internal consistency by obtaining Cronbach's coefficient alpha. The results of the reliability tests conducted on this study's questionnaire are presented in Table 6.2.

Table 6.2: Cronbach alpha coefficients for the factors

Construct	Alpha	2nd round	Final Alpha	
Client related causes	0.83		0.83	
Contractor related causes	0.87		0.87	
Labour/Equipment issues	0.64		0.64	Note a
Material related issues	0.75		0.75	
Consultant related issues	0.84		0.84	
Community related issues	0.86		0.86	
Contractual related issues	0.78		0.78	
External natural cause	0.61	0.29	-	Note b
External human cause		0.66	0.66	
Delay causes	0.85		0.78	
Financial effects	0.69		0.69	
Human effects	0.67		0.67	Note c
Legal effects	0.83		0.83	
Delay effect	0.81		0.81	
Frequency	-		-	
Duration	0.74		0.74	
Delay incidence	0.52		0.52	Note d
Planning	0.90		0.90	
Organising	0.91		0.91	
Leading	0.87		0.87	
Controlling	0.93		0.93	
Management	0.92		0.92	

N=133
Source: Researcher's own compilation

Table 6.2 shows that the constructs delays, construction effect and management all have acceptable Cronbach alphas. It should be stated that delay incidence had a small Cronbach alpha and the construct was not used. The only dimension that would be used in analysis (see note d) was the duration. Further explanation of the notes indicate the following:

- Note a:

If "2.18 Labour or unrest disputes" was removed, then alpha improves to 0.70 but it results in inferior content validity, because it is the only item about labour disputes. Removing any other items results in a poor alpha.

Decision:

It was decided not to remove 2.18 and to work with it as it was.

- Note b:

Item "2.41 Natural disasters" was very skewed with 94% of the responses either being 1 or 2.

Decision:

It was decided to remove 2.41 and only "2.40 inclement weather conditions" as a single indicator for External Natural causes was used.

- Note c:

If "3.12 Stress on contractors" was removed, then alpha improves non-significantly to 0.68. Removing any other items would result in a poor alpha.

Decision:

It was decided to remove nothing and leave it as it was.

6.7 CORRELATION ANALYSIS

Correlation analysis measures the relationship between continuous variables (DeCoster, 2004). The further away the value of the correlation is from the centralised '0' the more it shows increased strength of the relationship, ranging to both -1.0 and 1.0. The direction of the relationship is identified by a negative or positive sign. The closer the correlation coefficient is to 1.0, the stronger the relationship between variables. Positive correlation coefficients indicate that higher variable 1 values tend to correspond with higher variable 2 values, whilst a negative correlation indicates a

relationship in the opposite direction. Therefore, higher variable 1 values tend to correspond with lower variable 2 values.

Taylor (1990) provides the following guidelines for interpreting a correlation coefficient (*r*):

- -1.0 to -0.5 Strong negative relationship
- -0.5 to -0.3 Moderate negative relationship
- -0.3 to -0.1 Weak negative relationship
- -0.1 to 0.1 No or very weak relationship
- 0.1 to 0.3 Weak positive relationship
- 0.3 to 0.5 Moderate positive relationship
- 0.5 to 1.0 Strong positive relationship

These guidelines were used to interpret the correlation coefficients calculated in this study.

The four constructs used in this study were the respondents' perceptions of the construction delays, construction effects, incidence of construction delays and the management of construction projects.

Table 6.3 shows the results of the correlation coefficients of the four constructs measured by in Section 2, 3 and 4 of the questionnaire.

Table 6.3: Correlation coefficients for the four constructs

	Delay Causes	Delay Effects	Delay Incidence	Management
Delay Causes	-	***.718***	***.564***	.095
Delay Effects	***.718***	-	***.691***	-.020
Delay Incidence	***.564***	***.691***	-	.017
Management	.095	-.020	.017	-

Source: Researcher's own compilation

Table 6.3 shows that the constructs (indicated in red) show statistical significant correlations. The correlations for the constructs delay causes, delay effect and delay incidence were strong (above 0,5). There is no statistical correlation with the construct

management. Respondents might perceive management as important, but that there was no correlation with delay causes, delay effects and delay incidence. Table 6.4 provides the correlation for the construct management with the other three constructs.

Table 6.4: Pearson moment correlations of management functions

Factors	Planning	Organi -sing	Leading	Control	Overall Manage- ment
Delay Cause Client related	-.003	.004	-.070	-.019	-.028
Delay Cause Contractor related	-.089	.022	-.074	-.155	-.080
Delay Cause Labour/ Equipment	.103	.158	.048	-.018	.087
Delay Cause Material related	.119	.142	.099	.053	.116
Delay Cause Consultant related	.096	.128	.070	.024	.085
Delay Cause Community related	.042	.232	.071	-.019	.093
Delay Cause Contractual related	.001	.175	-.004	-.089	.023
Delay Cause External Natural	.081	-.018	.070	.101	.062
Delay Cause External Human	.123	.241	.178	.078	.175
Delay Cause	.084	.189	.072	-.004	.095
Delay Effect Financial	.022	.045	-.018	-.037	.004
Delay Effect Human	-.023	.016	-.001	-.095	-.028
Delay Effect Legal	-.027	.027	-.045	-.063	-.029
Delay Effect	-.010	.035	-.026	-.075	-.020
Delay Incidence Frequency	.056	.079	.016	-.048	.029
Delay Incidence Duration	.031	-.087	-.020	.060	-.006
Delay Incidence	.055	.012	.001	-.005	.017
Planning	-	***.730***	***.740***	***.767***	***.896***
Organising	***.730***	-	***.743***	***.715***	***.888***
Leading	***.740***	***.743***	-	***.778***	***.909***
Controlling	***.767***	***.715***	***.778***	-	***.904***
Management	***.896***	***.888***	***.909***	***.904***	-

Source: Researcher's own compilation

Table 6.4 shows that the only significant correlations between the management variables and the three constructs variables of delay causes, delay effects and delay incidence, were found in:

- Organising: There was a small significant correlation between organising and delay cause community, delay cause contractual and delay cause external human
- Leadership: The only significant correlation for leadership was found with delay cause external human

The management functions were highly-significantly correlated with each other and all were above 0.5.

6.8 RESULTS OF THE EXPLORATORY FACTOR ANALYSIS

Factor analysis was used to measure the variability among correlated variables so that underlying factors might be detected. These might show joint variations among the observed variables, and show up hidden factors not previously observed. Factor analysis could be used to explore the data for patterns, and reduce the numerous variables to a more controllable number (Abdi, 2003). Table 6.5 shows the results of the exploratory factor analysis of the delay causes using Varimax rotation and selecting loadings >.478.

Table 6.5: Results of exploratory factor analysis for the delay causes

	Factor 1	Factor 2
	HM1	CLW2
Delay Cause Client related	.715	.266
Delay Cause Contractor related	.824	.112
Delay Cause Labour/Equipment	.690	.369
Delay Cause Material related	.662	.239
Delay Cause Consultant related	.582	.485
Delay Cause Community related	.159	.759
Delay Cause Contractual related	.288	.792
Delay Cause External Natural	-.458	.499
Delay Cause External Human	.391	.618

	Factor 1	Factor 2
	HM1	CLW2
Expl.Var	2.92	2.35
Prp.Totl	32.4%	26.1%

Source: Researcher's own compilation

Table 6.5 shows that only two factors were extracted. Factor 1 related to human and material related causes (HM1) while factor 2 related to community, legal and weather related factors (CLW 2). These two factors would be used in testing the hypotheses.

6.9 REGRESSION ANALYSIS

In this study, multiple regression analysis was employed to test the influence of the independent variables on the dependent variables. More specifically, stepwise regression analysis was adopted in this study. Stepwise multiple regression analysis is a model-building technique that finds subsets of independent variables that most effectively explains the influence on a dependent variable (StatSoft 2013). In this study, stepwise regression was used for two purposes. Firstly, to test the influences of the respondents' education and years employed, delay causes and management towards the effect of delays. The second purpose of the stepwise regression was to establish whether the respondents' education and years employed s, delay cause and management had a relationship with the incidence of delays. Table 6.6 provides the regression results for financial delay effects.

Table 6.6: Regression results for financial delay effects

Regression Summary for Dependent Variable: Financial Delay Effect (n = 127) R^2= .412; Adjusted R^2= .383 F(6,120)=14.04; p<.0005; Std.Error of estimate: .585				
	Coefficients	Std.Err.	t(120)	p-value
Intercept	0.5219	0.367	1.423	.157
Education.No Degree	0.0167	0.133	0.125	.900
Education.PostGrad	-0.0340	0.134	-0.254	.800
Employed	0.0041	0.005	0.856	.394
Delay Cause 1 (HM1)	0.9376	0.126	7.450	.000
Delay Cause 2 (CLW 2)	0.0398	0.107	0.371	.711

Regression Summary for Dependent Variable: Financial Delay Effect (n = 127) R^2= .412; Adjusted R^2= .383 F(6,120)=14.04; p<.0005; Std.Error of estimate: .585				
Management	-0.0068	0.077	-0.089	.929
Stepwise Regression results: Regression Summary for Dependent Variable: Financial Delay Effect (n = 127) R^2= .407; Adjusted R^2= .403 F(1,125)=85.90; p<.0005; Std.Error of estimate: .576				
	Coefficients	Std.Err.	t(125)	p-value
Intercept	0.5653	0.286	1.979	.050
Delay Cause1 (HM1)	0.9757	0.105	9.268	.000

Source: Researcher's own compilation

Table 6.6 shows that Delay Cause 1 had a positive significant influence on the effect of financial delays (b=0.9757; p=0.000). Thus, Delay Cause 1 would influence the effect of financial delays. An increase in client, contractor, labour and material related as well as consultant causes of delays would lead to an increase in the financial effect of the delays. It further shows that the respondents' education and years employed had no significant influence on the financial effect of delays.

Table 6.7 provides the regression results for human delay effects.

Table 6.7 Regression results for human delay effects

Regression Summary for Dependent Variable: DE Human (n = 127) R^2= .462; Adjusted R^2= .435 F(6,120)=17.15 p<.0005; Std.Error of estimate: .472				
	Coefficients	Std.Err.	t(120)	p-value
Intercept	0.3650	0.296	1.234	.220
Education.No Degree	0.2109	0.107	1.968	.051
Education.PostGrad	0.1749	0.108	1.618	.108
Employed	-0.0056	0.004	-1.470	.144
Delay Cause 1 (HM1)	0.6862	0.101	6.762	.000
Delay Cause 2 (CLW 2)	0.2228	0.087	2.573	.011
Management	-0.0646	0.062	-1.045	.298

Regression Summary for Dependent Variable: DE Human (n = 127) R^2= .462; Adjusted R^2= .435 F(6,120)=17.15 p<.0005; Std.Error of estimate: .472				
Stepwise Regression results: Regression Summary for Dependent Variable: DE Human (n = 127) R^2= .433; Adjusted R^2= .424 F(2,124)=47.32; p<.0005; Std.Error of estimate: .477				
	Coefficients	Std.Err.	t(124)	p-value
Intercept	0.2135	0.244	0.876	.382
Delay Cause 1 (HM1)	0.6889	0.102	6.749	.000
Delay Cause 2 (CLW 2)	0.2117	0.086	2.461	.015

Source: Researcher's own compilation

Table 6.7 shows that Delay Cause 1 and Delay Cause 2 had a positive significant influence on the effect of human delays (b=0.6889; p=0.000) and (b=0.2117; p= 0.015). Thus, Delay Cause 1 and Delay Cause 2 would influence the effect of human delays. An increase in client, contractor, labour and material related as well as consultant causes of delays (Delay Cause 1) and community, contractual, external natural and external human causes of delay (Delay Cause 2) would lead to an increase in the human effect of the delays. It further shows that the respondents' education and years employed had no significant influence on the human effect of delays.

Table 6.8 provides the regression results for legal delay effects

Table 6.8: Regression results for legal delay effects

Regression Summary for Dependent Variable: DE Legal (n = 127) R^2= .303; Adjusted R^2= .268 F(6,120)=8.70 p<.0005; Std.Error of estimate: .607				
	Coefficients	Std.Err.	t(120)	p-value
Intercept	0.4414	0.380	1.161	.248
Education.No Degree	0.1561	0.138	1.133	.260
Education.PostGrad	0.2745	0.139	1.976	.050
Employed	-0.0053	0.005	-1.063	.290
Delay Cause 1 (HM1)	0.4783	0.130	3.666	.000
Delay Cause 2 (CLW 2)	0.3602	0.111	3.236	.002
Management	-0.0789	0.079	-0.993	.323

Regression Summary for Dependent Variable: DE Legal (n = 127) R^2= .303; Adjusted R^2= .268 F(6,120)=8.70 p<.0005; Std.Error of estimate: .607				
Stepwise Regression results: Regression Summary for Dependent Variable: DE Legal (n = 127) R^2= .286; Adjusted R^2= .269 F(3,123)=16.43; p<.0005; Std.Error of estimate: .607				
	Coefficients	Std.Err.	t(123)	p-value
Intercept	0.2142	0.317	0.675	.501
DC.1	0.4783	0.130	3.682	.000
DC.2	0.3489	0.110	3.166	.002
Educ.PostGrad	0.1805	0.116	1.554	.123

Source: Researcher's own compilation

Table 6.8 shows that Delay Cause 1 and Delay Cause 2 had a positive significant influence on the effect of legal delays (b=0.4783; p=0.000) and (b=0.3602; p= 0.002). Thus Delay Cause 1 and Delay Cause 2 would influence the fffect of legal delays. An increase in client, contractor, labour and material related as well as consultant causes of delays (Delay Cause 1) and community, contractual, external natural and external human causes of delay (Delay Cause 2) would lead to an increase in the legal effect of the delays. It further shows that the respondents' education and years employed had no significant influence on the human effect of delays. Table 6.9 provides the regression results for delay incidence frequency.

Table 6.9: Regression results for delay incidence frequency

Regression Summary for Dependent Variable: DI Freq (n = 127) R^2= .310; Adjusted R^2= .275 F(6,120)=8.98; p<.0005; Std.Error of estimate: .691				
	Coefficients	Std.Err.	t(120)	p-value
Intercept	0.6671	0.433	1.542	.126
Educ.No Degree	0.2198	0.157	1.402	.164
Educ.PostGrad	-0.0886	0.158	-0.561	.576
Employed	0.0021	0.006	0.367	.714
DC.1	0.7012	0.148	4.722	.000
DC.2	0.1886	0.127	1.488	.139
DM	-0.0164	0.090	-0.181	.857

Regression Summary for Dependent Variable: DI Freq (n = 127) R^2= .310; Adjusted R^2= .275 F(6,120)=8.98; p<.0005; Std.Error of estimate: .691				
Stepwise Regression results: Regression Summary for Dependent Variable: DI Freq (n = 127) R^2= .307 ;Adjusted R^2= .290 F(3,123)=18.18; p<.0005; Std.Error of estimate: .683				
	Coefficients	Std.Err.	t(123)	p-value
Intercept	0.6005	0.350	1.718	.088
DC.1	0.7023	0.147	4.791	.000
Educ.No Degree	0.2601	0.127	2.043	.043
DC.2	0.1924	0.124	1.547	.124

Source: Researcher's own compilation

Table 6.9 shows that only Delay Cause 1 had a positive significant influence on the delay incidence frequency (b=0.7012; p=0.000) and (b=0.2117; p= 0.015). Thus, Delay Cause 1 would influence the delay incidence frequency. It should be noted the stepwise regression showed that education no degree had a positive significant influence on the delay incidence frequency (B=0,2601; p=0.43). An increase in client, contractor, labour and material related as well as consultant causes of delays (Delay Cause 1) and education no degree would lead to an increase in the delay incidence frequency. It further shows that Delay Cause 2 and respondents' years employed had no significant influence on the delay incidence frequency. Table 6.10 provides the regression results for delay incidence duration.

Table 6.10: Regression results for delay incidence duration

Regression Summary for Dependent Variable: DI Dur (n = 127) R^2= .230; Adjusted R^2= .191 F(6,120)=5.97; p<.0005; Std.Error of estimate: .533				
	Coefficients	Std.Err.	t(120)	p-value
Intercept	2.1266	0.334	6.368	.000
Educ.No Degree	-0.1133	0.121	-0.936	.351
Educ.PostGrad	-0.0311	0.122	-0.255	.799
Employed	-0.0073	0.004	-1.681	.095
DC.1	0.6486	0.115	5.660	.000
DC.2	-0.1694	0.098	-1.732	.086
DM	0.0432	0.070	0.619	.537

Regression Summary for Dependent Variable: DI Dur (n = 127) R^2= .230; Adjusted R^2= .191 F(6,120)=5.97; p<.0005; Std.Error of estimate: .533				
Regression Summary for Dependent Variable: DI Dur R= .47188912 R^2= .22267934 Adjusted R^2= .20372030 F(3,123)=11.745 p<.00000 Std.Error of estimate: .52890				
N=127	b	Std.Err.	t(123)	p-value
Intercept	2.2303	0.275	8.106	.000
DC.1	0.6419	0.114	5.655	.000
DC.2	-0.1718	0.096	-1.798	.075
Employed	-0.0073	0.004	-1.719	.088

Source: Researcher's own compilation

Table 6.10 shows that Delay Cause 1 had a positive significant influence on the delay incidence duration (b=0.6486; p=0.000). Thus Delay Cause 1 would influence the delay incidence duration. An increase in client, contractor, labour and material related as well as consultant causes of delays (Delay Cause 1) would lead to an increase in the delay incidence duration. It further showed that Delay Cause 2, respondents' education and years employed had no significant influence on the delay incidence duration.

6.10 PARTIAL CORRELATIONS AND TESTING THE HYPOTHESES

Partial correlation is the relationship between two variables while controlling for a third variable. The purpose is to find the unique variance between two variables while eliminating the variance from a third variables. Partial correlation is a measure of the strength and direction of a linear relationship between two continuous variables whilst controlling for the effect of one or more other continuous variables (also known as 'covariates' or 'control' variables). Although partial correlation does not make the distinction between independent and dependent variables, the two variables are often considered in such a manner (there is one continuous dependent variable and one continuous independent variable as well as one or more continuous control variables). Partial correlation analysis involves studying the linear relationship between two variables after excluding the effect of one or more independent factors.

6.10.1 Relationship between demographics and managing functions in construction projects

Hypothesis one was formulated as:

H_1: Demographics of contractors predict the management functions employed in construction project delays

To test this hypothesis partial correlations were employed. Table 6.11 provides the partial correlations to investigate the relationship between the respondents' education and years employed (demographics) and management functions in construction projects.

Table 6.11: Partial correlations of education and years employed and management functions in construction projects

Partial Correlations for H_1							
		Planning	Organising	Leadership	Control		
	Educ.No Degree	.212	.234	.276	.195		
	Educ.PostGrad	.096	.038	.124	-.001		
	Employed	.068	.040	.080	.067		
Planning	**Regression Summary Statistics for Planning**						
		R= .22950555 R^2= .05267280 Adjusted R^2= .02956726 F(3,123)=2.2797 p<.08274 Std.Error of estimate: .74433					
	n=127	b*	Std.Err.	B	Std.Err.	t(123)	p-value
	Intercept			2.808824	0.156813	17.91192	0.000000
	Educ.No Degree	0.251716	0.104724	0.390702	0.162548	2.40361	0.017727
	Educ.PostGrad	0.112768	0.105312	0.181515	0.169514	1.07080	0.286358
	Employed	0.066906	0.088799	0.004526	0.006006	0.75346	0.452614
Organising	**Regression Summary Statistics for Organising**						
		R= .26175448 R^2= .06851541 Adjusted R^2= .04579627 F(3,123)=3.0158 p<.03258 Std.Error of estimate: .79457					
	n=127	b*	Std.Err.	b	Std.Err.	t(123)	p-value
	Intercept			2.598748	0.167397	15.52447	0.000000
	Educ.No Degree	0.277774	0.103845	0.464144	0.173519	2.67490	0.008492
	Educ.PostGrad	0.044118	0.104428	0.076448	0.180955	0.42247	0.673419
	Employed	0.039463	0.088053	0.002874	0.006412	0.44818	0.654814

Partial Correlations for H_1							
		Planning	Organising	Leadership	Control		
Leading	**Regression Summary Statistics for Leadership**						
		R= .29550458 R^2= .08732296 Adjusted R^2= .06506254 F(3,123)=3.9228 p<.01028 Std.Error of estimate: .80646					
	n=127	b*	Std.Err.	b	Std.Err.	t(123)	p-value
	Intercept			2.488633	0.169902	14.64743	0.000000
	Educ.No Degree	0.327669	0.102791	0.561409	0.176116	3.18773	0.001818
	Educ.PostGrad	0.143808	0.103368	0.255517	0.183663	1.39123	0.166668
	Employed	0.077551	0.087160	0.005790	0.006508	0.88976	0.375330
Controlling	**Regression Summary Statistics for Controlling**						
		R= .24094012 R^2= .05805214 Adjusted R^2= .03526308 F(3,124)=2.5474 p<.05897 Std.Error of estimate: .75683					
	n=128	b*	Std.Err.	b	Std.Err.	t(124)	p-value
	Intercept			3.211549	0.157471	20.39457	0.000000
	Educ.No Degree	0.228837	0.103582	0.362793	0.164216	2.20924	0.028994
	Educ.PostGrad	-0.001442	0.104193	-0.002371	0.171389	-0.01384	0.988983
	Employed	0.065594	0.088295	0.004531	0.006099	0.74290	0.458950

Source: Researcher's own compilation

From Table 6.11, the following can be reported on whether demographics predicted the management functions in a construction project:

- Management function: Planning

The results of R^2_{adj} = 0.029 [(F(3,123) = 2.2797, p = 0.08274]. This means that demographics did not significantly predict planning in construction projects. In other words, demographics did not influence how constructions managers of all ages and years of employment executed planning in construction projects.

- Management function: Organising

The results of R^2_{adj} = 0.05 [(F(3,123) = 3.0158, p = 0.03258]. This means that demographics significantly predicted organising in construction projects. In other words, demographics influenced how construction managers of all ages and years of employment executed organising in construction projects. In particular, those managers with no degree had a statistical significant relationship with how they executed leadership and control in construction projects.

- Management function: Leadership

The results of R^2_{adj} = 0.065 [(F(3,123) = 3.9228, p = 0.01028]. This means that demographics, significantly predicted leadership in construction projects. In other words, demographics influenced how contractors of different ages executed leadership in construction projects.

- Management function: Control

The results of R^2_{adj} = 0.035 [(F(3,124) = 2.5474, p = 0.05897]. This means that demographics did not significantly predict control in construction projects. In other words, demographics did not influence how construction managers of all ages and years of employment executed control in construction projects.

Demographics thus predicted two of the four functions of management, namely, organising and leading. H_1 could thus partially be accepted.

6.10.2 Relationship between causes of construction project delays and management functions in construction projects

Hypothesis two was formulated as:

H_2: Management functions employed in construction project delays predict the causes of construction project delays

To test this hypothesis, partial correlations were employed. Table 6.12 provides the partial correlations to investigate the relationship between the causes of construction project delays and management functions in construction projects. In this case, the two factors extracted in the factor analysis were used for the causes of construction delays (Factors 1 and 2).

Table 6.12: Partial correlations of management functions employed and causes of construction project delays

Partial Correlations for $H_{1.2}$									
	DC Client	DC Contr	DC Lab.Eq	DC Mat	DC Cons	DC Com	DC Ext.N	DC Contl	DC Ext.H
DM Plan	.041	-.036	.084	.061	.071	-.061	.060	-.019	-.032
DM Org	.059	.179	.182	.098	.118	.331	-.145	.327	.207
DM Lead	-.106	-.004	-.041	.015	.013	.001	.038	-.037	.086
DM Contr	-.004	-.172	-.149	-.090	-.133	-.193	.074	-.233	-.134

Regression Summary Statistics for Delay Cause Client Related Factor 1						
	R= .11699964 R^2= .01368891 Adjusted R^2= ----- F(4,126)=.43719 p<.78154 Std.Error of estimate: .64722					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.97243	0.263440	11.28314	0.000000
DM Plan	0.071451	0.154521	0.059756	0.129228	0.46240	0.644590
DM Org	0.097952	0.146544	0.076528	0.114492	0.66841	0.505092
DM Lead	-0.190034	0.159400	-0.147085	0.123374	-1.19219	0.235429
DM Contr	-0.007540	0.160310	-0.006205	0.131928	-0.04703	0.962562

Regression Summary Statistics for Delay Cause Contractor Related Factor 1						
	R= .24272248 R^2= .05891420 Adjusted R^2= .02903846 F(4,126)=1.9720 p<. 0.02038 Std.Error of estimate: .74092					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			3.174357	0.301581	10.52573	0.000000
DM Plan	-0.061597	0.150937	-0.060373	0.147938	-0.40810	0.683893
DM Org	0.292250	0.143145	0.267593	0.131068	2.04164	0.043275
DM Lead	-0.006836	0.155702	-0.006201	0.141236	-0.04391	0.965048
DM Contr	-0.307386	0.156592	-0.296464	0.151028	-1.96298	0.051852

Regression Summary Statistics for Delay Cause Labour Related Factor 1						
	R= .24100074 R^2= .05808135 Adjusted R^2= .02817918 F(4,126)=1.9424 p<.10744 Std.Error of estimate: .65899					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.394737	0.268230	8.92792	0.000000
DM Plan	0.143375	0.151004	0.124930	0.131578	0.94948	0.344196
DM Org	0.296879	0.143208	0.241664	0.116573	2.07306	0.040205
DM Lead	-0.072103	0.155771	-0.058146	0.125617	-0.46288	0.644248
DM Contr	-0.265651	0.156661	-0.227778	0.134326	-1.69571	0.092411

Regression Summary Statistics for Delay Cause Material Related Factor 1						
	R= .17030085 R^2= .02900238 Adjusted R^2= ----- F(4,126)=.94086 p<.44268 Std.Error of estimate: .58959					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.273387	0.239983	9.47311	0.000000
DM Plan	0.104915	0.153317	0.080557	0.117722	0.68430	0.495040
DM Org	0.160468	0.145402	0.115104	0.104297	1.10361	0.271864
DM Lead	0.026821	0.158157	0.019059	0.112389	0.16958	0.865610
DM Contr	-0.160642	0.159061	-0.121375	0.120181	-1.00994	0.314460

Regression Summary Statistics for Delay Cause Consultant Factor 1						
	R= .18855725 R²= .03555384 Adjusted R²= .00493650 F(4,126)=1.1612 p<.33116 Std.Error of estimate: .56405					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.565924	0.229589	11.17615	0.000000
DM Plan	0.121477	0.152799	0.089536	0.112623	0.79501	0.428103
DM Org	0.193030	0.144911	0.132913	0.099780	1.33206	0.185243
DM Lead	0.022869	0.157623	0.015600	0.107521	0.14509	0.884875
DM Contr	-0.239149	0.158523	-0.173453	0.114975	-1.50861	0.133903

Regression Summary Statistics for Delay Cause Community Factor 2						
	R= .35848994 R²= .12851504 Adjusted R²= .10084885 F(4,126)=4.6452 p<.00157 Std.Error of estimate: .73046					
N=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.199560	0.297322	7.39791	0.000000
DM Plan	-0.099979	0.145248	-0.100392	0.145849	-0.68833	0.492509
DM Org	0.541890	0.137750	0.508322	0.129217	3.93387	0.000137
DM Lead	0.001223	0.149834	0.001137	0.139242	0.00817	0.993498
DM Contr	-0.332153	0.150690	-0.328197	0.148895	-2.20422	0.029325

Regression Summary Statistics for Delay Cause Contractual Factor 2						
	Regression Summary for Dependent Variable: DC Contl R= .36407707 R²= .13255211 Adjusted R²= .10501408 F(4,126)=4.8134 p<.00120 Std.Error of estimate: .60835					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.612703	0.247619	10.55131	0.000000
DM Plan	-0.031673	0.144912	-0.026549	0.121467	-0.21857	0.827341
DM Org	0.534374	0.137430	0.418445	0.107616	3.88833	0.000162
DM Lead	-0.062941	0.149487	-0.048826	0.115965	-0.42104	0.674440
DM Contr	-0.404932	0.150340	-0.333998	0.124004	-2.69343	0.008035

Regression Summary Statistics for Delay Cause External Natural Factor 2						
	R= .17276000 R²= .02984602 Adjusted R²= ----- F(4,126)=.96907 p<.42697 Std.Error of estimate: .96214					
N=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.413743	0.391625	6.16340	0.000000
DM Plan	0.103393	0.153251	0.129609	0.192109	0.67467	0.501123
DM Org	-0.238814	0.145339	-0.279667	0.170201	-1.64315	0.102844
DM Lead	0.067351	0.158089	0.078137	0.183406	0.42603	0.670810
DM Contr	0.132729	0.158992	0.163725	0.196121	0.83482	0.405401

Regression Summary Statistics for Delay Cause External Human Factor 2						
	R= .28579638 R²= .08167957 Adjusted R²= .05252654 F(4,126)=2.8018 p<.02866 Std.Error of estimate: .71210					
n=131	b*	Std.Err.	b	Std.Err.	t(126)	p-value
Intercept			2.030983	0.289848	7.00706	0.000000
DM Plan	-0.052984	0.149100	-0.050526	0.142183	-0.35536	0.722914
DM Org	0.335414	0.141403	0.298804	0.125969	2.37205	0.019204
DM Lead	0.149810	0.153808	0.132213	0.135741	0.97401	0.331919
DM Contr	-0.234095	0.154686	-0.219667	0.145152	-1.51336	0.132693

From Table 6.12, the following can be reported on whether management functions employed predicted construction project delays:

- Delay Cause: Client related – Factor 1

The results of R^2 = 0.0136 [(F(4,126) = .43719, p < 0.78154]. This means that management functions did not significantly predict client related construction delays. In other words, management functions did not influence client related constructions project delays.

- Delay Cause: Contractor related – Factor 1

The results of R^2_{adj} = 0.029 [(F(4,126) = 1.9720, p < 0.02038]. This means that management functions significantly predicted contractor related construction project delays. In other words, management functions influenced contractor related

construction project delays. More specifically, organising influenced contractor related construction project delays.

- Delay Cause: Labour related – Factor 1

The results of R^2_{adj} = 0.028 [(F(4,126) = 1.9424, p < 0.10744]. This means that management functions did not significantly predict labour related construction project delays. In other words, management functions did not influence labour related construction project delays. However, organising influenced labour related construction project delays (p=0.040205).

- Delay Cause: Material related – Factor 1

The results of R^2 = 0.029 [(F(4,126) = .94086, p < 0.44268]. This means that management functions did not significantly predict material related construction project delays. In other words, management functions did not influence material related construction project delays.

- Delay Cause: Consultant – Factor 1

The results of R^2_{adj} = 0.0049 [(F(4,126) = 1.612, p < 0.33116]. This means that management functions significantly predicted consultant related construction project delays. In other words, management functions influenced consultant related construction project delays.

- Delay Cause: Community – Factor 2

The results of R^2_{adj} = 0.1008[(F(4,126) = 4.6452, p < 0.00157]. This means that management functions significantly predicted community related construction project delays. In other words, management functions influenced community related construction project delays. More specifically organising and controlling would influence contractor related construction project delays.

- Delay Cause: Contractual – Factor 2

The results of R^2_{adj} = 0.1050[(F(4, 126) = 4.8131, p < 0.00120]. This means that management functions significantly predicted contractual related construction project

delays. In other words, management functions influenced contractual related construction project delays. More specifically, organising and controlling would influence contractual related construction project delays.

- Delay Cause: External Natural – Factor 2

The results of $R^2 = 0.029$ [$(F(4,126) = .96907, p < 0.42697$]. This means that management functions did not significantly predict external natural construction project delays. In other words, management functions did not influence external natural construction project delays.

- Delay Cause: External Human – Factor 2

The results of $R^2_{adj} = 0.052$ [$(F(4,126) = 2.8018, p < 0.02866$]. This means that management functions significantly predicted external human construction project delays. In other words, management functions influenced external human construction project delays. More specifically, organising would influence external human construction project delays.

Management functions employed in construction projects predicted five of the nine causes of construction delays. H_2 could thus be accepted.

6.10.3 Relationship between causes of construction project delays and Incidence of construction project delays

Hypothesis three was formulated as:

H_3 : The causes of construction project delays predict the incidence of construction project delays

To test this hypothesis, partial correlations were employed. Table 6.13 provides the partial correlations to investigate the relationship between the respondents' education and years employed (demographics) and management functions in construction projects.

Table 6.13: Partial correlations of causes of construction project delays and incidence of the delay

Partial Correlations for $H_{1.3}$		
	Delay Incidence Frequency	Delay Incidence Duration
DC Client	.180	.172
DC Contr	.038	.119
DC Lab.Eq	.053	.083
DC Mat	.073	.110
DC Cons	.178	.077
DC Com	.044	-.207
DC Contl	-.039	.087
DC Ext.N	-.008	.166
DC Ext.H	.194	-.057

Regression Summary Statistics for Delay Incidence Frequency						
	R= .59958934 R^2= .35950738 Adjusted R^2= .31225792 F(9,122)=7.6087 p<.00000 Std.Error of estimate: .69093					
n=132	b*	Std.Err.	b	Std.Err.	t(122)	p-value
Intercept			0.334031	0.395070	0.845499	0.399487
DC Client	0.206177	0.102046	0.268415	0.132850	2.020434	0.045528
DC Contr	0.043259	0.104029	0.048101	0.115675	0.415831	0.678264
DC Lab.Eq	0.061897	0.106049	0.077006	0.131937	0.583661	0.560526
DC Mat	0.072353	0.090071	0.102651	0.127788	0.803290	0.423369
DC Cons	0.208481	0.104569	0.308311	0.154641	1.993724	0.048413
DC Com	0.048112	0.099134	0.052206	0.107570	0.485320	0.628320
DC Contl	-0.045451	0.105300	-0.059058	0.136825	-0.431629	0.666773
DC Ext.N	-0.006711	0.075726	-0.005835	0.065847	-0.088618	0.929531
DC Ext.H	0.202510	0.092920	0.231476	0.106212	2.179387	0.031224

Regression Summary Statistics for Delay Incidence Duration						
	R= .52090263 R^2= .27133955 Adjusted R^2= .21802294 F(9,123)=5.0892 p<.00001 Std.Error of estimate: .52523					
n=133	b*	Std.Err.	b	Std.Err.	t(123)	p-value
Intercept			1.756962	0.299506	5.86620	0.000000
DC Client	0.209396	0.108327	0.194664	0.100706	1.93300	0.055535
DC Contr	0.146890	0.110491	0.116721	0.087798	1.32943	0.186168
DC Lab.Eq	0.103959	0.112180	0.092049	0.099329	0.92671	0.355891
DC Mat	0.117841	0.095671	0.119642	0.097134	1.23172	0.220402

Regression Summary Statistics for Delay Incidence Duration						
	R= .52090263 R²= .27133955 Adjusted R²= .21802294 F(9,123)=5.0892 p<.00001 Std.Error of estimate: .52523					
n=133	b*	Std.Err.	b	Std.Err.	t(123)	p-value
DC Cons	0.094884	0.111013	0.099882	0.116860	0.85471	0.394371
DC Com	-0.247050	0.105067	-0.191784	0.081563	-2.35136	0.020294
DC Contl	0.107888	0.112039	0.100147	0.104000	0.96295	0.337461
DC Ext.N	0.150350	0.080649	0.093304	0.050049	1.86425	0.064671
DC Ext.H	-0.062892	0.098537	-0.051437	0.080589	-0.63826	0.524490

Source: Researcher's own compilation

From Table 6.13, the following can be reported on whether management functions employed predicted construction project delays:

- Delay Incidence: Frequency

The results of R^2_{Adj} = 0.3122 [(F(9,122) = 7.6087, p < 0.0000]. This means that causes of construction delays significantly predicted the frequency of construction delays. In other words, causes of construction delays influenced the frequency of construction delays. In particular, client related delay causes, consultant related delay causes and external human related delay causes predicted the frequency of the construction delays.

- Delay Incidence: Duration

The results of R^2_{Adj} = 0.2180 [(F(9,123) = 5.0892, p < 0.00001]. This means that the causes of construction delays significantly predicted the duration of construction delays. In other words, causes of construction delays influenced the duration of the constructions project delays. In particular, community related delay causes predicted the duration of construction project delays.

Causes of construction project delays predicted both frequency and duration in the incidence of construction delays. H_3 could thus be accepted.

6.10.4 Relationship between causes of construction project delays and effects of construction project delays

Hypothesis four was formulated as:

H_4: The causes of construction project delays predict the effects of construction project delays

To test this hypothesis, partial correlations were employed. Table 6.14 provides the partial correlations to investigate the relationship between construction project delays and the effects of the construction project delay.

Table 6.14: Partial correlations of causes of construction delays and the effects of construction delays

Partial Correlations for $H_{1.4}$			
	DE Fin	DE Human	DE Legal
DC Client	.389	.230	.224
DC Contr	.132	.167	-.021
DC Lab.Eq	.009	.154	.166
DC Mat	.106	.112	.198
DC Cons	.163	.017	-.095
DC Com	.127	.131	.196
DC Contl	-.024	-.022	.132
DC Ext.N	.047	.026	.214
DC Ext.H	-.028	.143	-.044

Regression Summary Statistics for Delay Effect Financial						
	R= .70535723 R^2= .49752882 Adjusted R^2= .46076264 F(9,123)=13.532 p<.00000 Std.Error of estimate: .56251					
n=133	b*	Std.Err.	b	Std.Err.	t(123)	p-value
Intercept			0.166477	0.320762	0.519004	0.604691
DC Client	0.420697	0.089956	0.504395	0.107853	4.676687	0.000008
DC Contr	0.135551	0.091753	0.138913	0.094029	1.477345	0.142139
DC Lab.Eq	0.009431	0.093156	0.010770	0.106378	0.101244	0.919522
DC Mat	0.093951	0.079447	0.123019	0.104028	1.182565	0.239263
DC Cons	0.168731	0.092186	0.229072	0.125153	1.830328	0.069622
DC Com	0.124008	0.087248	0.124155	0.087352	1.421322	0.157753
DC Contl	-0.024970	0.093038	-0.029893	0.111381	-0.268388	0.788850
DC Ext.N	0.034915	0.066972	0.027945	0.053601	0.521345	0.603064
DC Ext.H	-0.025757	0.081826	-0.027168	0.086308	-0.314780	0.753462

Regression Summary Statistics for Delay Effect Human						
	R= .68683030 R^2= .47173587 Adjusted R^2= .43276556 F(9,122)=12.105 p<.00000 Std.Error of estimate: .48295					
n=132	b*	Std.Err.	b	Std.Err.	t(122)	p-value
Intercept			0.204321	0.276149	0.739894	0.460786
DC Client	0.241401	0.092675	0.241884	0.092861	2.604805	0.010335
DC Contr	0.177244	0.094476	0.151690	0.080855	1.876070	0.063035
DC Lab.Eq	0.165607	0.096311	0.158576	0.092222	1.719502	0.088059
DC Mat	0.101379	0.081800	0.110702	0.089323	1.239348	0.217596
DC Cons	0.017400	0.094966	0.019805	0.108092	0.183223	0.854927
DC Com	0.131326	0.090030	0.109678	0.075190	1.458683	0.147222
DC Contl	-0.023557	0.095631	-0.023559	0.095639	-0.246331	0.805840
DC Ext.N	0.019612	0.068772	0.013125	0.046026	0.285169	0.775998
DC Ext.H	0.134564	0.084388	0.118383	0.074241	1.594588	0.113392

Partial Correlations for $H_{1.4}$						
Regression Summary Statistics for DE Legal						
	R= .63426377 R^2= .40229052 Adjusted R^2= .35819720 F(9,122)=9.1236 p<.00000 Std.Error of estimate: .60181					
n=132	b*	Std.Err.	b	Std.Err.	t(122)	p-value
Intercept			-0.383122	0.344110	-1.11337	0.267738
DC Client	0.250802	0.098579	0.294396	0.115714	2.54417	0.012202
DC Contr	-0.023123	0.100495	-0.023182	0.100754	-0.23009	0.818408
DC Lab.Eq	0.190189	0.102446	0.213343	0.114918	1.85647	0.065799
DC Mat	0.194210	0.087011	0.248436	0.111305	2.23202	0.027439
DC Cons	-0.106240	0.101016	-0.141660	0.134694	-1.05172	0.295008
DC Com	0.211216	0.095765	0.206648	0.093694	2.20556	0.029289
DC Contl	0.149925	0.101723	0.175649	0.119176	1.47386	0.143095
DC Ext.N	0.176608	0.073153	0.138463	0.057353	2.41422	0.017254
DC Ext.H	-0.043343	0.089763	-0.044670	0.092512	-0.48286	0.630061

Source: Researcher's own compilation

From Table 6.14, the following can be reported on whether the causes of construction project delays predicted the effect of construction project delays:

- Effect of Delay: Financial

The results of R^2_{Adj} = 04607 [(F(9,123) = 13.532, p < 0.0000]. This means that causes of construction delays significantly predicted the effect of construction delays. In other words, causes of construction delays influenced the effect of construction delays. In particular, client related delay causes, consultant related delay causes predicted the financial effect of construction project delay.

- Effect of Delay: Human

The results of R^2_{Adj} = 0.4327 [(F(9,122) = 12.105, p < 0.0000]. This means that causes of construction delays significantly predicted the human effect of construction delays. In other words, causes of construction delays influenced the human effect of construction delays. In particular, client related delay causes predicted the human effect of the construction delay.

- Effect of Delay: Legal

The results of R^2_{Adj} = 0.3581[(F(9,122) = 9.1236, p < 0.0000]. This means that causes of construction delays significantly predicted the legal effect of construction delays. In other words, causes of construction delays influenced the legal effect of construction delays. In particular, client related delay causes, material related delay causes, community related delay causes and external natural related delay causes predicted the legal effect of construction delays.

Causes of construction project delays predicted the financial, human and legal effects of construction delays. H_4 could thus be accepted. Table 6.15 summarise the research hypotheses of this study.

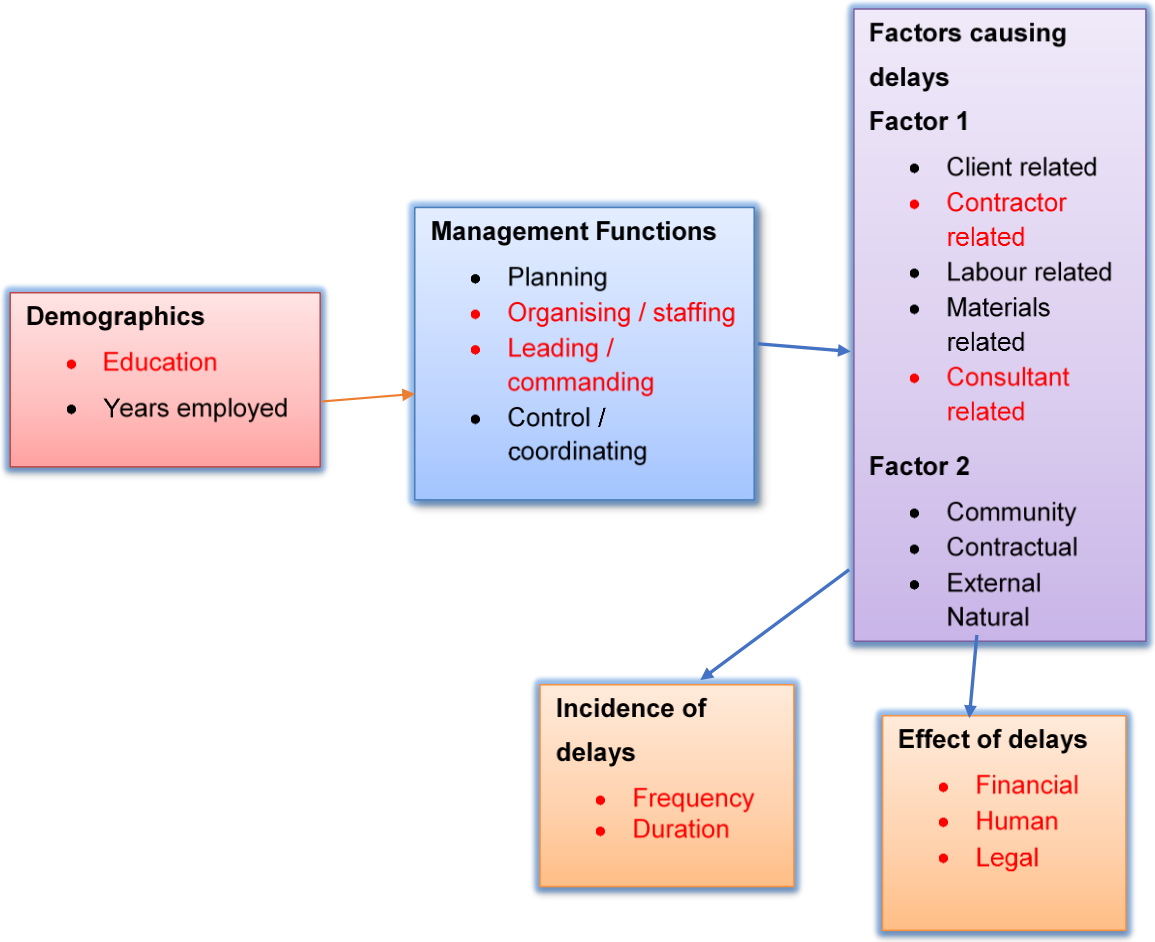
Table 6.15: Results of the testing the study's research hypotheses

Research Hypotheses	Accepted / Rejected	Details
H_1 : Demographics of contractors predict the management functions employed in construction project delays	Partially-accepted	Demographics influenced organising and leadership in construction project delays

Research Hypotheses	Accepted / Rejected	Details
H_2 : Management functions employed in construction project delays predict the causes of construction project delays	Accepted	Management functions employed in construction project predicted five of the nine causes of construction delays
H_3 : The causes of construction project delays predict the incidence of construction project delays	Accepted	Causes of construction project delays predicted both frequency and duration in the incidence of construction delays.
H_4 : The causes of construction project delays predict the effects of construction project delays	Accepted	Causes of construction project delays predicted the financial, human and legal effects of construction delays

Source: Researcher's own compilation

Figure 6.8 depicts the new empirically-tested model to show the role of management and factors to minimise the effects and incidence of construction delays.



Source: Researcher's own compilation

Figure 6.8: Empirically tested model for the role of management in the causes, effects and incidence of construction project delays

Figure 6.8 shows that management functions predicted the causes of construction delays which, in turn, predicted both the incidence and effects of construction delays. Only the level of education in demographics predicted the management function. The components in red show statistical significant relationships.

6.11 SUMMARY

Chapter six presented an overview of the demographic profile of the study's respondents. The majority of the respondents were males, in the age groups of 40 to 49 years with at least a degree or post-graduate degree. Most of the respondents had been employed for 10 years or more and held a level 1 to grade 4 BBBEE contribution.

The descriptive statistics of Sections 2, 3 and 4 of the questionnaire showed that overall, respondents had regularly experienced most of the causes of construction delays, financial problems were most often the effect of construction delays and controlling seem to be the management function mostly adopted to manage construction delays.

The Cronbach alphas indicated that the measuring instrument had internal reliability. The correlation analysis indicated that respondents might perceive management as important, but that there was no correlation with delay causes, delay effects and delay incidence. The only significant correlations between the management variables and the three constructs variables of delay causes, delay effects and delay incidence, were found in:

- Organising: There was a small significant correlation between organising and delay cause community, delay cause contractual and delay cause external human
- Leadership: The only significant correlation for leadership were found with delay cause external human

The management functions were highly-significantly and correlated with each other and all were above 0,5. Regression analysis results showed the relationships between delay causes and delay effects. Partial correlations were used to test the four hypotheses of the study, and three of the four hypotheses were accepted.

In chapter seven, the study is summarised and concluding arguments are highlighted by answering the research questions. Contributions and recommendations are then made.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

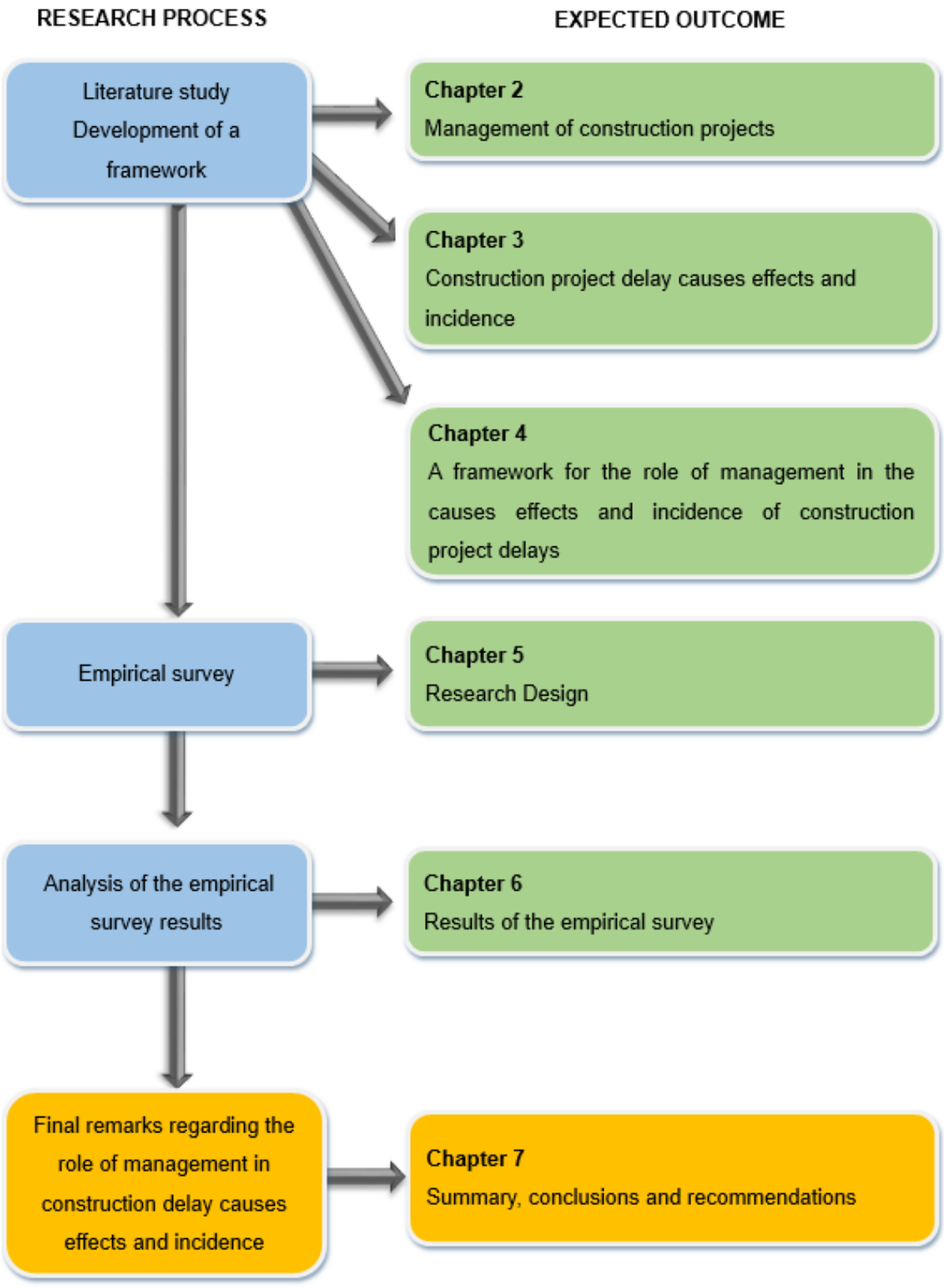
7.1 INTRODUCTION

The primary objective of this study is to investigate the role of management in the causes, effects and incidence of construction project delays. Chapter two to three provided the literature overview of the management of construction projects and construction project delays and incidence. Chapter four outlined the development of a framework to investigate the role of management in construction project delays and incidence. Chapter five provided an overview if the research design of the study while Chapter six provided the results and interpretation of the findings of the empirical survey.

Chapter seven is the final chapter and provides an overview of the study. A synopsis of the literature overview is also provided. The chapter indicates how research objectives were met and the research questions in chapter one are answered. The most pertinent research findings are highlighted and recommendations based on the literature overview and empirical findings are made. The contribution of the study is discussed, limitations of the study are indicated, and areas for possible future research are suggested. To conclude the chapter and study, final remarks are made regarding the study.

7.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH PROCESS

Figure 7.1 is reproduced to illustrate the place of chapter seven within the research process.



Source: Researcher's own compilation

Figure 7.1: Conceptual framework of the research process

7.3 SUMMARY OF CHAPTERS

The following sections provide the summary of the chapters in this thesis.

7.3.1 Summary of chapter one

Chapter one presented the introduction and background of the research. The research problem statements, purpose of the study as well as the research objectives were briefly explained. Research questions were provided to give directions to the course of the study. A literature review of the main concepts central to the study, namely, management in construction projects as well as the delays and incidence of construction projects, was provided. A proposed theoretical framework with research hypotheses was designed, followed by a brief description of the scope and demarcation of the study. A brief overview of the research design was presented and, lastly, the content of subsequent chapters was explained.

7.3.2 Summary of chapter two

Chapter two first considered a definition of a construction project and concluded that a construction project would be seen as the conversion of resource inputs into defined functioning outputs by means of a managed process. It also clarified the role players in a construction project and showed the main difference between a project manager and a contractor. It was further indicated that the main function of contractors included the planning, organising, directing and controlling of the activities in a construction business.

Previous research in construction management was elaborated on showing how research had evolved from identifying 75 managerial skills in 1999 to how excellence is achieved in construction businesses in 2016. An overview of the construction industry in the global context showed the main issues in the various countries. In the South African construction industry, the focus was on ethical standards and corruption. Factors affecting the success of construction projects were also discussed. The chapter concluded with an explanation of competencies of contractors.

7.3.3 Summary of chapter three

Chapter three focused on the literature overview of construction project delay causes, effects and incidence. A construction project delay for the purposes of this study was seen as when project that was not delivered on time, at the correct cost and quality. The causes of construction project delays in the international context were also described using examples from twenty countries. Although the causes might differ from country to country, large similarities did exist. The different factors could be grouped into categories. The ten most identified categories included delays related to clients, delays related to designers, delays related to project management or consultants, delays related to contractors, delays related to labour, delays related to finance, delays related to the contract, delays related to communications, delays related to the site and the environment and other miscellaneous factors.

South African research on construction project delay causes was scant. However, the causes did not differ much from the international context and included delay cause categories such as design related delay causes, project related delay causes, client related delay causes, contractor related delay causes, consultant related delay causes, material related delay causes, equipment related delay causes, labour related delay causes and external delay causes. The effect of construction project delays showed a number of delay effects that revolved around time overrun, cost overrun, negative social impact, idle resources, disputes, arbitration, delay by the client in returning loans, poor quality of work owing to hurrying the projects, bankruptcy, litigation, creating stress for contractors, total abandonment and acceleration losses. To conclude, the incidence of construction project delays referred to the duration of the delay and the frequency of the delay.

7.3.4 Summary of chapter four

The purpose of chapter four was to develop a framework for the role of management in the causes, effects and incidence of construction project delays. Secondary research relating to causes, effects and incidence of construction project delays was explored. Various aspects of these components were investigated. Ten causes of construction project delays were identified and twelve effects of construction projects outlined.

A theoretical framework is proposed to describe role of management in the causes, effects and incidence of construction project delays. The framework showed how the four management functions predicted the causes, effects and incidence of construction project delays.

7.3.5 Summary of chapter five

Chapter five first outlined the research paradigm used in this study. This study made use of a quantitative research paradigm to achieve the research objectives. The sample of this study was drawn from building contractors in South Africa. Only building contractors with a CIDB grading of 7 and above was included in the sample. The business collecting the data was instructed to ensure a sample return of 150 questionnaires. Only 133 questionnaires were useable and included in the study. The data was collected by the company using an electronic survey.

The questionnaire was developed by considering the theoretical framework developed. The questionnaire consisted of four sections. Section 1 requested demographic information relating to both the respondents and their contactor businesses. Section 2 of the questionnaire consisted of five-point Likert-type questions investigating the causes of delays in construction. Section 3 of the questionnaire also consisted of the five-point Likert-type questions on the effects of delays in construction whereas Section 4 of the questionnaire related to questions concerning management in construction.

To conclude, the method of data analysis was outlined and how the reliability and validity of the measuring instrument was ensured was provided. In Chapter six, the results of the empirical survey was outlined and discussed.

7.3.6 Summary of chapter six

Chapter six presented an overview of the demographic profile of the study's respondents. The majority of the respondents were males, in the age groups of 40 to 49 years with at least a degree or post-graduate degree. Most of the respondents had been employed for 10 years or more and held a level 1 to grade 4 BBBEE contribution. The descriptive statistics of Sections 2, 3 and 4 of the questionnaire showed that overall, the respondents had regularly experienced most of the causes of construction

delays, financial problems were most often the effect of construction delays and controlling seemed to be the management function mostly adopted to manage construction delays.

The Cronbach alphas indicated that the measuring instrument had internal reliability. Correlation analysis indicated that respondents might perceive management as important, but that there was no correlation with delay causes, delay effects and delay incidence. The only significant correlations between the management variables and the three constructs variables of delay causes, delay effects and delay incidence, were found in:

- Organising: There was a small significant correlation between organising and delay cause community, delay cause contractual and delay cause external human
- Leadership: The only significant correlation for leadership were found with delay cause external human

The management functions were highly-significantly correlated with each other and all were above 0,5. Regression analysis results also showed the relationships between delay causes and delay effects. Partial correlations were used to test the four hypotheses of the study. Three of the four hypotheses were accepted while the forth one was only partially-accepted.

7.4 ACHIEVEMENT OF RESEARCH OBJECTIVES

The achievement of the research objectives and the findings which addressed the research questions are discussed in Sections 7.4.1 and 7.4.2.

7.4.1 Achievement of primary and secondary objectives

Table 7.1 summarises the achievement of the various secondary objectives to achieve the primary objective as presented in chapter one.

Table 7.1: Achievement of research objectives

	OBJECTIVE	CHAPTER ADDRESSING OBJECTIVE
SECONDARY	**ONE:** Describe the factors that cause construction project delays	**Chapter three**
	TWO: Examine the effects of construction project delays	**Chapter three**
	THREE: Investigate the incidence of construction delays	**Chapter three**
	FOUR: Identify management activities that may predict the causes, effects and incidence of construction project delays	**Chapter two**
	FIVE: Develop a framework showing the role of management in predicting the causes, effects and incidence of construction project delays	**Chapter four**
	SIX: Describe the appropriate research design for the study	**Chapter five**
	SEVEN: Empirically-test the framework so as to propose managerial activities that may predict the causes, effects and incidence of construction delays	**Chapter six**
PRIMARY	Investigate the role of management in the causes effects and incidence of construction project delays	**Chapter six (see Figure 6.7)**

Source: Researcher's own compilation

7.4.2 Addressing the research questions

Seven research questions that were based on the primary objective and secondary objectives of the study were provided in chapter one. The findings addressing the seven research questions include:

a) Which factors are the main causes of construction project delays?

A literature overview of the factors causing construction project delays was presented in chapter three. Table 3.1 provides an overview of delay causes in the international context and Section 3.5 outlines the South African construction project delay causes. Based on this, the eight most identified project delay categories included:

- Delays related to clients
- Delays related to contractors
- Delays related to labour
- Delays related to equipment
- Delays related to materials
- Delays related to consultants
- Delays related to community
- Delays related to the contract
- Delays related to external issues

b) What are the primary effects of construction delays?

Chapter three presented a literature overview of the effects of construction project delays, and Table 3.2 provided a summary of the effects of construction project delays. Based on this, the following effects of construction delays was used in this study:

Finance related delay effects

- Budget exceeded
- Cash flow problems
- Delay with final account

Human related delay effects

- Poor quality of finished product
- Reputation influence
- Abandonment of project
- Stress on contractors

Legal related delay effects

- Disputes
- Disputes with large penalties
- Arbitration
- Litigation
- Claims

c) What are the incidence (frequency and duration) of construction delays?

Section 3.8 outlined that the incidence of construction project delays consisted of the frequency of the construction project delays (how many times) and the duration (how long) of the construction project delays.

d) Which management activities can predict the causes, effects and incidence of construction delays?

The literature outline in chapter two showed a number of management skills and functions. Based on the summary provided in Table 2.3, the management functions in construction projects could be derived. It could thus be concluded that the main function of contractors included the planning, organising, directing and controlling of the activities in construction.

e) What framework can show the role of management in predicting the causes, effects and incidence of construction project delays?

Based on the analysis of the literature overview of management activities in construction projects (Chapter two) and causes, effects and incidence of construction project delays (Chapter three), a framework was developed to investigate the role of management in predicting the causes, effects and incidence of construction project delays. The framework showed how the four components in this process and was illustrated by Figure 4.2. The components of the framework were also described briefly in chapter four. From the framework, the hypotheses to investigate the proposed relationships were formulated.

f) What is the appropriate research design for this study?

The primary and secondary objectives of this study were presented in chapter one (see Section 1.4). The research design employed to address these objectives was provided in chapter five. Attention was given to the research paradigm and research design employed in the study.

When investigating the role of management in the causes, effects and incidence of construction project delays, the research method included collecting and analysing data in a numerical form and investigating relationships between the role of management (construct 1), the causes of construction delays (construct 2), the effect of construction delays (construct 3) and the incidence of construction delays (construct 4). For this reason, the quantitative approach to research was judged to be most suitable for this study.

The research design was discussed by addressing the sampling technique, measuring instrument and the data-collection procedure. A measuring instrument in the form of a self-developed online questionnaire (see Annexure A) was constructed and administered by a research data collection business. The survey was administered by e-mail. The validity and reliability of the measuring instrument was also presented. To ensure reliability of the measuring instrument, Cronbach's coefficient alpha values were obtained to ensure that the scale measuring the items was reliable. The data analysis procedure was outlined focusing on the descriptive statistics used to describe the results of the empirical study as well as several inferential statistical techniques that were implemented to analyse the data.

g) Can this framework be tested empirically?

The theoretical framework to investigate the role of management in predicting the causes, effects and incidence of construction project delays (see Figure 4.2) indicated the hypotheses to investigate the proposed relationships between the four components in the framework.

Exploratory factor analysis were calculated to measure the variability among correlated variables so as to detect underlying factors. The results showed that the nine delay caused produced two factors. These two factors were identified as human related causes of construction project delays and materials related causes of

construction delays. These two factors were used to depict the empirically-tested framework. Multiple regression analysis was employed to test the influence of the independent variables on the dependent variables. More specifically, stepwise regression analysis was adopted in this study. To further investigate the relationships, partial correlations were used to test the hypotheses. Partial correlation analysis involved studying the linear relationship between two variables after excluding the effect of one or more independent factors.

7.5 MAJOR FINDINGS BASED ON EMPIRICAL RESULTS

This section provides the major findings pertaining to the demographic profile of the respondents as well as the findings of the statistical tests employed to achieve the research objectives as stated in chapter one. It also discussed the results of the hypotheses testing in this study.

7.5.1 Demographic profile of the respondents

Annexure C contains the frequencies of the biographic and demographic data. The analysis of the demographic findings of the empirical survey yielded the following results:

- Majority of respondents (76%) were males
- Majority of the respondents (52%)were above 40 years old
- Majority of the respondents (91%) had a post-matric qualification, where 30% had a bachelor's degree and 32 % had a post-graduate qualification
- Median number of years that respondents had been in the business was 19 years and they had on average 20-29 employees
- Majority of the respondents (91%) fully-complied with BBBEE requirements

From the demographic profile as highlighted, it can be concluded that the majority of respondents were well-educated and had been in business for a significant period of time. The data obtained during the empirical survey could thus be regarded as meaningful to make recommendations. It should be kept in mind that the data would have been completely different if smaller businesses (CIDB grade lower) were included in the sample or if respondents were in possession of lower qualifications.

7.5.2 Hypotheses testing

To meet the primary objective of this study, a number of hypotheses were tested. The results of the hypotheses testing are summarised in Table 7.2.

Table 7.2: Summary of the hypotheses testing

HYPOTHESIS	OUTCOME	METHOD USED
H_1 : Demographics of contractors predict the management functions employed in construction project delays	Only accepted for two of the four management functions: Demographics significantly predicted organising and leading in construction project delays. Demographics thus influenced how contractors of different education execute organising and leadership in managing construction project delays. H_1 can thus be partially-accepted	Partial Correlations
H_2 : Management functions employed in construction project delays predict the causes of construction project delays	Management functions employed in construction project predicted five of the nine causes of construction delays. H_2 can thus be accepted.	Partial Correlations
H_3 : The causes of construction project delays predict the incidence of construction project delays	Causes of construction project delays predicted both frequency and duration in the incidence of construction delays. H_3 can thus be accepted	Partial Correlations
H_4 : The causes of construction project delays predict the effects of construction project delays	Causes of construction project delays predicted the financial, human and legal effects of construction delays. H_4 can thus be accepted	Partial Correlations

Source: Researcher's own compilation

As can be seen in Table 7.2, four hypotheses were tested in this study, using partial correlation analysis. Support for all the hypotheses were found in this study. However, the hypothesis dealing with the demographics predicting the management function was only partially-accepted (H_1).

7.6 RECOMMENDATIONS AND PRACTICAL IMPLICATIONS OF THIS STUDY

Respondents in this study included only contractors at CIDB level above 7, thus the larger and more experienced contractors. For contractors dealing with large-scale projects, this study has indicated that education is important as it influences both leadership and organising functions of these contractors.

Management function predicted contractor related and consultant related causes of delays (Factor 1) and community, contractual and external human causes of delays (Factor 2). To address these, contractors should:

- Appoint skilled contractors and other building employees to oversee the activities on site and also provide more practical onsite training
- Ensure sufficient, adequate and good quality materials as well as suppliers of the materials and equipment are available to execute the project successfully
- Address contractor related causes of delays such as legal disputes by constant liaising with the role players
- Appoint an onsite health and safety officer
- Ensure timeous planning of building activities and coordinate it to ensure a constant flow of activities
- Execute daily monitoring of activities executed on site
- Ensure constant quality inspections by the relevant managers
- Have bi-weekly meetings with project managers to ensure that cost and quality are adhered to
- Keep a daily site progress chart whereby time, quality and resources are managed
- Appoint a community liaison officer to improve or maintain good relationships with the community where necessary
- Ensure that planning at the design phase is executed properly to minimise changes to project at later stages in execution as changes will inevitably lead to project delays

The managers that contractors appointed should be onsite regularly as quality can be compromised. The following should be noted:

- Detailed planning and coordination of building activities could lead to the success of a project
- Correct distribution of labour force is very important
- Constant monthly evaluations of payments or evaluations of critical value will eliminate cash flow problems which can lead to disputes
- Late change or additional work to the project should be minimised or completely eliminated to ensure timeous completion of the project
- As quality is problematic owing to unskilled labour, this should be addressed by constant training, good incentives, better salary and paid training opportunities

7.7 CONTRIBUTIONS OF THE STUDY

When considering the purpose of the research, a number of contributions are evident.

A first contribution of the research is in terms of the literature overview of the role of management in the causes, effects and incidents of construction project delays. Based on the research into the definitions, previous research, functions and processes, a theoretical framework was proposed that was tested-empirically. This study, thus contributes to the body of knowledge on the role of management in the causes, effects and incidents of construction project delays, and is useful to both educators and researchers. This study adds to the debate and literature on construction project delays, especially the role of management therein. However, this study could also prove useful on a practical level and could benefit contractors and other role players.

Educators, especially business educators, are responsible for developing future business leaders. Given the increasing importance of addressing construction project delays, business educators can use the findings of this study to make students aware of the empirically-tested framework. Educators can also ensure that the causes, effects and incidence of construction project delays are understood among students. The findings of this study can be used to ensure that future business leaders realise their responsibility as managers in the mitigation of construction project delays.

The construction fraternity have a keen interest in predicting, understanding and changing behaviour of management and workers in construction project delays. Thus, researchers in this fields could also benefit from the results of this study. Researchers

interested in construction project delays could use the findings of this study to develop and improve models to assess the role of managers in construction project delays. The empirical evidence that this study provides could also be used to justify future studies, especially concerning the role of management in construction project delays gap. The introduction of other moderating variables could advance discussions and understanding.

Construction project management training providers who are responsible to equip those interested in construction delays (causes effects and incidence) with the necessary knowledge and skills needed to address this, should also benefit from this study.

Certification bodies, such as the CIDB that promote the construction in South Africa can gain insights from the findings of this study. They would be able to see what role managers play and should play in addressing construction delays.

Through the findings in this study, policy makers can gain insights on how effective existing regulations are at encouraging management to mitigate construction project delays. The findings are also useful to identify whether any incentives, infrastructure, or resources are required to encourage emerging contractors.

Finally, the media plays a significant role in shaping public opinion and creating awareness of pertinent issues in society. Thus, media could benefit from the results in this study by enhancing the view that if a project is finished within the time, cost and quality, society as a whole may benefit.

7.8 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH AREAS

Limitations identified in the current study are presented in Section 7.8.1 that follows, together with recommendations for future research.

7.8.1 Limitations of the study

Limitations identified relate to the sample, sampling method and data-collection methodology used in this study.

The first limitation related to the sample. Only large contractors with a tender range above R6.5 million were included in the study. These contractors are experienced in managing construction projects. The results could be different for other contractors especially the upcoming and emerging contractors.

An outside research business was used to execute the data collection by means of an online questionnaire. Although the researcher worked very closely with the outside business in the data collection, the researcher had no control over the compilation of the database. The researcher also had no control over the accuracy of the database and had to rely on the reputation of the outside business.

Respondents had to indicate whether they were male or female. It was shown by Figure 6.1 that the majority of respondents (77%) were males and that only 23 % were females. Although one should expect this in a male-dominated profession, it should be kept in mind when interpreting the results.

7.8.2 Future research areas

In the current study, topics that have the potential for expanding the research were identified. Possible future research areas include the following:

- As the majority of the respondents included males, this offers an interesting opportunity for further research including females only.
- Respondents were mostly large successful contractors. Conducting similar surveys including emerging and small contractors could be a good addition to expand the existing theories and contribute to alternative findings.
- The framework for the research in this study focused on the role of management in the causes, effects and incidence of construction delays. More specific the functions of management were investigated. Future studies concerning management could include other possible aspects of management such at the management process and strategic management.
- This study showed that there was still a lack of understanding of the role of management in the causes, effects and incidence of construction projects. Research focussing on each aspect specifically may also lead to a better understanding of each management function.

- It is also important to include a study of female contractors as their approach to management may be different than males.

7.9 CONCLUDING REMARKS

Although much has been written on the causes, effect and incidence of construction project delays, very little attention has focussed on the role of management in these. This study suggested a framework to investigate the role of management in the causes, effects and incidence of construction project delays. This framework highlighted the four management functions and their influence on the causes, effects and incidence of construction project delays. The proposed framework to investigate the role of management in the causes, effects and incidence of construction project delays, was tested empirically. For the respondent contractors who were included in the research, the two management functions that would influence the causes, effects and incidence of construction project delays, included organising and leadership. It was further shown that these contractors were adequately dealing with planning and controlling, but needed to pay attention to organising and leadership. It was determined that demographics significantly predicted organising and leading in construction project delays. More specifically, demographics influenced how contractors with different educational levels executed organising and leading in managing construction project delays. The results further showed that management functions employed in construction projects, predicted five of the nine causes of construction delays. Further, the causes of construction project delays predicted both frequency and duration representing the incidence of construction delays. Lastly, the causes of construction project delays predicted the financial, human and legal effects of construction delays. The role of management for contractors is thus to ensure proper organising and leadership to mitigate the causes, effects and incidence of construction project delays.

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Annexure A: Copy of the questionnaire used in the online study

Unit of Applied Management Sciences

The role of management in minimizing the incidence and effects of construction delays

- Please read each question carefully.
- Please complete the whole questionnaire.
- PLEASE NOTE: This questionnaire will not be analysed on an individual basis: anonymity is thus ensured – it is therefore important that you provide honest answers.

SECTION 1: DEMOGRAPHICAL DETAILS

1.1 Please indicate your gender

Male		1
Female		2

A.2 Please indicate to which age category you belong (for statistical purposes only)

< 20		1
20 – 29		2
30 – 39		3
40 – 49		4
50 – 59		5
60 +		6

A. 3 Please indicate the form of enterprise of your business

Sole proprietor		1
Partnership		2
Closed corporation		3
Private company		4
Trust		5
Other. Please specify		6

A.4 Please indicate your level of education

Grade 11 or less		1
Grade 12 or equivalent		2
National certificate or Diploma		3
Bachelor's degree		4
Postgraduate degree (e.g. Honours/Masters/MBA/Doctorate)		5

1.5 How long have you been in business? _____ years

1,6 How many **full-time** employees are currently employed in your business? ____ employees

1.7 Please indicate your BBBEE status

Contribution level 1		1
Contribution level 2		2
Contribution level 3		3
Contribution level 4		4
Contribution level 5		5
Contribution level 6		6
Contribution level 7		7
Contribution level 8		8
Contribution level 9		9

1.8. Home Language

Afrikaans		1
English		2
Xhosa		3
Zulu		4
Other		5

2 CAUSES OF DELAYS IN CONSTRUCTION

Please indicate how often, in projects you have been involved in, delays in construction were caused by:		Never	Seldom	Regularly	Often	Always
2.1	Funds that are not adequately released during phases in construction	1	2	3	4	5
2.2	Interference with project performance (e.g. some scope could be introduced without due authorisation)	1	2	3	4	5
2.3	Time delays between invoice and payment date	1	2	3	4	5
2.4	Impractical allocation of resources (funds, manpower, materials and equipment)	1	2	3	4	5
2.5	Unrealistic period to complete a project	1	2	3	4	5
2.6	Appointment of unsuitable contractors to projects	1	2	3	4	5
2.7	Inadequate decision making	1	2	3	4	5
2.8	Design alterations	1	2	3	4	5
2.9	Change of scope	1	2	3	4	5
2.10	Poor coordination of sub-contractors	1	2	3	4	5
2.11	Inappropriate construction methods	1	2	3	4	5
2.12	Inadequate planning	1	2	3	4	5
2.13	Inadequate experience	1	2	3	4	5
2.14	Mistakes during construction stage	1	2	3	4	5
2.15	Incompetent construction site managers	1	2	3	4	5
2.16	Unskilled site manpower	1	2	3	4	5
2.17	Improper and/or faulty equipment selection	1	2	3	4	5
2.18	Labour or unrest disputes	1	2	3	4	5
2.19	Poor quality materials that lead to unacceptable quality workmanship	1	2	3	4	5
2.20	Material shortages	1	2	3	4	5
2.21	Late ordering	1	2	3	4	5
2.22	Late delivery of materials for construction	1	2	3	4	5
2.23	Inappropriate design for construction purpose	1	2	3	4	5
2.24	Poor contract management	1	2	3	4	5
2.25	Incorrect communication	1	2	3	4	5
2.26	Lack of information from consultants	1	2	3	4	5

Please indicate how often, in projects you have been involved in, delays in construction were caused by:		Never	Seldom	Regularly	Often	Always
2.27	Late changes to drawings, specifications or other scope documentation	1	2	3	4	5
2.28	Unexpected increases in cost of material	1	2	3	4	5
2.29	Long waiting period between inspections and test results	1	2	3	4	5
2.30	Inappropriate coordination of information	1	2	3	4	5
2.31	Lack of timeous information	1	2	3	4	5
2.32	Lack of community buy-in	1	2	3	4	5
2.33	Lack of community involvement	1	2	3	4	5
2.34	Non-payment of compensation to secure land	1	2	3	4	5
2.35	Community unrest	1	2	3	4	5
2.36	Lack of adequate communication between various parties	1	2	3	4	5
2.37	Major disputes	1	2	3	4	5
2.38	Negotiations that are time consuming	1	2	3	4	5
2.39	Incorrect organizational structure linking to the project	1	2	3	4	5
2.40	Inclement weather conditions	1	2	3	4	5
2.41	Natural disasters	1	2	3	4	5
2.42	Procurement policy changes	1	2	3	4	5
2.43	Interferences by higher authorities	1	2	3	4	5
2.44	Political interferences	1	2	3	4	5
2.45	Health and safety requirements	1	2	3	4	5

2.46. Indicate any other cause of delays in construction not listed in 2.1 to2.45 above

……

2.47. What is the most important reason for a construction delay?

……

2.48. What has been the most frequent cause of construction delays that you have experienced? (Select number from the above list – 2.1 to 2.45)

……

3 EFFECTS OF DELAYS IN CONSTRUCTION

Please indicate how often, in projects you have been involved in, a delay in construction had the following effects:		Never	Seldom	Regularly	Often	Always
3.1	The stipulated completion time of projects was extended	1	2	3	4	5
3.2	Original projected costs of the budget was exceeded	1	2	3	4	5
3.3	Poor/inferior quality completed project	1	2	3	4	5
3.4	Construction time was affected	1	2	3	4	5
3.5	Reputation of construction was negatively affected	1	2	3	4	5
3.6	Large penalties	1	2	3	4	5
3.7	Disputes	1	2	3	4	5
3.8	Arbitration	1	2	3	4	5
3.9	Litigation	1	2	3	4	5
3.10	Claims	1	2	3	4	5
3.11	Total abandonment of the project	1	2	3	4	5
3.12	Stress on contractors	1	2	3	4	5
3.13	Cash flow problems	1	2	3	4	5
3.14	Delay with final account	1	2	3	4	5
3.15	The frequency of delays decreased	1	2	3	4	5
3,16	The stipulated completion time was not affected	1	2	3	4	5
3.17	The duration of the delay was more than expected	1	2	3	4	5
3.18	The actual of a project differed from the duration estimates	1	2	3	4	5
3.19	The actual duration of smaller projects is shorter than larger projects	1	2	3	4	5
3.20	Loss of skilled labour	1	2	3	4	5

3.21. Indicate any other effect of delays in construction not listed in 3.1 to 3.19 above

……

3.22. What is the average duration of a construction delay in your business?

…… Days

3.23 In what percentage of the projects that you have been involved has there been a significant delay?

……..%

4 MANAGEMENT IN CONSTRUCTION

Please indicate, in projects you have been involved in, to what extent the following management practices were adopted as solutions for preventing and mitigating the effects of construction delays:		**Never**	**Seldom**	**Regularly**	**Often**	**Always**
4.1	Approach contracts from a capabilities perspective rather than a cost perspective	1	2	3	4	5
4.2	Comprehensive design preparation	1	2	3	4	5
4.3	Resource planning	1	2	3	4	5
4.4	Formulate a risk mitigation plan	1	2	3	4	5
4.5	Adopt realistic agreed upon time schedules	1	2	3	4	5
4.6	Ensure damage clauses in the contract	1	2	3	4	5
4.7	Provision of an adequate budget	1	2	3	4	5
4.8	Timeous decision-making	1	2	3	4	5
4.9	Design and build integration	1	2	3	4	5
4.10	Comprehensive contract /tender	1	2	3	4	5
4.11	Source/appoint more skilled/competent workforce to the profession	1	2	3	4	5
4.12	Develop existing human resources in construction	1	2	3	4	5
4.13	Proper training of labour/ skills development in specific fields	1	2	3	4	5
4.14	People centred development	1	2	3	4	5
4.15	Ongoing training in competent key staff training	1	2	3	4	5
4.16	Motivation of workers	1	2	3	4	5
4.17	Clear lines of responsibility	1	2	3	4	5
4.18	Regular performance evaluation	1	2	3	4	5
4.19	Involvement of stakeholders in constructive discussion	1	2	3	4	5
4.20	Minimise change in orders	1	2	3	4	5
4.21	Adequate compensation to contractors	1	2	3	4	5
4.22	Create incentives for early completion	1	2	3	4	5
4.23	Adequate consultation with all parties	1	2	3	4	5
4.24	Constant monitoring on progress and feedback	1	2	3	4	5
4.25	Adequate training of construction / site managers	1	2	3	4	5
4.26	Frequent site meetings with relevant parties	1	2	3	4	5
4.27	Identify quality standards	1	2	3	4	5

Please indicate, in projects you have been involved in, to what extent the following management practices were adopted as solutions for preventing and mitigating the effects of construction delays:		Never	Seldom	Regularly	Often	Always
4.28	Sound financial backings	1	2	3	4	5
4.29	Improvement of site management	1	2	3	4	5
4.30	OHSA compliant to ensure safer sites	1	2	3	4	5
4.31	Monthly progress and technical meetings	1	2	3	4	5
4.32	Quality assurances plans to be implemented on site	1	2	3	4	5
4.33	Site daily task reports to all staff / labour force	1	2	3	4	5
4.34	Constant controlling of quality on daily basis	1	2	3	4	5

4.35. Indicate any other management practice for preventing delays in construction not listed in 4.1 to 4.34 above

……

4.36. What is the single most important management practice for preventing a construction delay? (Select number from the above list 4.1 to 4.34.)

……

4.37. What is the single most important management practice for mitigating the effects of a construction delay? (Select number from the above list 4.1 to 4.34.)

……

Thank you for your kind cooperation

Annexure B: Cover Letter

Dear Respondent

The role of management in minimizing the incidence and effects of construction delays

A measure of success in the management of construction projects is whether the project was completed within the prescribed time, cost and quality.

If you have experienced construction delays, you are invited to take part in the above study by completing a questionnaire. This study will form part of my PhD in Business Management.

By completing this questionnaire and taking part in this survey, you will contribute to the understanding of the achievable managerial variables that are related to construction delays in South Africa.

The survey consists of four sections and you need to complete all questions. The identity of respondents will not be captured and questionnaires will not be individually analysed, thus ensuring respondents' anonymity. Your participation is voluntary. All information will be treated with utmost confidentiality.

Thank you for your time and valuable feedback.

Gerrit Smit

For any enquiries or additional information relevant to the study, please contact me via e-mail:

Gerrit.Smit@nmmu.ac.za

You can also contact my supervisor

Prof Miemie Struwig

miemie.struwig@nmmu.ac.za

Annexure C: Frequencies of the results

CODES

Unit of Applied Management Sciences

Nelson Mandela Metropolitan University
for tomorrow

The role of management in minimizing the incidence and effects of construction delays

- Please read each question carefully.
- Please complete the whole questionnaire.
- PLEASE NOTE: This questionnaire will not be analysed on an individual basis: anonymity is thus ensured – it is therefore important that you provide honest answers.

SECTION 1: DEMOGRAPHICAL DETAILS

1.1 Please indicate your gender

Male	76%	1
Female	23%	2

A.2 Please indicate to which age category you belong (for statistical purposes only)

< 20		1
20 – 29	11%	2
30 – 39	26%	3
40 – 49	28%	4
50 – 59	22%	5
60 +	12%	6

A. 3 Please indicate the form of enterprise of your business

Sole proprietor	1%	1
Partnership	8%	2
Closed corporation	28%	3
Private company	30%	4
Trust	32%	5
Other. Please specify	1%	6

A.4 Please indicate your level of education

Grade 11 or less	1%	1
Grade 12 or equivalent	8%	2
National certificate or Diploma	29%	3
Bachelor's degree	30%	4
Postgraduate degree (e.g. Honours/Masters/MBA/Doctorate)	32%	5

1.5 How long have you been in business? ___Median 19 years_____ years

1,6 How many **full-time** employees are currently employed in your business? 20-29____ employees

1.7 Please indicate your BBBEE status

Contribution level 1	13%	1
Contribution level 2	35%	2
Contribution level 3	26%	3
Contribution level 4	17%	4
Contribution level 5	1%	5
Contribution level 6	2%	6
Contribution level 7	3%	7
Contribution level 8	2%	8
Contribution level 9	2%	9

1.8. Home Language

Afrikaans	44%	1
English	46%	2
Xhosa	6%	3
Zulu	3%	4
Other	1%	5

2 CAUSES OF DELAYS IN CONSTRUCTION

Please indicate how often, in projects you have been involved in, delays in construction were caused by:		Never	Seldom	Regularly	Often	Always
CLIENT RELATED ISSUES						
2.1	Funds that are not adequately released during phases in construction	10	45	26	17	2
2.2	Interference with project performance (e.g. some scope could be introduced without due authorisation)	8	38	30	20	4
2.3	Time delays between invoice and payment date	5	41	23	26	5
2.4	Impractical allocation of resources (funds, manpower, materials and equipment)	8	36	34	18	4
2.5	Unrealistic period to complete a project	7	27	30	29	8
2.6	Appointment of unsuitable contractors to projects	5	31	31	30	4
2.7	Inadequate decision making	3	29	38	25	5
2.8	Design alterations	2	22	34	31	11
2.9	Change of scope	2	29	30	32	8
CONTRACTOR- RELATED ISSUES						
2.10	Poor coordination of sub-contractors	3	38	29	24	6
2.11	Inappropriate construction methods	9	59	20	11	2
2.12	Inadequate planning	7	36	34	17	6
2.13	Inadequate experience	8	33	31	24	4
2.14	Mistakes during construction stage	4	47	33	11	5
2.15	Incompetent construction site managers	6	45	28	16	5
LABOUR/EQUIPMENT ISSUES						
2.16	Unskilled site manpower	5	37	35	20	2
2.17	Improper and/or faulty equipment selection	11	66	20	3	1
2.18	Labour or unrest disputes	9	44	27	16	5
MATERIAL-RELATED ISSUES						
2.19	Poor quality materials that lead to unacceptable quality workmanship	8	63	19	10	1
2.20	Material shortages	8	56	30	5	1
2.21	Late ordering	6	40	40	13	2
2.22	Late delivery of materials for construction	2	47	39	12	1
CONSULTANT-RELATED ISSUES						
2.23	Inappropriate design for construction purpose	12	59	21	8	0
2.24	Poor contract management	8	47	28	15	3
2.25	Incorrect communication	1	38	41	17	4
2.26	Lack of information from consultants	4	42	31	17	6
2.27	Late changes to drawings, specifications or other scope documentation	0	28	29	35	8
2.28	Unexpected increases in cost of material	5	54	33	8	1
2.29	Long waiting period between inspections and test results	8	62	24	4	2
2.30	Inappropriate coordination of information	4	41	38	12	5
2.31	Lack of timeous information	3	32	50	11	4
COMMUNITY –RELATED ISSUES						
2.32	Lack of community buy-in	14	52	24	9	1
2.33	Lack of community involvement	16	49	26	9	1
2.34	Non-payment of compensation to secure land	40	44	11	5	0
2.35	Community unrest	20	41	22	13	5
CONTRACTUAL –RELATED ISSUES						

Please indicate how often, in projects you have been involved in, delays in construction were caused by:		Never	Seldom	Regularly	Often	Always
2.36	Lack of adequate communication between various parties	6	36	42	13	3
2.37	Major disputes	14	55	26	5	1
2.38	Negotiations that are time consuming	11	41	37	10	2
2.39	Incorrect organizational structure linking to the project	13	56	25	5	2
EXTERNAL ISSUES						
	Natural					
2.40	Inclement weather conditions	4	41	32	18	5
2.41	Natural disasters	59	35	2	2	3
	Human					
2.42	Procurement policy changes	27	50	14	7	2
2.43	Interferences by higher authorities	17	49	17	13	4
2.44	Political interferences	23	40	23	8	5
2.45	Health and safety requirements	10	43	31	11	6

2.46. Indicate any other cause of delays in construction not listed in 2.1 to2.45 above

Those listed was only for one respondent .....

2.47. What is the most important reason for a construction delay?

Client-related issues

2.48. What has been the most frequent cause of construction delays that you have experienced? (Select number from the list – 2.1 to 2.45)

2.6 - Appointment of unsuitable contractors to projects

2.5 – Unrealistic period to complete a project

2.1 – Funds that are not adequately released during phases in construction

3 EFFECTS OF DELAYS IN CONSTRUCTION

	Please indicate how often, in projects you have been involved in, a delay in construction had the following effects:	Never	Seldom	Regularly	Often	Always
3.1	The stipulated completion time of projects was extended	0	13	41	35	11
3.2	Original projected costs of the budget was exceeded	0	26	33	33	8
3.3	Poor/inferior quality completed project	13	47	19	17	4
3.4	Construction time was affected	0	12	39	32	17
3.5	Reputation of construction was negatively affected	8	41	31	14	6
3.6	Large penalties	11	42	28	15	3
3.7	Disputes	14	39	25	18	4
3.8	Arbitration	31	56	8	5	1
3.9	Litigation	39	53	4	3	2
3.10	Claims	9	27	32	18	14
3.11	Total abandonment of the project	55	41	2	2	1
3.12	Stress on contractors	2	18	38	24	18
3.13	Cash flow problems	5	26	38	25	7
3.14	Delay with final account	4	17	40	27	12
3.15	The frequency of delays decreased	3	19	56	17	5
3,16	The stipulated completion time was not affected	20	59	16	4	2
3.17	The duration of the delay was more than expected	1	30	48	17	4

	Please indicate how often, in projects you have been involved in, a delay in construction had the following effects:	Never	Seldom	Regularly	Often	Always
3.18	The actual of a project differed from the duration estimates	1	21	46	23	8
3.19	The actual duration of smaller projects is shorter than larger projects	8	38	29	20	5
3.20	Loss of skilled labour	12	38	32	11	8

Green = INCIDENCE OF CONSTRUCTION DELAYS

Rest = EFFECTS OF DELAYS

3.21. Indicate any other effect of delays in construction not listed in 3.1 to 3.19 above

Most effects only reported by one respondent.

The most serious effect of construction project delays is that the original projected costs of the budget was exceeded, followed by a time extension.

3.22. What is the average duration of a construction delay in your business?
.....30..... Days

3.23 In what percentage of the projects that you have been involved has there been a significant delay? 20%

4 MANAGEMENT IN CONSTRUCTION

	Please indicate, in projects you have been involved in, to what extent the following management practices were adopted as solutions for preventing and mitigating the effects of construction delays:	Never	Seldom	Regularly	Often	Always
Planning						
4.1	Approach contracts from a capabilities perspective rather than a cost perspective	11	32	33	19	5
4.2	Comprehensive design preparation	3	29	30	26	13
4.3	Resource planning	2	24	33	27	14
4.4	Formulate a risk mitigation plan	8	37	26	18	12
4.5	Adopt realistic agreed upon time schedules	3	25	34	27	11
4.6	Ensure damage clauses in the contract	5	31	33	15	17
4.7	Provision of an adequate budget	2	25	38	20	15
4.8	Timeous decision-making	3	20	44	17	17
4.9	Design and build integration	7	31	34	17	11
4.10	Comprehensive contract /tender	1	23	36	26	14
Organising						
4.11	Source/appoint more skilled/competent workforce to the profession	4	37	32	15	11
4.12	Develop existing human resources in construction	9	35	38	11	6
4.13	Proper training of labour/ skills development in specific fields	7	39	34	11	9
4.14	People centred development	10	48	26	14	2
4.15	Ongoing training in competent key staff training	8	34	35	15	9
4.16	Motivation of workers	5	37	37	11	8
4.17	Clear lines of responsibility	1	20	44	21	14
Leading						
4.18	Regular performance evaluation	6	35	34	15	9

	Please indicate, in projects you have been involved in, to what extent the following management practices were adopted as solutions for preventing and mitigating the effects of construction delays:	Never	Seldom	Regularly	Often	Always
4.19	Involvement of stakeholders in constructive discussion	6	23	39	18	13
4.20	Minimise change in orders	5	38	31	17	10
4.21	Adequate compensation to contractors	8	23	44	14	11
4.22	Create incentives for early completion	28	36	18	15	3
4.23	Adequate consultation with all parties	2	21	47	17	14
Controlling						
4.24	Constant monitoring on progress and feedback	2	10	45	23	21
4.25	Adequate training of construction / site managers	5	33	40	17	5
4.26	Frequent site meetings with relevant parties	1	5	38	35	21
4.27	Identify quality standards	0	13	37	32	19
4.28	Sound financial backings	1	25	38	26	10
4.29	Improvement of site management	1	24	38	27	10
4.30	OHSA compliant to ensure safer sites	2	11	35	23	29
4.31	Monthly progress and technical meetings	1	3	33	27	36
4.32	Quality assurances plans to be implemented on site	2	17	33	26	23
4.33	Site daily task reports to all staff / labour force	7	26	29	18	20
4.34	Constant controlling of quality on daily basis	6	25	27	22	20

4.35. Indicate any other management practice for preventing delays in construction not listed in 4.1 to 4.34 above Those listed only by 1 respondent.

4.36. What is the single most important management practice for preventing a construction delay? (Select number from the above list 4.1 to 4.34.)

4.31 – Monthly progress/technical meetings - CONTROL

4.37. What is the single most important management practice for mitigating the effects of a construction delay? (Select number from the above list 4.1 to 4.34.)

4.2 – Comprehensive design preparation - PLANNING

Thank you for your kind cooperation

Annexure D: Confirmation ethical clearance

From: Van Rensburg, Lindie (Ms) (Summerstrand Campus South)
Sent: 29 April 2015 03:32 PM
To: Struwig, Miemie (Prof) (South Campus)
Cc: Smit, Gerrit (Mr) (Summerstrand Campus North)
Subject: RE: G Smit - Ethical clearance forms April 2015

Dear Prof Struwig,

Thank you kindly.

Everything is in order.

Regards,
Lindie

From: Struwig, Miemie (Prof) (South Campus)
Sent: Wednesday, April 29, 2015 3:31 PM
To: Van Rensburg, Lindie (Ms) (Summerstrand Campus South)
Cc: Smit, Gerrit (Mr) (Summerstrand Campus North)
Subject: G Smit - Ethical clearance forms April 2015
Importance: High

Dear Lindie

Attached find all the forms for Ethical clearance for the PHD of Mr Gerrit Smit. You will note he only completed Form E. A hardcopy of this will be send to your office tomorrow.

Would you kindly confirm that all is in order.

Thank you
Friendly greetings
Miemie

Professor Miemie Struwig (PhD)
Director: School of Management Sciences
Nelson Mandela Metropolitan University
PO Box 77 000
Floor 11 Main Building
South Campus
PORT ELIZABETH
6031
South Africa
Tel: +27 (0) 41 504 2475

Annexure E: Language Editors letter

nmmu

Department of Applied Languages

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• Port Elizabeth • 6031 · South Africa • www.nmmu.ac.za

Nelson Mandela Metropolitan University
for tomorrow

To: **TO WHOM IT MAY CONCERN**
From: Dr Marcelle Harran
Date: 15 June 2017
Re: **LANGUAGE PRACTITIONER DECLARATION**

This is to confirm that Dr Marcelle Harran completed a linguistic edit of Mr Gerrit Smit's PhD thesis in June 2017. The thesis was entitled:

THE ROLE OF MANAGEMENT IN THE CAUSES, EFFECTS AND INCIDENCE OF CONSTRUCTION PROJECT DELAYS

Regards

Dr Marcelle Harran
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+971 528818195
mailto:marcelle.harran@nmmu.ac.za