UNIVERSITY OF LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

DEVELOPING STRATEGIES FOR IMPROVING IMPLEMENTATION OF PUBLIC SECTOR CONSTRUCTION PROJECTS IN ZAMBIA

BY

JOSHUA BANDA

PHDPM1611832

SUPERVISORS:

DR. WISE MAINGA

DR. IAN N. BANDA

Submitted in fulfilment of Academic requirements for the award of the Doctor of Philosophy Degree (PhD) in Project Management of the University of Lusaka

2019

DECLARATION

I, **Joshua Banda**, hereby declare that this research work is my original work and has not been submitted in whole or in part, to qualify for any other academic degree in any University.

All the views and opinions tendered in this PhD thesis are solely mine and not in any way, those of the University of Lusaka.

.....Date..... 5th September, 2019

JOSHUA BANDA

RESEARCH SCHOLAR (PhD PM1611832)

Date: 4th September 2019 .

DR. WISE MAINGA

SUPERVISOR

.....Date..... 5th September 2019

DR. IAN BANDA

SUPERVISOR

DEDICATION

This thesis is dedicated to my late father Welengani Banda, and my mother Lita Marubeni Banda, who sharpened my destiny in the education circles and made sacrifices for us, their thirteen children, so that we could have the opportunities they never had.

ACKNOWLEDGEMENT

The doctoral journey can at times be long, tedious and lonely. Along this journey I was fortunate to meet many inspiring people who encouraged me to be focused and struggle until the completion of the programme. I therefore wish to extend my gratitude to the University of Lusaka for offering me such rare opportunity which in academic circles has sharpened my destiny. Special thanks go to my Supervisors Dr. Wise Mainga and Dr. Ian Banda for their guidance and insistence on unwavering focus on the academic programme. I further express my deepest appreciation, respect and gratitude to the thesis committee members of the University of Lusaka for their great assistance. I also individually thank the following distinguished senior lecturers: Prof. Eustarckio Kazonga, Prof. Dominic Byarugaba, Prof. Sichalwe Kasanda, Prof. Evaristo Nsenduluka, Prof. Reinford Khumalo, Prof. Chibelushi Musongole, Prof. Gelson Tembo, Dr. John Simwinga, Dr. Mike Goma, Dr. Anthony Musonda, Dr. Jason Mwanza and Dr. Christine Phiri-Mushibwe for their expert guidance on doctoral research work.

I am thankful to the Government of the Republic of Zambia for affording me a chance to pursue this study through granting of study leave and sponsorship. I am also indebted to my wife Chabala Mwamba Banda and our wonderful Children, for their love, support and tremendous sacrifices during this programme. Lastly but not the least, many thanks and profound gratitude go to the almighty God for the gift of life, energy and direction during the course of duty. May his name be exalted, honoured, and glorified for eternity.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
APM	Association of Project Management
ASCE	American Society of Civil Engineering
CDF	Community Development Fund
CFFs	Critical failure Factors
COMESA	Common Market for Eastern and Southern Africa
COST	Construction Sector Transparency
CPM	Critical Path Method
CSFs	Critical Success Factors
CSO	Central Statistics Office
CSO	Civil Society Organisation
CWM	Collaborative Work Management
DAC	Development Assistance Committee
EFA	Exploratory Factor Analysis
FIDIC	Federation Internationale Des Ingenieurs-Conseils
GDP	Gross Domestic Products
GRZ	Government of the Republic of Zambia
IEEE	Institute for Electrical and Electronics Engineers
JICA	Japan International Cooperation Agency
KMO	Kaiser-Meyer-Olkin
KPI	Key Performance Indicator
MANCOSA	Management College of Southern Africa
MANOVA	Multiple Analyses Of Variance
MPSAs	Ministries, Provinces and other Spending Agencies
MSMEs	Micro, Small and Medium Enterprises

NCC	National Council for Construction
OECD	Organisation for Economic Co-operation and Development
PCA	Principal Components Analysis
PM	Project Management
PMBoK	Project Management Body of Knowledge
PMI	Project Management Institute
PSCPs	Public Sector Construction Projects
PRINCE^2	Projects IN Controlled Environments
RDA	Road Development Agency
SADC	Southern African Development Committee
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
TIZ	Transparency International Zambia
ToC	Theory of Change
UNICEF	United Nations International Children`s Emergency Fund
UNRWA	United Nations Relief and Works Agency
USD	United States Dollar
ZMK	Zambian Kwacha
ZNS	Zambia National Service
ZPPA	Zambia Public Procurement Authority

ABSTRACT

The purpose of the study was to develop strategies and a framework for successful implementation of public sector construction projects in Zambia, which was marred with public outcries and constant reports of failure by Auditor General`s reports. An exploratory sequential mixed method was used to attain the objective. This design allowed application of mixed methods where by exploratory study was conducted to establish basic facts and main study followed which in this case was general survey. For the first study which was qualitative in nature, seventy five (75) experts in public sector construction management were selected using purposive sampling technique and data collected was analysed using Exploratory Factor Analysis (EFA) after aggregation. Results from exploratory study were used to development a data collection tool which was a questionnaire. 384 respondents in the general survey were selected using stratified random sampling technique and data collected was analysed through multiple regressions.

The major findings were that there were twelve (12) key challenges and eleven (11) possible Critical Success Factors (CSFs) affecting performance of public sector construction projects in Zambia. Found also was varying relationships between Critical Success Factors and successful implementation of public sector construction projects represented by various success criteria. It was also confirmed that collectively Critical Success Factors determines performance of construction projects. From the study it was concluded that using established relationships, strategies and framework for performance measurement during implementation of public sector construction projects could greatly contribute to improvement of the construction industry.

The study had limitations in that it focussed only implementation stage of the projects, key stakeholders leaving out beneficiaries and only contractors in Grades 1 to 3 participated in the study because of their national character. It is recommended that future studies should focus other stages of construction project, communities and also other contractors. The practical implications to project managers are that challenges and success factors are multidimensional as such they should always be broad focused when need arises. Incorporating strategies developed in their day to day management could improve performance of the sector. The Social implications are that use of strategies developed in this study would not only improve efficiency in operations but also efficient utilisation of resources which will lead to wealth creation. The strategies are

environmental degradation proof as it depicts environmental impact as one of the success criteria. Development to come with development of construction sector will ultimately improve quality of lives of people through decent job creation by expanded construction industry.

The study contributed to the body of knowledge in terms of ceiling of the literature gap and the methodology gap. On literature, the study added the missing strategies and framework for improvement of implementation of projects. On methodology, the study introduced use of Principal Component Analysis as the way of selecting factors from the abundant factors extracted from literature reviewed.

Keywords: Project Management, Project implementation, Project life cycle, Public sector construction projects, Project success criteria.

CHAPTER 1

BACKGROUND OF THE STUDY

1.1 Introduction

This chapter highlights the background of the problem. Subsequently, the chapter presents the research problem, research questions, and objectives, importance of study and scope of the research. Assumptions are also deliberated. Lastly, outline of the thesis` organisation and summary of the chapter are given.

1.2 Background of the Problem

Formulation of strategies for public construction projects` improvement has assumed importance due attempt to overcome challenges, grow economy and also ensure developmental sustainability. The Construction sector is one of the key drivers of Gross Domestic Product (GDP) in Zambia (GRZ, 2015). It has been one of the most promising industries in Zambia from 2010 to 2016, recording an average contribution of about 10 percent of GDP (CSO, 2017). In a less developed country like Zambia, the significance of infrastructure development cannot be over-emphasized. The list of notable public construction projects ranging from road construction and rehabilitation, construction of houses in urban and rural areas, universities, colleges, and schools to mention but a few is endless (GRZ,2017.

There is undoubtedly no sector that has significant effects on the day lives of human beings than the construction industry. It is universally accepted that for example, the well and boreholes where human creatures get domestic water for life, the shelters we live and work in, the road infrastructure we drive on and others like airports , power lines , are all products of this industry (Chilongo and Mbetwa, 2017).Construction sector has been key driver of development in various developmental frameworks [i.e., African Agenda, 2064; Vision 2030; Millennium Development Goals; Seventh National Development Plan running from 2016 to 2021] (GRZ, 2017). Despite massive investment directed towards the industry, the construction sector in Zambia is marred with a lot of problems. From 2011 to 2017 the Auditor General`s reports have been reporting irregularities to do with Public sector construction projects as indicated in

table 1.1. There has been a common tendency of construction projects not being completed on within schedule (Zulu and Chileshe, 2014). Failure of projects to be implemented within planned cost, time and quality seem to counterbalance the paybacks that are supposed to be yielded from projects (Mukuka et al., 2016; Tembo et al., 2015; Zulu and Chileshe, 2014).

Supported by the Public Finance Act No. 15 of 2004, the Minister of Finance, through the Auditor General`s office is mandated to manage, control and direct substances involving financial, planning and economic administration of the republic. In relation to challenges in Public Construction Industry in Zambia, the Auditor General`s reports from 2014 to 2017 made the observations as stipulated in Table 1.1 below:

Table 1: Summary of challenges in Auditor General Reports from 2014 to 2017

Findings	**2017 (ZMK)**	**2016 (ZMK)**	**2015 (ZMK)**	**2014 (ZMK)**
Misappropriation of funds	61,657,450	162,095,699	28,153,9997	73,637,561
Un vouched Expenditure	14,137,189	170,554,478	349,306,160	389,905,333
Un accountable for stores	6,370,531	14,428,573	13,460,323	26,409,272
Non-adherence to Procurement Procedures	1,051,686	509,535	35,701,492	2,720,434
Un delivered Materials	1,486,568	116,759,240	251,523,804	522,904
Wasteful Expenditures	7,865,395	3,586,879	39,854,959	8,354,290
Over-Payments	7,437,149	1,061,247	26,559,013	1,578,571

Source: Auditor Generals Reports (2014, 2015, 2016 and 2017)

The thorough scrutiny of the Auditor General`s reports demonstrates that most of the Ministries, Provinces and Spending Agencies (MPSAs) in Zambia, in one way or another, had faced problems in implementation of public sector construction Projects. Other reported irregularities were failure to commence works, abandoned works, failure to submit claims (Payment requests) certification, and sub-contracted works without authority from the client(GRZ, 2017). All the irregularities were blamed on project-stakeholders` non-compliance to requirements, as confirmed by summoning of Controlling officers by Parliamentary select committee in charge of projects for questioning (GRZ, 2015).

In an effort to remedy the identified problems in the Construction industry a lot of interventions were instituted. Part of the interventions had been restricting local

contractors to 20 percent sub-contraction for projects rated grade 1 to 3 (Phiri, 2016).There was a creation of the fully fledged Ministry of Housing and Infrastructure Development to oversee construction activities in the country (GRZ, 2017). Capacity building programmes for Government organisations like the Anti-corruption commission, National Council for Construction (NCC) and Auditor General`s office were embarked upon (Mukumbwa, 2013).

Academically, an attempt to solve the problem facing construction industry has been made as observed from various empirical studies conducted by previous researchers on construction industry in Zambia (Aghimien et al., 2018; Muleya and Kamalondo, 2017; Chilongo and Mbetwa, 2017; Mukuka et al., 2016) elaborated in chapter two. Thorough and critical review of past literature revealed that during study period ranging from 2016 to 2019, there were no known studies that specifically focused on performance issues along the "construction stage" of public sector projects in Zambia.

Observed also was the insufficient of established failure and success factors predicting performance of construction activities in the public sector of Zambia The CSFs were established using mostly traditional success criteria which was based on Iron triangle (time, cost, quality) as success indicators leaving other equally important ones like client satisfaction, site disputes, health and safety and environmental impact (Kaliba et al., 2009; Zulu and Chileshe, 2009; Mukuka et al., 2016). In addition, reviewed literature, as indicated in literature review chapter, failed short of establishing the linkage between stage success and overall performance of public construction projects. Lastly, no strategies for improvement of implementation of projects were formulated.

Although locally, there were few studies done on performance at implementation stage of construction projects, existing literature indicated that there were lots of studies done elsewhere on the same phenomena. These studies done in other countries have produced a lot of data on Challenges and Critical success factors which could not be replicated to Zambia (Kiarie and Wanyoike, 2015; Bubu and Sudharkar, 2015; Odogo, 2013). From the literature reviewed it was discovered that there no methodology for screening foreign established challenges and Critical success factors for applicability to Zambia. It was also established that no framework or strategies for improvement of Public sector construction projects implementation were developed specifically for Zambia.

Despite all the progressive interventions made and recommendations from previous studies, the list of reported unsuccessful project implementation in publicsector on construction projects is endless as could be observed from the latest Auditor General's report (2017).

1.3 Statement of the problem

As it has been stated above, construction segment in Zambia is one of the catalysts of economic growth through wealth creation, employment creation, delivering of social well and also at times has the ability to create environmental impact. To keep the sector running the Government of Zambia has been investing almost 78 percent of the Annual budgets into this sector (GRZ, 2016). Despite massive investments into the sector, it is marred with a lot of problems. Notable challenges are the common ones captured year in year out by Auditor General`s reports like construction project schedule overruns, poor workmanships, abandoned works, budget overrun and uncompleted works to mention but a few, mostly noticed at implementation stage of the construction life cycle (Auditor General`s reports,2017;2016;2015;2014;2013; 2012).

In order to remedy the problem, it was necessary that key challenge and success factors be identified, so that thorough preparation should be made against them. However, as already mentioned these Critical Success factors and key challenges were mostly established based on three success criteria namely, time, cost and quality only. This criteria, though captures some performance elements, leaves out some equally important expected success criteria for public construction projects. Leaving out some makes it difficult to attain the needed public project outcome.

Literature reviewed on Zambia also demonstrated that there was no known study which attempted to consider failure or success factors as a system (collective influence) with factors which acts together to determine performance or failure of projects. Furthermore it was observed that there were a lot of studies conducted in other countries with different environments to Zambia which yielded large number of challenges and success factors. However no known study had applied methodology for testing foreign established factors for applicability to Zambia. Therefore, the basis of failure of construction projects in the public sector of Zambia seems to be inappropriate strategies at implementation stage, which broadly stages of projects like implementation stage

covered in this study. A study which aimed at developing strategies for improvement of public sector construction projects` implementation through exploratory sequential design which includes data collection through literature review, interview guide and a questionnaire survey would solve the problem.

1.4 General Objective

The key purpose of this research was to develop strategies for successful implementation of construction projects in the public sector of Zambia.

1.4.1 Specific Objectives

1. To analyse challenges experienced at "construction phase" of public projects in Zambia.
2. To analyse Success factors affecting successful construction of public projects.
3. To examine the relative impacts of various CSFs on successful construction of Projects.
4. To survey the collective impact of CSFs on successful construction of public projects.
5. To develop strategies that could be applied to advance the construction of public projects.

1.5 Research Questions

Based on the stated research problem and objectives of the research, the research posed following questions:

1. What challenges are experienced at "construction phase" of construction projects in the public sector of Zambia?
2. What are the CSFs for successful construction of public projects in Zambia?
3. To what magnitude does each of the identified factors influence successful implementation of construction projects in the Zambian public sector?
4. To what extent do all the identified CSFs collectively influence successful construction of public projects in Zambia?
5. What strategies can be used to advance the construction of public projects in Zambia?

1.6 Scope of Study

The research concentrated on developing strategies and a framework for measuring performance of activities during implementation stage of construction projects with ultimate aim of improving the industry in Zambia. Much as success of the project is dependent on performance at all stages of the project, the study focused on the 'project execution/implementation' stage. The construction projects under public sector has a fundamental part in ensuring development; as such only Government funded projects were considered in the study.

1.7 Significance of the study

It is presumed that findings of the study will benefit project managers, participants and stakeholders who are currently missing strategies for successful implementation of projects as well as, researchers. Project monitoring and evaluation organisations will also enhance their capacities by adopting and operationalizing developed strategies. The framework will provide the project managers with a checklist against which they will be base their decisions. The set Success Criteria, Challenges and CSFs established will enable the project participants to compare planned and actual performance and report progress of the project as implementation of projects progress. Furthermore, the project implementing partners can apply the developed project strategies to efficiently distribute resources to the CSFs in order to attain optimal required outcome.

The strategies of implementation of public sector construction project in the current study also justifies need for application of comprehensive performance criteria which is inclusive, without leaving out all facets of success measure. The current study brings on board the methodology of using Exploratory Factor Analysis as a testing tool of foreign established failure and success factors for local applicability. It also brings in the need to treat all components of the projects seriously as they all have capacity to cause success or failure of projects.

Further, literature review established that there were no known studies on public sector construction project implementation performance evaluation with reference to Zambia throughout the period of study from 2016 to 2017. Given that this study could be the first of its kind on development of strategies for improvement of construction projects in

public sector, it advances the knowledge on Project Management. The future researchers would need to try the methodology, strategies and a framework on other equally important stages of projects in order to test for applicability.

1.8 Assumptions of the Study

Four assumptions are made for this research. Firstly, it was assumed that experts were experienced and knowledgeable enough to precisely express their views regarding key success indicators, key challenges as well as Critical success factors which were part of the questionnaire administered to them. Secondly, it was assumed that the key players namely clients, contractors, consultants, Material suppliers and interest groups were similarly skilled of judging success or failure of construction projects. Thirdly, as for contractors, this study assumed that contractors in Grades 1 to 3 could fairly represent all the other contractors because of their national character, wider experience and exposure. Further, it assumed that all five key players' view may be prejudiced by their past experiences. Lastly it is assumed that the developed strategies at implementation stage of public sector construction projects from the current study would be applicable to all other similar projects.

1.9 The Organisation of the thesis

The report is made up of five chapters. The road map for readers is as shown in figure 1.1 below

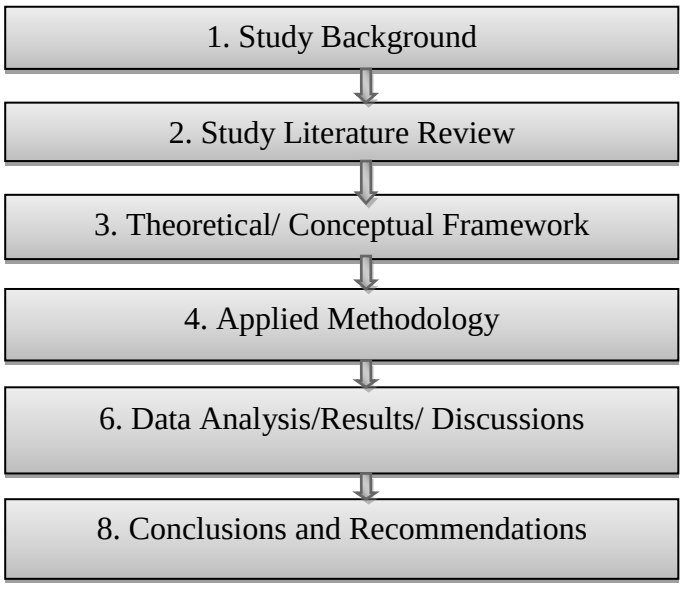

Figure 1.1: Layout of the thesis.

Chapter one is study background. It introduces the study by giving its background. Covered also in this chapter are statement of a problem, goals, scope, and justification of research, assumptions, Layout of thesis and summary of chapter.

Chapter two is literature review. It gives detailed literature review which aims at appreciating what researchers had already done on the subject in order to avoid duplication of work and gather theoretical underpinnings on the subject.

Chapter three is conceptual framework formation. It gives the cause and effect association between related factors (Independent versus Dependent variables)

Chapter four is methodology. It narrates different techniques used to arrive at outcome. Research design used to provide the study was discussed in this chapter. It also discusses the techniques used to arrive at the population of participants. Sampling techniques and estimation of sample size was also elaborated. Techniques used to collect and analyse data was also presented. In addition to the fore-going, limitations and ethical considerations were also presented.

Chapter five is data analysis/results/discussions. It describes how the collected, presented and analyzed. It also presents the results and immediately after the results is interpreted and discussed.

Chapter six is conclusions. The chapter concludes the study by highlighting major findings and insights, value addition to existing knowledge, managerial implications of research and the proposed directions for the upcoming studies.

1.10 Summary

The background of the research was deliberated. The foundation of the study was also given in this chapter. The objectives, scope of the research, justification of the research, assumptions and the organisation of the thesis have been presented.

In the next Chapter, Literature review is covered will be presented on implementation of construction projects in the public sector.

CHAPTER 2

LITERATURE REVIEW

2.1Introduction

Reviewed literature on management of construction projects is presented in this chapter. In order to create foundation of the subject explanations and definitions of the key terms used in Public sector construction project management have been given first. Next, challenges and CSFs experienced during implementation stages of projects are discussed. There after the identified gaps in the existing literature are elaborated. After that the correlation between CSFs (Independent and intervening variables), project implementation success (Dependent variables) and overall project implementation performance are highlighted. It also highlights the various monitoring and control methods and proposed strategies for successful implementation of projects derived from the literature reviewed. Lastly, various monitoring and control methods and existing strategies are reviewed.

2.2 Explanations and Definitions of Key Terms

Before reviewing the literature on Performance Indicators used to establish success or failure of implementation of public sector construction, challenges facing implantation of the same public sector construction projects, critical success factors as well coping mechanisms and strategies for successful implementation projects, it was found necessary to define and explain key terms used.

Terms defined and explained are as follows: project management, project life cycle, phases of construction projects, public sector construction projects and classification of public projects. This was done to foster increased understanding of terms used in reviewed literature.

2.2.1What is Project Management?

Various previous researchers define Project and Project management differently, although the meaning seems to be the same. Steyn (2008) defined a Project as a premeditated, provisional endeavor undertaken to generate an exceptional result, service or other inclusive and explicit product within a limited schedule and budget. As for

Project management definitions, it was observed that there were also many definition but adopted for this study was the PMBoK one which defines it as "the use of skills , techniques , tools , skills and knowledge to project activities in order to meet intended targets and outcomes from a Project" (PMBOK, 2006).

2.2.2 Project Life Cycle

There is very little agreement about the life cycle approaches of a project between various Project Management bodies like PMI, PRINCE[2], Association of Project Management (APM) and other organizations. Various researchers also have demonstrated different approaches to project life cycles (Boars, 2006; Kerzner, 2006; Petersen, 2013; and Newton, 2015). PMI (2013) stated that there was no single best way to define an ideal project life span that applies to all projects. The same issue arises in naming the stages as demonstrated by Table 2.1.

Table 2.1: Nomenclature and number of stages of project life cycle proposed

Authors	**No. of Stages**	**The Stage Name**
Boars (2006)	6	Initiation, Definition, Design, Development, Implementation, Follow up Phase
PMI(2013)	5	Initiation, Planning, Executing, Monitoring and Controlling, Closing
Petersen (2013)	6	Initiation, Planning, Execution, Control, Closing
PMBOK(2013)	5	Initiate, Plan, Execute, Monitor and Control, Close
Newton (2015)	4	Initiation or Conceptualisation, Planning, Execution/Implementation, Closure
Kerzner (2006)	5	Conceptual, Planning, Definition, Implementation, Conversion

Table 2.1 above confirms that different researchers define Project life cycle differently, although with harmonization all the definitions could be narrowed to fit the four staged cycle which defined as Conception, Design, Implementation and termination or closure of project (Newton, 2015). Adopted for this study was the 4 spanned project life cycle as it better fitted the construction projects being researched on. Thus Project implementation is the process whereby "project inputs are converted to project outputs". May be looked at as : 1) putting in action the activities of the project ; 2) putting into practice what was proposed in the document, that is, transforming the project proposal

into the actual project; and 3) management of the project or executing the project intentions (Banda, 2015).

2.2.3 Phases of Construction Projects

Construction project process does not differ from the general project life cycle described in section 2.2.2 in that the construction project life cycle is similar to the general project life cycle earlier explained in that it follows almost similar stages, each of which is a designated cluster of events that normally result in a milestone (Ngacho, 2013). In line with PMI (2008) which states that there are four phases to a project namely (1) conception, (2) development, (3) implementation and (4) termination. It could safely be confirmed that the four stated stages explains all the activities that take place in construction projects. The four different stages could also be termed as (1) Project conception and planning, (2) Project design and tendering, (3) Project construction and (4) Project operation and maintenance. This taxonomy better reveals the action carried out during the four stages of construction projects (Ngacho, 2013). Figure 2.1 presents the construction project life-cycle.

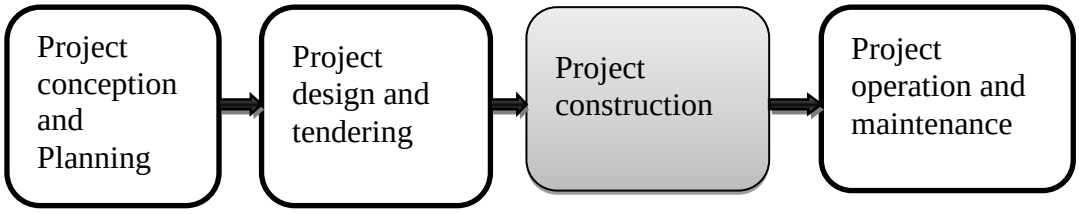

Figure 2.1: Phases of a construction project after Ngacho (2013).

As already alluded to above the focus of this study is Project construction which is shown above as implementation stage in the general project life cycle above. The Construction stage involves combining resources in a systematic manner in order to attain planned outcome.

2.2.4 Definition of Public Sector Construction Projects

Public Construction projects are construction projects mostly conducted by the state on behalf of the general citizenly (Ibid). It is mostly seen as a vehicle for creation of public infrastructures like roads, buildings, maintenance and repairs of available infrastructure

to mention but a few. Construction projects have been categorized in many ways in order to differentiate each other (Ngacho, 2013).

2.2.5 Classifications of Public Construction Projects

Construction projects can be categorized based on size, ownership, use and scope (Halpin and Woodhead, 2006). Among these categories of classification, project scope provides a better classification of public construction projects. Accordingly, based on scope, a project is categorized as a building or infrastructural project. Infrastructural projects include engineering industries, highway, heavy constructions and bridges (Ibid)).

The current study concentrates on both building and infrastructure as long as it is undertaken by the state using state resources. "Construction" for purposes of this research means: alteration, or repair of roads, power plants, buildings, bridges, water treatment facilities and vertical structures.

2.3 Performance measurement Indicators for Public Construction Projects

Various scholars and authors have designed different performance measurements of projects due to complexity nature of projects themselves. The variation in performance measurement is connected to the difference in definitions of projects success or failure among researchers.

2.3.1 Project Success versus failure

In order for one to understand success of the project, it is necessary first to understand failure which is the opposite. This entails that if the presence of a factor encourages failure, the lack of it encourages success (examples are, unsuitable infrastructure and demoralized staff). The opposite is likely to be true that if the absence of a factor causes success, its presence will cause failure (Heeks, 2004; Mangonyi, 2003and Khaled, 2003). Factors for failure are those occurrences whose presence determines failure of a project (Ibid).

The above definitions did not consider the effect of external environment to project performance. They did not even consider the effect success or failure factors have on

each other as they collectively affect success criteria of projects. For this project both the relative individual effects and collective effects of the projects will be considered in determination of success or failure of projects.

2.3.2 Project Success versus Success Criteria

Cooke-Davies (2002) attempted to differentiate the two terms namely "success criteria" and "Success factors" and found that there was a thin line between the two terms. He defined Project success factors as components of a project that can be swayed to increase the possibility of success (Independent variables). On the other hand Project success criteria were defined as the measures by which success of projects are judge (Dependent variables). Project success factors are not general for all projects because different people attach different importance to success factors. Project success criteria also differ from project to project and what is suitable in one project may not be suitable in another project (Bubu and Sudharkar, 2015).

2.3.3 Key Performance Indicators (KPIs) for Success Criteria

The several generally considered broad categories of KPIs which could be used to assess the performance are as follows: the traditional criteria (iron triangle), the proposed five pillars by OECD/DAC and the contemporary measures.

a) **Traditional Criteria, the "iron triangle" and "Golden triangle"**

Success criteria are "measures by which success or failure of a project or business will be judged" (Cooke-Davies, 2002). Most previous studies used the trio (time, quality and cost) as success criteria (Zuo et al., 2007; Ahadzie et al., 2008; Kaliba et al., 2009; Kamrul &Indra, 2010).The difference between iron and golden triangles is that the former considers only Cost, Schedule and Quality success criteria whilst the later puts people on the centre of the stated trio (Iyer and Jha, 2005). As it could be observed focus on effect on only cost, schedule, quality and people leaves out a lot variable indicators for success.

b) Performance Criteria based on "five pillars"

According to Ngacho (2013) most of the international development organizations, have assimilated the performance criteria defined by OECD/DAC in evaluating public sector projects. The five pillars are relevance, efficiency, effectiveness, impact and sustainability. This OECD definition, therefore, hardly covers ecological protection

which is vital in public sector projects. Though the five pillars were considered as advanced compared to iron triangle, certain weaknesses were identified. It was discovered that, the five pillars concentrated too much on the benefits of the project sponsors as opposed to benefiting communities. The five pillars could not be operationalised (Chianca, 2008).

The difficulty in operationalization of them (pillars) makes it difficult to measure social, environmental and environmental magnitudes of the public projects (Ngacho and Das, 2013a). It is difficult to attain the five pillars because of complicated nature of the surrounding project `s environments (Ibid).

c) The Contemporary measures of project performance

Several previous researchers have suggested need to have expanded view of judging performance in construction projects. Other researchers suggested that it was important to consider safety aspects, health aspects, client satisfaction aspects, site dispute aspects and environmental impact aspects (Ugwu and Haupt, 2005; Rawlinson and Farrell, 2010). The advocacy for inclusion of success criteria was based on the fact that construction in nature had inherent dangers for workers, therefore health and safety was necessary for projects (Zuo, 2011).

The ultimate aim of the project was to achieve planned target for client, therefore it was seen wise to consider client satisfaction as one of the performance indicators (Dakhi et al, 2016; Dang and Le-Hoai, 2016). Construction a project, being as it is has a lot of participants and for projects to advance there should be no site disputes as such several researchers claimed site dispute should be added to performance indicators(Tan et al., 2011; Tobish and Jha 2011). Construction has a tendency of harming the environment through massive destruction and consumption of natural resources as such for construction development to be sustainable environmental impact should be added as one of the success criteria (Tsoulfas &Pappis, 2008; Chen et al., 2010; Tan et al., 2011).

Table 2.2 summarises the findings of various studies undertaken with a view to identifying Success Criteria in public sector construction projects.

Table 2.2: Summary of Success Indicators for successful project implementation

Success Indicators	Contributions
Budget (Cost)	Yung and Yip. (2010), Kaur and Aggrawal (2013), Owour(2016), Kogi (2013), Ibrahim et al. (2013)
Time (Schedule)	Dang and Le-Hoai(2016), Kaur and Aggrawal (2013), Owour(2016), Kogi (2013), Ibrahim et al. (2013)
Quality	Kaliba et al. (2009), Dang and Le-Hoai(2016), Wallar(2017), Kaur and Aggrawal (2013), Owour(2016), Kogi (2013), Ibrahim et al. (2013)
Client Satisfaction/Community satisfaction	Amide et al.(2012),Bubu and Sudharkar (2015), Ngacho, (2013), Dakhi et al. (2016), Dang and Le-Hoai (2016), Kaur and Aggrawal (2013), Owour(2016), Auma (2014), Kogi (2013), Ibrahim et al. (2013)
Safety and Health	Ugwu and Haupt (2005), Rawlinson and Farrell (2010), Yung and Yip (2010), Ngacho(2013), Bubu and Sudharkar (2015),
Environmental Impact	Yung and Yip(2010), Erickson and Westerberg (2011), Tan et al. (2011), Ngacho (2013),Bubu and Sudharkar (2015)
Site Dispute Resolution	Takim and Akintoye (2004), Tsoulfas and Pappas (2008), David (2009), Tobish and Jha (2011), Tan et al. (2011). Bubu and Sudharkar (2015), Enshassi et al. (2009)

Table 2.2 have demonstrated that although various researchers have concentrated on time, cost and quality success criteria several others have proposed use of the contemporary measures of project performance which is inclusive in nature. This confirms the fact that use of contemporary measure had massive support from several earlier researchers. Despite impressive support, observation was that only few earlier scientists had attempted to use them in judging performance along the project cycle (Ngacho, 2015).

In a nutshell an observation is that the contemporary measures of project performance were found to be suitable for the measurement of project performance at the implementation stage (Amide et al., 2012; Ngacho, 2013; Dakhi et al, 2016; and Dang and Le-Hoai, 2016) as such it was adopted for this study. For this study the considered success criteria are Budget (Cost), Time, Quality, Client Satisfaction, Safety and Health, Site dispute resolution, and environmental factors that are applicable to this study.

2.4 Challenges at Implementation stage of PSCPs

Challenges were first established in order to appreciate the gravity of the problem and also create awareness to project managers that there are challenges they should always be aware of as they attempt to successfully implement projects. Both foreign and local

literature was reviewed in order to come up with reasonable number of challenges to select from using exploratory factor analysis (EFA). EFA was a suitable method for selecting challenges which were applicable to Zambia leaving out the ones which were not applicable to Zambia (Hair et al., 2006). The selected ones were adopted and the remaining ones discarded. The inclusion of foreign literature was necessitated by the relatively small number of challenges established for Zambia by previous local researchers (Aghiemien et al., 2018; Muleya and Kamalondo, 2017; Chilongo and Mbewe, 2017; Mukumbwa, 2013; Sichombo, 2009).

Several previous studies tried to establish identical characteristics of public construction projects which cause failure of the project and classified these into Critical failure factors (CFFs) or Challenges(Alsolaiman,2014; Amade et al, 2012). The grouping has been based on which element(s) is /are more prominent in the type of the project and at different stages of the project (Ibid)). Alsolaiman (2014) categorized challenges into four groups, that is, (1) management problems, (2) financial problems, (3) technical Problems and (4) political problems. Amade et al. (2012) categorized them as (1) financial problems, (2) environmental factors and (3) participants' problems.

The review showed that there were no consensus on classification of challenges encountered at implementation stage of public construction projects, although the commonality indicates that they could safely be classified into six categories namely project design and planning, project management, procurement related, project participants, financial related and environmental challenges. Grouping them was found necessary for easy handling of the huge numbers of challenges in literature. For this study adopted was the proposed classification into 6 main grouping of challenges namely: design and planning, project management, procurement, Project participants', financial and environment related challenges.

2.4.1 Project Design and Planning Challenges

Studies done on Zambia revealed that under this category prominent challenges were *poor and inadequate design* which had a tendency of reflecting weakness at implementation stage of the project (Phiri, 2016). Foreign studies in support of poor design as a challenge was also established from previous researchers (Kogi, 2013; Odoyo, 2013; Burke, 2013; Hendrickson, 2008). *Fault project conceptualisation* was

also found to be a problem in Zambia as most of the public sector constructions were initiated in response to political pressure and usually were top down to allow uniform developments in all districts and provinces (Kaliba, et al., 2009; Sichombo, 2009). This was found applicable even in other countries as confirmed by studies conducted in other developing countries (Jha and Iyer, 2006; Kogi, 2013).

Another challenge established for Zambia`s public sector construction projects was *non-involvement or inadequate participation of potential beneficiaries* which did not allow communities to participate from conception to closure of project in order to them to develop interest, and ownership of projects (Sichombo, 2009; Kaliba, 2009). This was also found applicable in other developing countries (Odoyo, 2013). Kaliba (2009) also found the challenge of *non-involvement of project participants* during design as one of the dominant failure factor for Zambia`s public construction projects. Contractors and quality controllers only comes in to translate the designs without having any input into design development there by sometimes creating problems of misinterpretations(Kogi, 2013:Odoyo, 2013).

Other factors established in other countries for test of applicability to Zambia were *under budgeting* of projects which usually constrain implementation of projects through shortages of constructions materials and other requisites (Kogi, 2013; Burke, 2013; Ali, 2010). *Unrealistic scope* which is a situation of too less or too much to do always negatively affect implementation process of the project in the sense that the resources are not commensurate to the project and also the timing is compromised (Hendrickson, 2008; Chan et al., 2004).The last challenge established in other developing countries to be examined for Zambia was *poor project scheduling* (Alsolaiman, 2014; Kogi, 2013, Hendrickson, 2008). Implementation stage of construction projects have distinct milestones which if scheduled wrongly has the tendency to not only derail the operations. Even the wider frame of the entire project schedule may negatively affect implementation of projects. Therefore use of either GHART Chart or Critical Path Method is necessary (Leslie, 2015).

The seven (7) design related challenges gathered from both local and foreign studies to be screened for applicability to Zambia through use of Exploratory Facto Analysis tool were as follows: 1) poor and inadequate design, 2) fault project conceptualization, 3)

under budgeting, 4) non-involvement or inadequate participation of potential beneficiaries in identification of project, 5) unrealistic scope, 6) non involvement of project participants during design and poor project scheduling.

2.4.2Project Management related Challenges

Various local researchers had attempted to establish project management related challenges which cause failure of most of the public sector construction projets in Zambia. Notable among these were those who established *lack of technical skills of project management teams* as one of the project management related challenges (Mukuka et al., 2016; Kaliba, 2009). Some studies conducted in other countries with some similar characteristics to Zambia were in agreement with this finding (Alsolaiman, 2014; Kogi, 2013; Burke, 2013 and Sweis et al., 2014). Other challenges established in studies done in Zambia involved, *lack of motivation of staff* and *inadequate or lack coordination of activities by managers* (Kaliba, 2009); *violation of health and safety rules by management* (Muleya and Kamalondo, 2017; Sichombo, 2009); *dishonesty conducts by contractors* (Mukumbwa, 2013; Kaliba, 2009), *poor supervision and control of problems by management* (ibid) and *lack of risk management skills* (Sibanyama et al., 2014).

Literature reviewed on Zambia`s public sector construction projects showed most of the challenges which seemed to be a must for Zambia were not yet explored for Zambia. Since Project management was one of the newest programmes which in the past considered it as one of the sub courses of other programmes, it was realized that most of the challenges established in other countries with similar characteristics to Zambia like less developed countries should be tested for applicability in Zambia . Some established challenges outside Zambia which needed selection for adoption or rejection using Exploratory Factor Analysis method were as follows: *poor project management* (Odoyo, 2016; Alsolaiman, 2014; Hendrickson, 2008); *management incompetence* (Kogi, 2013; Burke, 2013); *low level of leadership skills* (Sweis, et al., 2014); *ineffective monitoring and feedback*(Share, 2016; Amade et al., 2012); *lack of authority* (Bubu and Sudharkar, 2015; Ali, 20100 and *not working closely with the client* (Burke, 2013)

The gathered thirteen (13) Project Management related challenges to select key challenges affecting implementation of public sector construction from using Exploratory Factor Analysis were as follows: 1) poor project management, 2) management incompetence, 3) lack of technical skill, 4) inadequate project leadership skills, 5) lack of motivation of staff, 6) inadequate or lack of coordination of activities by management, 7) ineffective monitoring and feedback, 8) poor supervision and control of projects, 9) violation of health and safety rules by management, 10) lack of risk management skills, 11)dishonesty conduct by contractors, 120 lack of authority and 13) not working closely with the client.

2.4.3Procurement related Challenges

Literature showed that there were several challenges established on Zambia`s public sector construction projects by various previous researchers. Prominently established procurement related challenges were as follows: 1*) poor selection methods* blamed on reliance on traditional procurement methods which focus only on least costs (Tembo et al., 2015; Sichombo, 2009);*corruption* which had potential of diverting project resources through bribes and also offering contracts to inexperienced contractors(Mukumbwa, 2013; Sichombo, 2009); *tender documents not specifying needed materials and services* (Mukumbwa, 2013; Kaliba, 2009); *unrealistic and dishonesty variations* (Ibid); *unavailability of specified materials and equipments* (Kaliba et al., 2009), *length approval procedure* (Ali, 2010).

Established six (6) Procurement related challenges to be taken forward for further study were as follows: 1) poor selection methods, 2) corruption, 3) tender documents not specifying needed materials and services, 4) unrealistic and dishonesty variations, 5) unavailability of specific materials and equipment and 6) length approval procedure.

2.4.4Project Participants related Challenges

Some previous studies attempted to establish Project participants related challenges causing failure of public sector construction projects in Zambia. Notable ones being the following: *lack of team work* (Chilongo and Mbetwa, 2017); *lack of commitments to projects by participants* (Mukumbwa, 2013); *contractor`s violation of health and safety rules* (Sichombo, 2009); *negligence of duty by participants like consultants*

(Mukumbwa, 2013); *fraudulent certification of works in order to conceal errors* (Mukumbwa, 2013; Sichombo, 2009); and *collusion between contractors, consultants and sometimes client`s representatives to defraud the client* (Ibid).

Established eight (8) Project participants` related challenges to be taken for further study were as follows: 1) lack of team work, 2) excessive owner change orders, 3) lack of commitment to project, 4) conflict among project participants, 5) contractors` violation of safety rules, 6) negligent of duty by participants (e.g. consultants when supervising projects), 7) dishonest certification of works in order to conceal errors and 8) collusion between contractors, consultants and sometimes client`s representatives to defraud the client.

2.4.5 Financial related Challenges

Several Financial related cause failure of public sector constructions projects of Zambia were established although the list seemed to be leaving out a lot of potential challenges. To be inclusive some factors were gathered from studies in countries with similar characteristics to Zambia with the intention of screening them for adoption or rejection using Exploratory Factor Analysis. Locally established financial related challenges were as follows: *low client financing capacity* (Aghiemien et al., 2018); *delay in payment of progress funding (clearance of stage completion certificates)* (Sibanyama et al., 2014: Mukumbwa, 2013; Kaliba, 2009); *misallocation of funds by contractors* (Mukumbwa, 2013; Sichombo, 2009) and *lack of accountability and transparency* (Ibid)

Gathered financial related challenges from studies done elsewhere with intent of adoption or rejection using Exploratory Factor method were as follows: *delay and sometimes lack of counterpart funding* (Kogi, 2013; Joseph and Muturi, 2015; Alsolaimain, 2014); intended *postponement of payments in order to encourage room for corruption and bribes* (Ibid); *lack of community contribution* (Joseph and Muturi, 2015); *insufficient working capital for contractors* (Kogi, 2013; Enshassi et al., 2009) and *inaccessibility to funds due to lack of collateral* (Joseph and Muturi, 2015; Alsolaiman, 2014; Amade et al., 2012).

The nine (9) Financial related challenges gathered for further study were as follows: 1) low client financing, 2) delay in payment of progress project funding, 3) delay and sometimes lack of counterpart funding, 4) intended postponement of payments in order to encourage room for corruption and bribes, 5) lack of community contribution, 6) misallocation of funds by contractors, 7) lack of accountability and transparency, 8) insufficient working capital for contractors, and 9) inaccessibility to funds due to lack of collateral.

2.4.6 Environmental related challenges

Few External related challenges which were negatively affecting public sector construction projects in Zambia were established by various previous researchers. Notable among these was Sichombo (2009) who established *weak monitoring and control systems* as one of the challenges causing failure of projects in Zambia. Others were as follows: *changes in government rules and regulations* (Aghiemien et al., 2018; Kaliba et al., 2009); *escalation of project costs due to inflationary pressures* (Ibid); and *unanticipated policy changes* (Ibid).

External related challenges gathered from studies done in other areas with similar characteristics to Zambia with a potential of adoption were as follows: *frequent changes in governments* (Alsolaimain,2014); *political interference in contracts determination* (Alsolaiman, 2014; Salleh, 2009); *Bureaucracy in public sector projects* (Ali, 201); *Poor financing characteristics* (Salleh, 2009; Shaban, 2008); *manpower shortages* (Sweis et al., 2014;Salleh, 2009; Enshassi et al., 2009; *poor support infrastructure* (Salleh, 2009); *unavailability of specified materials*(UNRWA, 2006; Enshassi et al., 2009) and *adverse social aspects* (Amade et al, 2012; Jha and Iyer, 2006).

The thirteen (13) External related challenges gathered for further studies were s follows: 10 frequent changes in government, 2) political interference in contracts determination, 3) bureaucracy in public sector projects, 4) poor financing capacities, 5) weak monitoring and control systems in public sector projects, 6) natural calamities, 7) unanticipated policy changes, 8) manpower shortages, 9)poor supporting infrastructures, 10) unavailability of materials, 11) escalation of project costs due to inflationary pressures, 12) adverse social aspects and 13) changes in government rules and regulations.

2.4.7 Critique of Literature reviewed on Challenges

The above literature reviewed revealed that various previous studies had attempted to categorize the challenges for public sector construction projects differently as demonstrated above ((Alsolaiman, 2014; Amade et al, 2012; Chan et al., 2004). However, there was no general consensus on how to group the challenges. It was also established from above literature that apart from the few studies conducted on Zambia`s public construction projects, there were fewer studies conducted locally on the same (Aghimien et al., 2018; Muleya and Kamalondo, 2017; Chilongo and Mbewe, 2017; Mukumbwa, 2013; Sichombo, 2009). Previous studies mostly established challenges based on traditional success criteria only (time, cost and quality).

Further, it was observed that previous studies did not consider implementation as one of the stages along the public sector construction projects which could be considered as a project on its own with distinct beginning and end. Most of the challenges established in the previous literature were not focused on implementation stage only of the project.

2.5 Critical Success Factors (CSFs) for implementation of PSCPs

During a period of study there were few known studies done on Critical Success Factors (CSFs) for Public sector construction projects implementation in Zambia. Even the established few were found to have been mainly established based on the traditional criteria which focus on the use of time, cost and quality as the success indicators only. Looking outside Zambia, it was discovered that there were rich knowledge in form of huge number of established success factors determining success implementation of public sector construction projects. The other areas of study were despite having similar characteristics to Zambia, like those for less developed countries had unique environments to Zambia, making generalisability impossible. In order to make the study possible both the local and foreign established CSFs from literature were gathered and passed through the process of selection for domestication or rejection using Exploratory Factor Analysis.

As the case was with the challenges the problem of handling and management of huge number of CSFs arose. Critical analysis of literature on CSFs for successful implementation of public sector construction projects revealed that it was possible to

group them under few main distinct categories (Chan et al., 2004). Previous researchers attempted to goal around the problem of handling and management of the abundant number of CSFs in existence by coming up with different categories. Odeh and Battaineh (2002) categorized the CSFs into five groups, these are, (1) client related factors, (2) procurement related factors, (3) environment related factors, (4) consultant related factors and (5) client related factors. Chan et al., (2004) classified them into (1) human related factors, (2) project related factors, (3) project procedures, (4) project management actions and (5) external environment. Bubu and Sudharkar (2015) categorized them into seven, that is, (1) Project Management factors, (2) procurement related factors, (3) client related factors, (4) design team related factors, (5) contractor-related factors, (6) project manager related factors and (7) business and work related factors.

A careful study of previous literature suggests for this study the multiple CSFs for implementation of Public Sector Construction projects which can be grouped into seven (6) categories. These includes: (1) Design factors; (2) Procurement factors; (3) Project Management factors; (4) Project Participants factors; (5) Financial related factors and (6) Environmental factors (Ameh et al., 2010; Bubu and Sudharkar, 2015).

2.5.1 Project design related CSFs

Locally Mkuni (2016) established *clarity of project scope and work definition* as one of the Critical success factors for public construction projects which usually ensures that projects conducted within intended budget, time and it meets the set desired quality. This finding was in agreement by with the studies conducted outside Zambia which established the same results (Share, 2016; Bubu and Sudharkar, 2015; Kogi, 2013; Amide et al., 2012). Mukuka et al. (2016) found *adequacy of designs, specifications and documentations* as part of the strategic planning which has potential to determine the project time, quality and site disputes success criteria. This was supported by other studies conducted in different environments (Mohammad, 2011; Panuwatwanich, 2011; Blake, 2006).

Further, *design team experience* was found to be one of Critical success factors for success implementation of public sector construction projects in Zambia (Mukuka et al., 2016; Mkuni, 2016) affecting project time, cost and quality. It was also proved that

there was need to ensure *accurate initial cost* in order to avoid cost escalation, schedule overruns and quality shortfalls on construction projects (Kaliba, 2010). Tembo et al. (2015) added need for *team member's involvement during design* by recommending that there should be use application of Integrated Risk Management (IRM) which encourages team work, from inception of the project to completion which positively determine poject quality, site disputes, time and cost success criteria. Cooke-Davies (2004) in study conducted outside Zambia established *clearly established success criteria* as the Critical Success factor for projects which enables definition of milestones within the implementation stage. It was also established that *positive variations to original design during construction*, that is, variations meant to collect observed problems or reasonable expected changes as success factor for projects (Kaliba et al., 2009)

The seven (7) gathered Project design related CSFs for further study were as follows: 1) clarity of scope and work definition, 2) adequacy of designs, specifications and documentations, 3) design team experience, 4) accurate initial cost, 5) team members' involvement during design, 6) clearly established success criteria and positive variations to original design during construction.

The above literature reveals that most studies were based on traditional criteria (time, cost quality), meaning other equally important success criteria were left out to warrant generalization of results. Another notable observation was that these gathered Design related CSFs may not be confirmed to be applicable to Zambia today because the effects depends on the prevailing environment at the time of conducting the study.

2.5.2 Procurement related CSFs

Once again an observation was made that only few Procurement related challenges were established by studies done locally. Among those established locally was *choice of procurement procedure* (selection method) rather than relying on traditional procurement method that does not encourage integration of project parties in order to reduce performance of infrastructure projects (Tembo et al., 2015). A progressive procurement method was said to be positively predicting project time, cost, quality and site disputes (Ibid). In support of this finding was various studies done in other less developed countries (Cherop, 2016; Kogi, 2013; Oppong, 2013; Oladinrin et al., 2013).

Other notable procurement related Critical success factors established locally were as follows: *availability of skilled and trust worthy employees* (Kaliba et al., 2009); *availability of right material* (Ibid); *availability of suitable equipment* (Ibid); and *construction method adopted* (Ibid). Established procurement related CSFs in other environment for adoption or rejection using Exploratory Factor Analysis were as follows: *procurement planning* (Share, 2016; Cherop, 2016; Wambui et al., 2015, Tawil, 2013); Contract monitoring and control (Cherop, 2016; Barasa, 2014; Meredith and Mentel, 2012); Positive contract modifications (Barasa, 2014; Blake, 2006); and Progressive contract philosophy (Ali, 2010).

The nine (9) procurement related CSFs gathered to be exposed to further study were as follows: 1) procurement planning, 2) contract monitoring and control, 3) choice of procurement procedure, 4) contract modifications, 5) availability of trustworthy personnel, 6) availability of specified materials, 7) availability of specified equipments, 8) construction method adopted and 9) contracting philosophy.

2.5.3 Project Management related CSFs

Several studies were conducted in Zambia out of which success factors were either established or recommended. Project management related critical success factors established as affecting successful implementation of public sector construction projects mainly based on time, cost and quality success criteria were as follows: *Managers/Contractors` competence* which had potential to ensure appropriate project management practices which are thus required to curb causes and effects of cost escalation, schedule delays and quality compromise (Chilongo and Mbetwa, 2017; Mukuka et al., 2016; Banda, 2015; Kaliba et al.(2009); Kaliba, 2008).

Others were as follows: *on-site project manager* (Muleya and Kamalondo, 2017; Mukuka et al., 2016); *understanding of project mission* (Chilongo and Mbetwa, 2017; Banda, 2015); *top down commitment* (Kaliba, 2009); *project team motivation and good orientation* (Kaliba, 2010; Kaliba et al., 2009); *monitoring, feedback and control mechanisms* (Chilongo and Mbetwa, 2017; Sichombo, 2009); *effective project schedule application* (Chilongo and Mbetwa, 2017; Mkuni, 2016); *management of supply chain*

and logistics (Kaliba, 2009) and *risk management* (Muleya and Kamalondo,, 2017; Chileshe, 2016; Tembo et al., 2015 and Ngoma et al., 2014).

Project management related critical success factors established elsewhere to be screened to applicability in Zambia or not using Exploratory Factor Analysis were *possession of necessary authority* (Ali, 2010; Cooke-Davies, 2004b) and *client acceptance* (Bubu and Sudharkar, 2015; Amide and Ogbonna, 2012; Ali, 2010). The eleven (11) Critical success factors gathered for further study were as follows: 1) Managers`/Contractors` competence, 2) on-site project manager, 3) possession of necessary authority, 4) understanding of project mission, 5) top down commitment, 6) project team motivation and good orientation of project staff, 7) monitoring, feedback and control mechanisms, 8) effective project schedule application, 9) management of supply chain and logistics, 10) risk management and 11) client acceptance.

2.5.4 Project Participants related CSFs

Previous studies demonstrated that there were several Project participants related Critical success factor established to be affecting implementation of Public sector construction projects in Zambia. Notable ones were as follows: *adequate project team capability*, stating that human resource in the construction industry should be developed through suitable and continous training programs about construction performance (cost, time and quality) (Aghimien et al., 2018; Mbetwa, 2017); *size and skills of labour force* established based on poject cost, time and quality (Ibid) and *goal commitment of project team* (Tembo et al., 2015; Banda, 2015), said to be predicting poject time, quality and site disputes.

The other established project participants related Critical success factors were *effective communication channels between project participants* (Mukuka et al., 2016; Tembo et al., 2015) , known to be influencing project cost, time, site disputes, and health and safety and *good working collaboration among project participants*(Ibid). Adopted from study done outside Zambia for domestication was participants` emphasis on attainment of success criteria like cost, time and quality (Abudullah et al., 2009; Azhar et al., 2008; Jha and Iyer, 2006).

The five (5) Project participants related CSFs gathered for further study were as follows: 1) adequate project team capability, 2) size and skills of labour force, 3) goal commitment of project team, 4) effective communication channels between project participants and 5) good working collaboration among project participants

2.5.5 Financial related CSFs

Critical review of literature available indicated that though scant, there was little literature on studies done on critical success factors affecting successful implementation of public sector construction projects in Zambia. Although on the local scene few studies on this subject were in existence, there were a lot of studies on the same carried out in other countries with almost similar characteristics to Zambia but different environments altogether. Since critical success factors were said to be varying according to prevailing environments it meant those factors established in other areas could not be generalized to Zambia but could either be domesticated or rejected through the use Exploratory Factor Analysis. With the above in consideration, both local literature and foreign ones were reviewed.

Locally, some Project financial related Critical Success Factors were established as follows: *adequacy of working capital of contractors* which was found positively determining the project time, cost and quality(Chilongo and Mbetwa, 2017); *timely clearance of stage completion certificates by client* (Muleya and Kamalondo, 2017; Chilongo, 2017) and *Cash flow of contractor*(Chilongo and Mbetwa,2017). On adequacy of working capital of contractors Chilongo and Mbetwa (2017) intimated that there should be adequate contingency in order to cover increase in material costs. Muleya and Kamalondo (2017) on timely clearance of stage completion certificates by client stated that fair and expeditious settlement of claims in Zambia should be established through timely certification, record keeping, adequate legal and factual justification and presentation.

Gathered from studies done in other countries to be tried for domestication was the following financial related Critical success factors: *Financial capacity of the client* said to be affecting poject time, cost and site disputes (Abudayyer et al., 2006; Koushki et al., 2005; Swis et al., 2007); *availability of resources as planned throughout the project*

duration (Shaban, 2008; Cooke-Davies, 200b) found to be having positive effects on project time, cost and quality and accessibility to finance by contractors (Le-Hoai et al., 2008; Essam, 2006; Ibnu, 2006; Frimpong et al., 2003).

The six (6) gathered financial related CSFs to be exposed to further study are as follows: 1) financial capacity of client, 2) adequacy of working capital of contractors, 3) timely clearance of stage completion certificates by client, 4) availability of resources as planned though project duration, 5) Cashflow of contractor and 6) accessibility to finance by contactors.

2.5.6 Environment related CSFs

These are the factor in the environment of the project which directly or indirectly affect the performance of the project and the Project Manager usually on his own has no control over. Project Managers can only do good to understand them so that they establish strategies of how to go around them. Knowledge about them would make the Project Manager be able to account for their influence. Because of the indirect effects they have on the projects, it was observed that there were no known studies done in Zambia on Environmental related Critical success factors.

Critical review of available literature showed that much as they were no direct studies on this, few local researches indirectly found something (Aghiemien et al., 2018; Kaliba et al., 2008). The former touched investment cost and financial incentives which was connected to Economic conditions prevailing at a time and also need fo ideal and progressive government policies which are related to political conditions of the county. The later talked about labour harmony which ensures avoidance of labour disputes and strikes related to industrial relations and availability of specified equipments which is related to technology standard.

Since there were no locally established Environment related critical success factors in the midst of abundance of in other countries, a search was launched with intention of examining them for adoption or rejection using exploratory factor analysis. Found prominently established were as follows: *Economic conditions prevailing at a project time* which was found determining project cost, time and quality (Ameh et al., 2010; Enshassi et al., 2009; Ibnu, 2006); *social and cultural orientations*, that is, how those

affect work like certain quarters claim certain cultural norms makes people either be hand working or not (Baumann, 2013; Ameh et al., 2010; Ali, 2010); *political conditions*, that is, stable political atmosphere makes concentration of resources and attention to projects possible (Amide et al., 2012; Gangolells, 2011; Jha and Iyer, 2006); and *absence of bureaucracy* meaning effective and efficient service found determining project time and cost (Ali, 2010; Cooke-Davies, 2004b) .

The other Environment related Critical Success factors established in other countries with almost similar characteristics to Zambia were as follows: climatic conditions and ecological environment which was found affecting project cost, time, quality and environmental impact (Alsolaiman, 2014; Enshassi et al., 2009; Le-Hoai, 2008); industrial relations (Ngoma et al., 2014; Amade et al., 2012; Gangolells, 2011) and technology standard (Ishtiaq and Jahanzaib, 2017; Ali, 2010. Cooke-Davies, 2004b)

The gathered seven (7) Environment related CSFs were as follows: 1) economic conditions prevailing at a time, 2) social and cultural orientation, 3) political conditions, 4) absence of bureaucracy, 5) climatic conditions and ecological environment, 6) industrial relations and technology standard.

2.5.7 Critique of the literature reviewed on Critical Success Factors

Previous studies had focused on identification of the common features of projects and categorized them into CSFs. As earlier demonstrated, there has never been any generally unique accepted grouping for CSFs (Ameh et al., 2010). The grouping has mainly been based on importance of factors to success of projects subject to type and nature of projects. The above confirms that success factors amongst construction projects are based on multidimensional as stated by Long et al., 2004). There, is however, no consent on the grouping of factors prompting the success of construction projects.

Observation made from literature reviewed was that despite the body of knowledge having many studies on management of public construction projects, the number of local CSFs on public construction projects were found to be few (Ngacho, 2013; Amade et al., 2012). Unfortunately those established elsewhere could not be domesticated

directly without screening because of difference in the environments where they were established (Long et al., 2004). It was also established that most of the previous researchers considered performance of the entire construction projects as evaluation was done at the end of the project. The few who attempted to conduct studies on implementation did not consider it as the stage along the project life cycle which could be taken as a project on its own with distinct beginning and end to enable thorough evaluation. It was mostly considered as the by the way process of the construction project management. Further, the studies indicated that the CSFs were identified using traditional criteria which consider only project time, cost and quality as success criteria for public sector construction projects.

2.6 Strategies for Successful implementation of PSCPS

As defined by Micheli (2011), strategy is some kind of deliberately envisioned option of achievement, procedures to deal with a circumstance. Strategies mostly lead to formulation of performance measurement frameworks (Bourne et al., 2003). Performance measurement is a fundamental organisation process which can help you to evaluate and communicate activities and results, forecast and plan, focus attention and trigger change, guide beharviour and learn and improve (Ibid).

A search for literature on established strategies for improvement of public sector construction projects implementation in Zambia demonstrated that, at the time of study there were no known study on the same. Almost similar was the study done by Sichombo and Kaliba (2009) on introduction and promotion of important strategies like technical auditing to prevent unethical practices. Elsewhere, there was literature on strategies for improvement of construction industry in general, with Stewart et al. (2002) focusing on strategic implementation of IT/ARE projects in construction. Tengan and Aigbavboa (2016) developed a Project Monitoring and Evaluation framework for Ghanaian Construction industry.

Notable strategies for success of execution of public construction projects from previous researchers were five (5) (Leslie, 2015; Rahim, 2010; Sichombo and Kaliba, 2009; Boume et al., 2003; Tengan and Aigbovboa, 2016)). These are as follows:

1. **Creating a flow of Communication**

Communication is one of the most important elements for smooth management of projects. Therefore, the strategy of streamlining the flow of communication between project players cannot be overemphasized

2. **Continuous Planning**

Planning should be a continuous process, that is, it should start from conception via all project stages up to completion.

3. **Observing and Asking Questions**

Monitoring and evaluation of construction projects requires more attention and combined energy than most activities, because of the physical nature of the work. Construction projects` workflows are usually drastically affected by field elements.

4. **The use of Critical Path Method (CPM)**

Application of CPM, implementation of quality procedures (Best Practice Principle) and technical audit management during construction are the most effective project management strategies in Construction sector.

5. **Use of Regular project management tools**

Adoption of regular project management tools and work equivalent creativity are the most fundamental tactics for operational project delivery.

The above strategies mainly established in other environments which are different to Zambia may not be directly generalized to Zambia but could be tested for applicability to Zambia`s construction projects. During the period of study there were no known studies on strategies for improvement of implementation of public construction projects. Even the ones done in other environments had not focused on improvement of implementation stage of public sector construction projects only.

2.7 Implementation of Public Sector Construction Projects in Zambia

In Zambia more than 90 percent of the construction sector is under the state because of the importance attached to it by the Government (NCC and ZIPAR, 2017). Currently Public sector construction projects in Zambia are initiated, designed and executed by the government bureaucracy although the government of Zambia in 2017 established a new Ministry of Housing and Infrastructure development whose mandate is to oversee all construction projects in Zambia. In the same vain decentralization was embarked on to ensure equitable development in districts and provinces. In Zambia, Public projects are

always initiated by the project promoter and client. The tendering process is undertaken (GRZ, 2014).

As stated earlier Public Sector Construction projects includes projects that are useful to the public at large. Apart from the common infrastructures the 7th National Development Plan focuses on the following: a) Construction and rehabilitation of railways, b) Development of aviation infrastructure and operations, c) Construction and rehabilitation of road network, d) Construction and rehabilitation of marine and in land waterways, e) Enhance investment in agricultural infrastructure, f) promote tourism – related infrastructure and g) improvement of ICT infrastructure for service delivery (GRZ, 2017).

Construction projects like administrative buildings, schools, health centres, housing development projects and transport infrastructure were carried over from the 6th National Development Plan. Embarked on later were constructions of 4,000 houses for government officers using Public –Private-Partnership procurement method. Road Development Agency initiated a large–Scale link Zambia 800 infrastructure project. Initially 1,500 kilometers of inter district roads within Zambia was proposed to be done. In addition to the above roads, the Lusaka 400 (L400) which was basically a rehabilitation and construction of 400km road network within Lusaka Province was embarked on (GRZ, 2016).

2.7.1 Mechanisms for monitoring of PSCPs

In Public Construction Projects the Client which is public (i.e. Government, Donor or community) monitors the implementation process of the project through Consultants who includes architects/engineers from Ministry of Works and Supply (soon to be from Ministry of Infrastructure Development and line Ministries responsible for implementation of government projects. In most cases large projects are monitored by specialized company of consultants engaged by the public. For medium and small projects mostly the consultancy is done by Ministry of Works and Supply and line Ministries (GRZ, 2013).

For roads, it should be stated that Zambia has had a total categorized road system of 67,671km of roads comprising: Park, Tertiary, Secondary, Primary, Urban, District, Main and Trunk roads (GRZ, 2017). For roads classified Trunk, Main, District and Urban which involves larger contracts mostly consultants are engaged who designs and monitors the project together with engineers from RDA (Ibid). For minor roads usually classified as Primary, Secondary, Park roads and Community, RDA engineers provides their own consultancy which includes Monitory projects (Ibid). The consultants does comprehensive monitoring in that they also cover the technical audit of the process in line with the Project Implementation Plan, project schedule, scope and design. As it has been earlier refereed to Public Sector Construction Projects have many stakeholders as such Ministry of Planning also does monitor the progress of the implementation process from the social and financial perspective only. Politicians also monitor these projects on behalf of the beneficiaries.

As for Donors funded Public Sector Construction Projects the client like UNICEF, JICA and others have their own monitoring guides of the projects. Whistle blowers like Transparency International Zambia also monitor the implementation of projects. Lastly in Zambia the Auditor General's office does monitor the all the public projects through constant audits done on them (United Nations, 2014).

Implementation of public initiated construction projects is determined by public interest. Another fact is that the industry requires huge capital investment such that any mismanagement risks huge financial losses. There has been wide condemnation by stakeholders of the way public construction projects are initiated, managed and executed. This has led to many researches at both local and national level mostly attempting to establish both key success and failure factors for projects. The organizations in Zambia that conducted studies in this part includes; Auditor General`s office from 2011 to 2016, Parliamentary Select Committee of Communications, Transport, Works and Supply on Implementation of Public Sector Construction projects and its possible improvement and Local Civil Society Organisations.

Based on these studies, relevant watchdog organisations including opposition parties, Local and foreign Civil Society organizations like Transparency –Zambia, women in Construction, women for change and Construction Sector Transparency (COST)

initiative and political party in power have been in the position to separate performers from non-performers (Mukumbwa, 2013). To some extent the above intervention has improved implementation of some public construction projects although some are still in the old state despite purported increased funding.

2.8 Identified gaps in Literature

The literature reviewed signifies that, the project management literature is stuffed with studies pertaining to KPIs of projects as well challenges and CSFs influencing the same

- During the period of study it was observed from the available literature that there were no known studies specifically conducted on performance along the implementation stage of public sector construction projects in Zambia.
- The fewer studies which touched implementation of public sector construction projects managed to establish only few challenges and CSFs influencing implementation of public sector construction projects in Zambia.
- The above literature also reveals that identification of CSFs was done on the basis of traditional success criteria which only consider time, cost and quality as indicators leaving out other equally important indicators.
- There was no established relative association between individual project success factors an overall performance of implementation of PSCPs in Zambia
- There was no established collective association between project success factors an overall performance of implementation of PSCPs in Zambia
- No strategies for performance measurement along the implementation stage of PSCPs were formed in Zambia.

The study is an attempt to fill this gap by conceptualizing the relationship as shown in figure3.1, chapter 3.

2.9 Summary

To lay the foundation for the study, definitions an explanations of the main terms in text like project management, project life cycle, phases of construction projects, public sector construction projects and classification of public projects. From the same literature review performance measurement indicators amongst public sector construction projects were developed starting from the traditional criteria of focusing only time, quality and cost as KPIs through performance criteria which is based on

"five" pillars as relevance, efficiency, effectiveness, impact and sustainability as KPIs to the contemporary measures which are broad based considering cost, time, quality, client satisfaction, safety and health, environmental impact and site disputes among many as KPIs. In the same vain challenges faced at implementation stage of public sector construction projects were established from the literature review and grouped under six broad groups namely: project design and planning challenges, project management challenges, and procurement related challenges, financial related challenges and environmental related challenges.

In an attempt to establish the positive or opposite which is success factors, Critical Success factors (CSFs) contributing to implementation of public sectors construction projects were established from the literature review as success variables which affect various types of Success Indicators and grouped under six established major groups similar to those for challenges above. Not forgetting the importance of identifying the strategies for successful implementation of projects , strategies were gathered from literature as creating a flow of communication, making a habit of continuous planning, observing and asking questions, using of tools to monitor costs and budgets, implementing auto reporting systems, the use of CPM (Critical Path Method), and adoption of standardized project management tools.

Finally critique of the literature reviewed was given; including the fact that studies done on Zambia focused on performance of the entire project and not performance at various stages of the construction life cycle and that all of them measured performance of the projects using only time, cost and quality as KPIs. The gap in the literature review was established as lacking of challenges faced along the project life cycle and that identification of CSFs was based only on the effects they had on the traditional criteria model of focusing time, cost and quality. Other gaps were that collective impact of CSFs on implementation of public sector construction projects were not established together with the relative impact of various CSFs on implementation of Public Sector Construction Projects and finally strategies for improvement of the process were not comprehensible.

The next Chapter addresses the Theoretical and Conceptual framework of the study.

CHAPTER 3

THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter provides the links between the ideas of the research. In order to establish the linkages of variables, the identification of the theoretical and conceptual frameworks of this study is done in this chapter. This aims at creating a conceptual model that tries to solve the research problem and research questions, and provide the essential solutions. It comprises of the theoretical review and conceptual framework

3.2 Theoretical Framework

A theoretical framework is a set of proclamations or ideologies formulated to describe a collection of facts especially one that has been constantly verified or is widely acknowledged and can be used to make forecasts about natural phenomena (Kogi, 2013). Theories are logical tools for understanding, clarifying, and making estimates about a given subject matter. A theory is a set of interconnected perceptions, clarifications, and suggestions that describes or guesses or circumstances by postulating associations among variables (Amide et al., 2012). The adopted theories for this study are General systems theories, Contingency theories and theories of Change.

3.2.1 General Systems Theory

General System's theory was developed by Ludwig von Bertanlanffy in 1968, the theoretical biologist born and educated in Australia who first familiarized the General Systems Theory. He used it to search the interactions between creatures and the environment (Siporin, 1980, Goldstein, 1990 and Luhmann, 2017). As applied to this study, this theory holds that independent variables Project Design factors, Procurement factors, Project Management factors, Project Participants factors and Project related factors, intervening variables which are environmental factors to influence or explain the dependent variable "Successful Implementation of public sector construction projects" because they are identified subsystems that interacts and interrelates in order to ensure wellbeing of the whole system(Successful implementation of public sector projects).

3.2.2 Contingency Theory

Originated in the 1960`s by Edward Fiedler and Australian born psychologist, the Contingency principle builds on the Systems Approach yet acknowledges that there are abundant factors that may influence organization`s performance (Burns and Stalker, 1961).

Despite being similar in many ways with General systems theory, Contingency theory differs in some ways. Notable differences are that it discards use of some the management philosophies to any situation. In short it does not support management principles, but promotes management based on experience and judgment of the project manager in a given environment. Its principle is based on the capability of the managers to propel projects to higher heights.

As applied to this study, Contingency theory holds that it is expected that the intervening variable (External Environment factors) in addition to the internal ones CSFs) covered in systems theory does influence or explain the dependent variable (Successful implementation of public sector construction projects) because it is one of the contingencies which affect the result of the system as a whole.

3.2.3 Theory of Change (ToC)

Adopted from the Countries current five year development plan which is the Zambia`s 7th National Development plan is the theory of change under which the plan is premised. ToC is an idea that pronounces in a logical way, how plans, actions or programmes contribute to a set of specific outcomes through a series of intermediary results (Ministry of National Planning, 2017). Silva et al. (2015) defined a theory of change as an analytical notion about the association between preferred modifications and the activities that may create those changes. Change was said to have sources from both internal and external part of the organisation and that change was a necessity as such not accommodating it causes failure of projects. The application to this study is that construction being complex in nature has a lot of stages, stakeholders or participants as such there is need to come up with the strategies that are situational specific to come up with the overall desired success of the whole project.

3.3 Conceptual Framework

A Conceptual framework can be defined as a set of comprehensive concepts and values taken from pertinent fields of investigation and used to organize a following presentation (Sitko, 2013). The framework helps to illustrate the causal relationships between the independent variable(s) and the dependent variable. The current study is an attempt to fill the above identified gap by conceptualizing the relationship as shown in Figure 3.1 below:

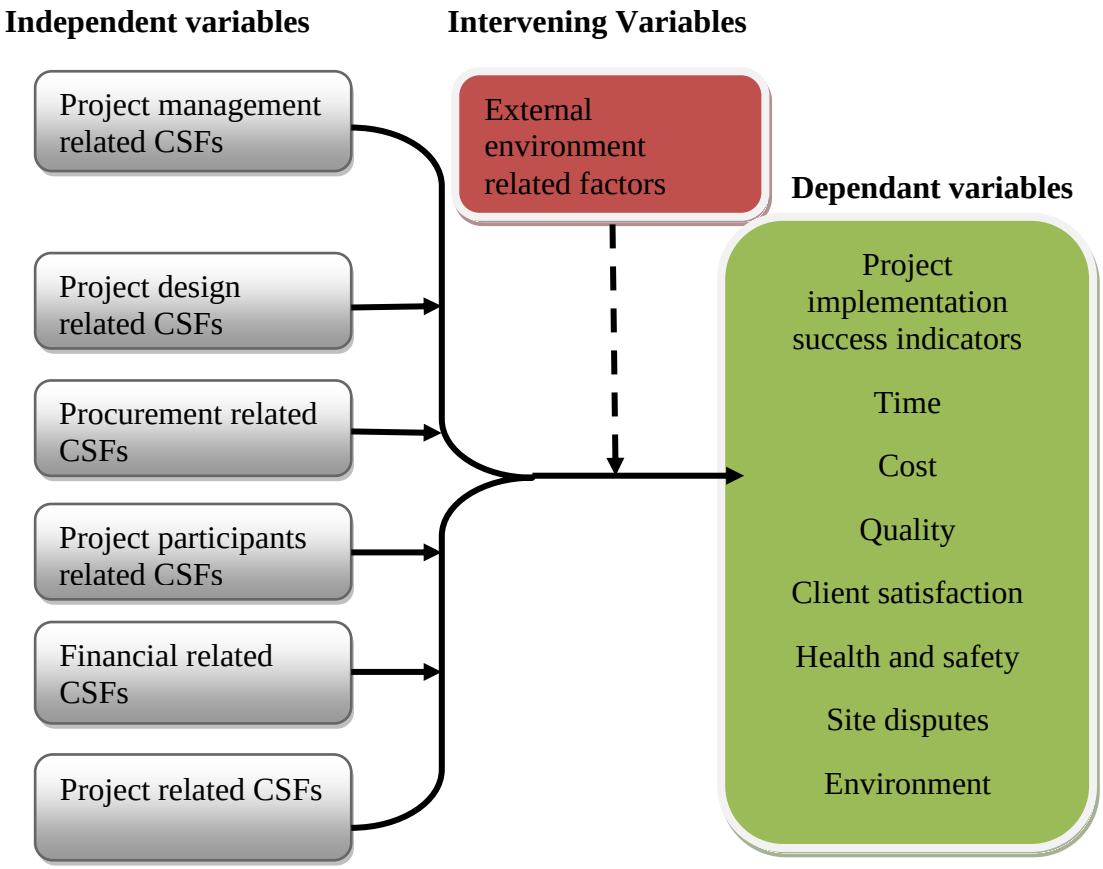

Figure 3.1 Relationship between CSFs and Successful Project implementation

In figure 3.1 the relationship was established between the CSFs variables which were either identified as independent or intervening variables and the indicators for successful implementation of public sector construction projects.

3.3.1 Description of variables and Hypothesis development

Established from thorough literature review was seven major groups of Critical Success factors namely: 1) project management, 2) project design, 3) procurement related, 4)

project participants, 5) financial, 6) project related and 7) environmental factors. The first six were identified as independent variables and the last one as the Intervening variables. On the other side the dependent variables were identified as Key indicators for successful implementation of projects.

3.3.1.1 Independent and Intervening Variables

These are factors that the researcher thinks explain variation in the dependent variable. They are sometimes referred to as the predictor or explanatory variables (Kombo and Tromp, 2006). Under Project Management factors though many were identified, considered for this study was management`s competence, top management commitment, effective communication, feedback and control mechanisms and supply chain management. On project design factors considered for this study are clearly defined goals, adequate schedule, quality designs, realistic cost estimates and team member`s involvement. Procurement related factors had procurement planning, contract monitoring and control, choice of procurement systems, ethical considerations (Corruption levels) and transparency. Considered on Project participants factors were competence of project team, client type and experience, characteristics of the project team, knowledge of project team and collaboration of project team. Under Financial factors considered were availability of funds, accessibility to finance, and time of clearance of stage completion certificates, accountability and transparency and counterpart/community contributions. Finally of independent variables was Project related factors with type of project, nature of project, number of floors of the project, complexity of the project and size of the project, number of incidences during implementation stage (Health and safety), site disputes, and environmental impact.

Intervening variables are variables that explain a relation or provides causal link between other variables. Also called by some authors "mediating variable" or intermediary variables. In this study identified as the intervening variables are environmental factors which were composed of economic, social, political, physical (ecological) and rules and regulations.

3.3.1.2 Dependent variable

It is the outcome variable the researcher is attempting to predict. Variation in the dependent variable is what the researcher tries to explain (Kombo and Tromp, 2006).

This is a variable which depends upon or is a consequence of the other variable. In this study the dependent variable is *success of implementation of public sector construction projects* which could be observed through variations in the following Key success indicators at implementation stage of the projects: These are time it takes to implement the projects (Time), whether project is implemented on budget (Cost), project executed as per specifications (Quality), project implemented to client`s satisfaction (Client satisfaction),

3.3.1.3 Hypothesis Development

It is hypothesized that CSFs have positive impact on successful project implementation. Accordingly seven CSFs proposed were project management-related, project design-related, procurement-related, and project participants-related, financial-related, project-related and environment-related factors. Besides having a direct influence on successful project implementation, it was hypothesed that external environment related factors mediates the effects of the remaining six CSFs on successful project implementation. It was also hypothesized that collective CSFs have positive impacts on successful implementation of projects.Further, there is an association between project implementation success and overall success of public sector construction projects, which are related to seven success indicators namely time, cost, quality, client's satisfaction, health and safety, site disputes and environmental impact.

Multiple linear regressions were used to test the null hypotheses with focus on structure coefficient analysis (rs). Multiple linear regression analysis helps us to understand how much the dependent variable will change when we change the independent variables.

3.4 Operationalisation of concepts

Table 3.1 is a summary of the systematic process of Operationalisation of the independent and dependent variables that was undertaken: from the basis of set objectives, through to indicators, measures and measurement. It further indicates the measurement scale.

Table 3.1: Operationalisation of the Research variables

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
1	To examine the effect of project management factors on the success of implementation of public sector construction projects in Zambia	Project Management issues	Management competence	-Level of competence of managers	Education, training and experience of Managers	Interval/Ratio
			Top management commitment	-Involvement	Levels of involvement	
			Effective communication	-Speed of information flow	Time taken to communicate necessary information	
			Feedback and control mechanisms	-Project Controls	Levels of project controls	
			Supply chain management	-Integration (Internal and External)	Levels of connectivity and simplification	
2	To examine the effect of project design factors on the success of implementation of public sector construction projects in Zambia	Project design aspects	Changes in design and specifications	-Complexity of design and specifications	Net cost of modifications	**Interval/Ratio**
			Adequate schedule	-Accuracy	Level of accuracy	
			Quality designs	-Completeness	Level of design and specification completeness	
			Realistic cost estimates	-Availability of specified inputs	Unit cost of production (cost per m^2 of floor area)	
			Team members` involvement	-Supervision	Number of periodic project team site inspections and meetings	
3	To examine the effect of	Procurement related aspects	Procurement planning	-Project delivery approach	Pace of project delivery	Interval/Ratio

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
	Procurement related factors on the success of implementation of public sector construction projects in Zambia			-Procurement lead times	Amount of time taken to procure the specified inputs(e.g. materials)	
			Contract monitoring and control	-Controls	Level of monitoring and evaluation	
			Choice of procurement	-Competiveness	Number of bids	
					Weight on price	
					Compensation price level	
			Corruption	-trustworthiness	Level of susceptibility to corruption	
			Transparency	-openness	Level of transparency	
4	To examine the effect of project participants factors on the success of implementation of public sector construction projects in Zambia	Project Participants	Competence of project participants	-Level of competence of available project team	Education , training, and experience levels of available project team as required at a specific time	Interval/Ratio
			Client type and experience	- Types(financing, contracting and Beneficiary)	Number of client types	
			Availability of appropriate human resources of project team	-Quantity of available appropriate workforce	Number of available personnel as required at specific time	
				-Demand fluctuations	Number differences in availability of personnel required over different periods of time	
			Collaboration of project team	-Teamwork	Level of collaboration	

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
			Commitment of participants	Involvement	Level of involvement	
5	To examine the effect of Financial factors on the success of implementation of public sector construction projects in Zambia	Financial issues	Availability of funds	-Adequacy of funds	Ratio of contract sum(work awarded) to tender sum (work bid for)	Interval/Ratio
				-Capital base	Level of capital base in relation to works undertaken	
			Accessibility to finance	-Financial system	Amount of time taken to process a loan	
			Progress payment process	-Timeliness of valuations and certification	Amount of time taken to value and certify works	
				-Accuracy of valuations	Level of discrepancy between technical valuation for payment and the contract`s claim	
				-Timeliness of honoring certificates	Amount of time taken to honour certificates	
			Accountabilty and transparency	-Control and accounting	Level of effectiveness of cost control	
			Counterpart/community contributions	-Commitment to pledges	Level of commitment to honoring pledges	
6	To examine the effect of project related factors on the success of implementation	Project related factors	Type of project	-Category of the actual facilities being constructed	Number of types of construction projects	**Interval/Ratio**
			Nature of project	-Character	Level of distinctiveness	

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
	of public sector construction projects in Zambia		Site of the project	-Unique site features and conditions	Unit cost of production (cost per m^2 of floor area)	
					Time taken to execute the works	
			Complexity of project	-Scope	Number of operatives involved	
					Number of floors of the project	
			Size of project	-Magnitude	Cost of the Project	
					Number of beneficiaries	
Item	**Objectives**	**Intervening variables**	**Indicators**	**Measures**	**Measurement**	**Measurement Scale**
7	To examine the intervening effect of Environmental factors between CSFs and success of implementation of public sector construction projects in Zambia	Project external environmental aspects	Economic	-GDP	Income levels	Interval/Ratio
				-Market conditions	Percentage increase in prices	
				Poverty	Poverty levels	
			Social	-Culture	Speed of doing work	
				-Social amenities	Number of Social amenities	
				-Social security	Levels of social security	
			Political	-Stability	Level of commitment to projects	
				-Democracy	Amount of support to projects	
				-Status Quo	Level of bureaucracy in decision making	
				-Interference	Level of interference	

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
			Ecological	-Natural endowments	Number of required natural resources	
				-Natural calamities	Number of calamities during implementation(droughts, floods, earthquakes, landslides and hailstorm hazards)	
				-Accessibility	Level of accessibility to resources	
			Laws and regulations	-Conformity	Level of adherence to laws and regulations	
				-Contradiction	Number of contradictory laws and regulations	
Item	**Objectives**	**Dependent variables**	**Indicators**	**Measures**	**Measurement**	**Measurement Scale**
8	To establish the extent to which success of implementation of public sector construction projects is affected by the above sated CSFs	Successful implementation of public sector construction projects	Implementation budget (Cost)	-Contract sum for implementation	Percentage of contract sum for implementation	Interval/Ratio
			Implementation duration (Time)	-Contract duration	Percentage of contract period	
			Adherence to specifications (Quality)	-Specifications details	Level of adherence to specifications (%)	
			Client satisfaction	-Attitudes	Level of corporation/support to the project	
			Health and safety	-Adherence to health and safety conditions	Number of Accidents and sicknesses	
			Site disputes	-On-site	Number of disputes	

Item	Objectives	Independent variables	Indicators	Measures	Measurement	Measurement Scale
				management		
			Environmental impact	-Sustainability	Level of adherence to environmental protection(air quality, noise level, waste around the project site and climate condition)	

Source: Own compilation

3.5 Summary

The theoretical framework for this study was based on these three theories. General systems theory was found to be applicable to this study in the sense that identified CSFs were assumed to be working together as systems and subsystems in influencing success of implementation of public sector construction projects. The Contingent theory was emphasing on the need to include focus both internal and external environment in the search for factors that affect success for the project. As for theory of change adopted from the current National Plan for Zambia, it was found to be applicable to the study because it`s emphasis on need of coming up with strategies for implementation of projects which were situational specific.

The theoretical framework guided the designing of the Conceptual framework, which showed the relationship between identified CSFs as independent variables/ intervening variables on the one side and Key Indicators for successful implementation of public sector construction projects. From the conceptual framework it could be deduced that variables in one group can influence a variable in the others, and vice versa. To study how these factors affect successful implementation of public sector Construction projects separately and collectively, it is hypothesized that Successful Implementation of Public Sector projects is a function of Project design factors, Project Procurement factors, Project Management Factors, Project Participants factors, Project Related factors, Financial factors and the Project Environmental factors and they are interrelated and interrelated".

To enable measurement possible, all of the identified variables were operationalised in line with the objectives guiding the study.

The next chapter presents the methodology used in the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

The purpose of this research is to investigate the factors that affect successful implementation of public sector construction projects in Zambia. In order to achieve this, an appropriate research design which include target population and sample, data collection method and instrument, data analysis, and ethical considerations are discussed. According to Saunders et al. (2010), these are jointly slated to as research design. Reason is also given for the particular methods or tactics engaged in this study.

4.2 Research Methodology

Methodology has been defined by Bailey (1984) as the viewpoint of the study process. It comprises the suppositions and beliefs that serve as a justification for study and the criteria the researcher uses for interpreting data and realising conclusions. It is further defined as the complete plan, from the problem identification, to the final strategies for data assembly and analysis (Saunders, 2007).

According to Kothari (2004) despite philosophical thought remaining secreted in research, they still affect the drill of study and need to be acknowledged. Creswell (2014) saw worldviews as an overall theoretical alignment about the world and the nature of study that a researcher embarks on. The type of orientations a researcher has mostly determines whether the study should be mixed methods namely: qualitative or quantitative methods.

4.2.1The Pragmatic Philosophy

This philosophy is the basis of mixed methods, as illustrated by earlier researchers who expressed it importance in targeting research problems and there after use mixed approaches to originate knowledge about the problem (Morgan, 2007; Tashakkhori and Teddlie, 2010).

Pragmatism does not see the world as unconditional entity. In a related manner, mixed method researches considers many methods for collection and examining data rather

than pledging to only one way (e.g. Qualitative or quantitative). In this study pragmatic philosophy enabled use of two main research philosophies namely Constructivism and Post positivism.

4.2.1.1 Constructivist Philosophy

This philosophy was said by earlier researchers to be the one which leads to interpretative or qualitative approach (Mertens, 2010; Crotty, 1998). This philosophy is based on the assumption that human beings attach have varying experiences which influence meanings attached to certain things. Constructivism or social constructivism (often combined interpretive) is a philosophy that is typically seen as an approach to qualitative research (Mertens, 2010; Crotty, 1998). Individuals develop subjective meanings of their experiences - meanings directed toward certain objects or things. Since attached meanings are diverse and many, researchers attempt to unearth the complexity of opinions rather than constricting meanings into reduced ideas (Creswell, 2014).

4.2.1.2 Post positivist Philosophy

The post positivist suppositions are mostly inclined to quantitative research than qualitative research. Cresswell (2014) refers to this philosophy as scientific method sometimes. The term post positivism was coined to represent the thinking after positivism; it challenges the existence of absolute truth of knowledge (Phillips and Burbules, 2000). It acknowledges the fact that no one can be positive about claims of knowledge when researching the developmental actions of humans. Saunders et al (2003) re-affirmed the fact that research mostly takes the mixture of the two philosophies.

4.3 Research design

Different researchers define research design differently with O`Sullivan et al (2010) defining it as strategies that influence choices on methods of data collection, what type of data to collect, population to collect data from and methods for data analysis. It is a roadmap for the research`s

O`Sullivan et al. (2010) defined research designs as plans that guide decisions about when and how to collect data, what data to gather, from whom and how to analyse it. It is a plan for the study`s methodology. It is also said to be a clearly a defined constructs

within which the research is executed (Saunders, 2007). In this study an exploratory sequential mixed method design was used. Exploratory sequential mixed method design enables researchers to first start with qualitative research in order to sample ideas of the respondents. Data gathered was then investigated, and the results were used to shape the next study`s data collection tool (Creswell, 2014). Findings from the initial qualitative study were used to create a questionnaire for the main study which was basically quantitative study. Thus, the research design was composed of the exploratory study design and the conclusive study design.

In this study the main designs used were exploratory and explanatory studies. Exploratory designs mainly use qualitative approaches, whilst explanatory used quantitative approaches.

4.3.1 Exploratory research

An exploratory research is cardinal where a researcher has less knowledge about the phenomena. It helps in accurately defining the problem and also setting the parameters for addition research (Burns and Bush, 2002; Hair et al. 2006). The design is not limited to one specific orientation as it could be applied within the confines of either qualitative or quantitative approaches. In this study, interviews with 63 construction projects management experts within Zambia were conducted to gather their opinions on the sector. A semi-structured interview guide (refer to Appendix 4.1) was used to collect data for the period of four weeks which was later aggregated to enable advance analysis.

Experience survey which is commonly known as expert interviews, enables researchers to seek insight of the subject from experts through interviews. Since there was little knowledge about the factors which affect successful implementation of construction projects in Zambia, exploratory survey was conducted on experts of construction project management.

4.3.2 Descriptive research

The main purpose of descriptive research is to present precise and convincing representation of the variables that relate or are pertinent to the research. According to Saunders et al. (1997), this design gives a picture of situations how they appear in their natural setting. The recommendations for strategies that could be applied to enhance the

implementation of public construction projects were made. This design was also adopted for this study.

4.3.3 Explanatory research

In addition to descriptive study, explanatory design was conducted. This design was advanced compared descriptive studies is that it did not only establish relationships but also cause and effects approaches (Hair et al., 2003). Causal research is cardinal in establishment of functional correlation between independent variables and dependent variables which is the effect on successful implementation of public construction projects (Ibid).

MANCOSA (2003) explained that explanatory research design attempts to create linkages between related components of a phenomenon. Explanatory design is this study enables conceptualising of the research problem, gather data on the incident and analytically and deductively establish relationships between variables. The emphasis here is on studying a situation or a problem in order to explain the relationships between variables.

In this study, explanatory design was used to establish the collective influence of CSFs on successful implementation of construction projects in the public sector. It was also used to explain the relative impacts of individual CSFs on successful implementation of public construction projects.

Survey technique was applied in this study. Underlying facts from Bailey (1984) and MANCOSA (2003) are that Survey involves collection of data through questions posed to representative cross-section of the population. Of interest in survey is determination of preferences, attitudes, perceptions and opinions of participants in the study. Survey technique was adopted because it usually accommodates large number of participants making generalization possible. There is more likelihood of the results being precise because of the inclusive nature of the large possible sample size which inhibits errors. Data collection is obtained directly from the respondents. Sampling techniques applied shrink or remove problems of bias. Survey allows use of many logical data collection methods like observation, questionnaires and interviews which could be used individually or collectively. The method enables researchers to have more control over the researcher procedure. The limitation of a survey technique is that it depends on the

good will of respondents and sometimes it is time consuming (Kombo and Tromp, 2014).

4.3.4 Qualitative research

In this study it has been stated already that qualitative research was used during the exploratory study as such it has been found ideal to explain what qualitative research is all about. Qualitative research is a type of social enquiry which targets on the way human beings translate and make meanings of their experience and the domain they live in (Holloway and Wheeler, 2002). Qualitative approach is used by researchers to explore the experiences, behaviour, feelings of the people and perspectives. It also stresses the understanding of the above stated elements.

The justification for use of qualitative approach in this study was to probe the views of construction experts and stakeholders on the challenges and CSFs for implementation of public construction projects.

4.3.5 Quantitative research

This approach was used in explanatory study. It was also used partially in exploratory and descriptive studies. Quantitative research is described as the one in which researchers ask particular questions. In addition quantitative research is concerned with statistical data and numerical measurements. It uses scientific manipulations to test hypotheses, and is in support of the view of the positivist philosophers who claim that there is an objective reality that can be accessed and measured (Cresswell, 2014). In this study, quantitative data was used to describe the challenges and Critical Success factors faced during implementation of public construction projects. It was also used to explain the relationship between identified variables.

4.4 The Research Population

Burns and Grove (2003:213) describe population as all the elements that meet the criteria for inclusion in a study. This is sometimes referred to as ‘Sampling Frame’ (O’ Sullivan et al., 2010).Burns and Grove (2003:234) define eligibility criteria as “a list of characteristics that are required for the membership in the target population”. The criteria for inclusion in this study were that one to be eligible should be a participant in public sector constructions projects. They included project promoters, clients or end users, Consultants, Contractors and suppliers of materials. The sampling frames for the

651 participants were obtained from various organisations as shown in Table 4.1 below. A subjective method of determining the population for clients was undertaken. However, all main public sector clients were included.

The major clients for public sector construction projects in Zambia are project promoters such as Road Development Agency (RDA); Zambia National Service (ZNS); Ministry of Housing and Infrastructure development; Ministry of local Government and Housing; Ministry of Transport and Communication; Ministry of Works and Supply; Ministry of Tourism and Environmental protection; Ministry of Health; Ministry of Education; and Ministry of Energy and Water development. Other promoters included in the survey were ten Provincial Administrations namely: Lusaka, Copperbelt, Muchinga, Southern, Western, North Western, Eastern, Luapula, Northern, and Central Provinces. Contractors in Grades 1 to 3 were expected to have national character and experience (Mukumbwa, 2013).

4.5 Sampling Design and Sample Size

This section highlights the sampling design and sample sizes used in the study.

4.5.1 Sampling Design

Sampling refers to the technique of choosing a represented sample from the population (Cresswell, 2014). A sample is a set of elements drawn from the population for the easy analysis of data (Polit & Hungler, 2004). In research sampling is perceived to be very important because it is cost effective allows use of manageable elements as opposed to census which is very expensive. More accurate results can be easily attained from the analysis of data from the sample due to easy management. Sampling is mainly divided into probability and non-probability sampling. O`Sullivan et al. (2010) further subdivided probability sampling designs into four sampling techniques namely; stratified random sampling, systematic random sampling, Cluster sampling and simple random sampling.

In this study a probability, Stratified random sampling method was used in determining the sample for descriptive and explanatory studies. Initially the element in the population was divided into strata based on the characteristics they possessed. The categories were formed in order to allow equal representation to all groups. Simple random sampling was then conducted on each stratum (Clients, Consultants,

Contractors, Manufacturers and Suppliers and Interest Groups). The reason for selection of Stratified random sampling is that it ensures adequate representation of all selected groups in the population. It eliminates any bias that could emanate from the likely over representations from some categories. It is also the most efficient method among other probability designs as it allows all groups equal chance to participate. Its shortfall is that it is time consuming as compared to simple random sampling. The population was divided into five main strata as shown in Table 4.1 below:

Table 4.1: Sampling frame and sample sizes for different strata of surveyed respondent construction industry groups

No.	Stratum	Type of Organisation	Population	Sample size
1	**Clients**	Major project promoters	36	30
2	**Consultants** Architects Engineers Quantity Surveyors	 Zambia Institute of Architects Association of Consulting Engineers Surveyors Institute of Zambia	 158 60 30	 80 39 11
3	**Contractors (**Grade 1to 3)	Association of Building Contractors(Registered with NCC)	313	189
4	**Manufacturers and Suppliers**	Association of Manufacturers and Association of Zambia (Registered with NCC)	47	30
5	**Interest Groups**	Auditor General`s office, Internal Audit, Transparency International Zambia, Anti-corruption Commission, Zambia Public Procurement Authority, National Council for Construction, Engineering Association of Zambia	7	5
Total			**651**	**384**

For the exploratory part of the study, non-probability or purposive sampling method was used to select a sample of experts in public construction project management. In purposive sampling, judgement was made by the researcher on which experts was to participate in the study out of the population of key participants in public construction projects. Specific characteristics were considered to choose representatives of the population. Experts in public construction projects were cautiously selected to be interviewed. The respondents to the interview were sampled from different clusters.

The advantage of purposive sampling which fits this study is that it is the only meaningful way to investigate the phenomenon. The disadvantage is that, it sometimes provides samples which are to some extent not representative, thereby giving findings which could not be generalized. The criteria for inclusion in the sample were that one

should have traceable experience with and contribution to local and other regions of the public sector construction projects. Other criteria were proven knowledge of local capabilities and Critical success factors for implementation of public sector construction projects.

4.5.2 Sample Size

The process of selecting a sample size for descriptive and explanatory studies required that a researcher determine an acceptable range of certainty, given the time and cost constraints of study. To be certain the sample size of 384 was determined as indicated in table 4.1 using the formula suggested by Easterby-Smith et al (2006):

$N= \{P (100-P)/E^2 \}$

Where N is the sample size required;

P is the percentage occurrence of the state; and

E is the maximum error required

Borrowing from Bartlett et al. (2001) who stated that the acceptable error for categorical data of 5% was a norm in educational and social research 0.05 was used as the maximum allowable error. To emphasise the point they also stated that 95% confidence level forms basis of modern statistics.

For exploratory study, the targeted sample was 75 made up of the 15 major representatives of the experts in construction in Zambia listed below with their 4 members preferably from their planning and project implementing sections:

- The Director, Ministry of Housing and Infrastructure Development
- The Director, Ministry of Local Government and Housing
- The Director, Roads Development Agency
- The Director, Zambia Public Procurement Authority
- The Director, National Council for Construction
- The Director, Auditor General's office
- The Committee Members, Association of Consulting Engineers of Zambia
- The Committee Members, Engineering Association of Zambia
- The Committee Members, Association of Building Contractors
- The Committee Members, Zambia Institute of Architect

- The Committee Members, Surveyors Institute of Zambia
- The Committee Members, Suppliers Association of Zambia
- The Director, National Council for Construction
- The Contractor-Roads
- The Contractor- Buildings

4.6 Data Collection Methods

Based on the population size of individual stratum depicted from various sampling frames as indicated in Table 4.1, all the categories of respondents were carefully arranged in chronological order and numbered. The contact number, email address, postal addresses of the respondents were collected from the data base maintained by secretariats of organizations respondents belong to. Collected were both secondary data through literature review and Primary data through General Survey technique by administration of the structured questionnaire and experience surveys techniques using expert interviews. The data collection instruments used is described below.

4.6.1 Research Instruments

According to Parahoo (1997:52), a research instrument is "a tool used to collect data". An instrument is a tool designed to measure knowledge, attitude and skills."

Since both qualitative and quantitative data was required in order to triangulate documentary review, expert interviews and self administered questionnaire was used to collect data for the study in order to increase credibility of the findings.

4.6.1.1 Semi-Structured Expert Interview

There are three types of interviews namely structured interviews, unstructured interviews and semi-structured interviews. O`Sullivan et al. (2010) stated that structured interviews refer to surveys in which all respondents are asked the same questions in the same order by all interviewers. Unstructured interviews in qualitative research involve asking relatively open-ended questions to respondents with a view to capture their perceptions on issues (Mwiya, 2009). Semi-Structured interviews allows use of questionnaire guide with both open-ended and closed ended questions (Ibid)

In this study, a semi-structured interview form (see Appendix 4.1) was used as the interview instrument and the data collection period was approximately four (4) weeks. 63 construction projects experts interviewed were selected using purposive sampling

technique. Mwiya (2009) stated that interviews in general enable the interviewer to be in control and able to assist the interviewee if there are any problems. Further, the response rate for this method is generally high. Interviews can also establish rapport and motivate respondents. It also allows clarification of the questions, clear doubts and adds new questions. Interviewers can read non-verbal clues and can also use visual aids to clarify points. Lastly, through interviewees rich data can be obtained (Cresswell, 2014)

4.6.1.2 General Survey Questionnaire

In this study self administered structured questionnaire was used to collect primary data for the descriptive and explanatory parts of the study. General Survey allowed collection of data from respondents using structured questionnaire. The questionnaire was administered to 384 respondents selected through stratified sampling technique. Participants were targeted from Public Infrustruture development sector. Participants were requested to asses/evaluate the extent to which the 43 project factors were important in achieving successful management of the implementation phase of the public sector construction projects. This used a Likert scale from 1 to 5, with 1 being "strongly disagree", and 5 being "Strongly agree".

Due to the sensitivity of the research topic, used in this study was a questionnaire which guaranteed privacy. This was done to conceal identification of the respondents. These self administered questionnaires were sent in two ways; as hard copies to some accessible people and as emails to distant respondents. Self administered questionnaire guarantees pressure and constraints free environments as respondents answer questions in the questionnaire.

Self administered questionnaires are the most ideal for the larger number of participants expected in the survey (Zikmund et al, 2010). It allows wide geographical area to be reached. When conducting research on sensitive topics, it is cardinal to choose the right methods. A questionnaire ensures maintenance of confidentiality and privacy of respondents. Since sampled elements answers to questionnaires at their comfort of their own, it increases the percentage rate of respondents to the questionnaires. The fact that enough time is given to respondents; it allows accurate and comprehensive feedback (Cresswell, 2014). Questionnaire was found appropriate method to obtain data from stakeholders of public sector construction industry because of the large numbers involved.

4.7 Validity and Reliability Test of Instruments

According to Leedy and Omrod (2012), "Validity of a research instrument is the extent to which the instrument measures what it is supposed to measure." Kombo and Tromp (2006) defined validity of a test as a measure of how well a test measures what it is supposed to be measured. Reliability of a measurement instrument is the extent to which it yields consistent results when the characteristic being measured has not changed. It is defined reliability as a measure of how consistent the results from a test are (Fink, 2006).

4.7.1 Validity Test

The General Survey Questionnaire items were inductively developed from the reviewed literature. For every variable, references of key studies are used for purposes of ensuring construct validity. In order to confer validity to the research tool, the items in the questionnaire were subjected to three phases of validity. The first one used the Delphi technique, the second one involved a pilot study, and the third one used a reliability analysis. The phases are described below.

Phase I

The researcher developed the questionnaire based on the literature. Thereafter, the researcher employed a Delphi technique. A Delphi procedure consisting of anonymous reviews of experts (Landeta et al, 2011) in project management at the Zambia Centre for Accountancy Studies (ZCAS) and the University of Lusaka individually appraised the questionnaire for content/face validity. The selection of participants for this Delphi was critical because if poorly managed, it was feared that it would affect the quality of the validation outcome according to (Hsu and Sandford, 2007). A panel of nine experts was recruited by personal invitation through an introduction letter by the University of Lusaka. The letter was addressed to the head of department business and marketing studies at ZCAS and the School of Graduate Studies at the University of Zambia. The panel members were enlisted voluntarily based on their ample specialized experience in project management. Two experts out of 24 who were eligible declined to participate. The experts were requested to score on the answer sheet all the items in the questionnaire by rating them as "clearly fitting," "somewhat fitting" or "not fitting." Only items that met the criterion "clearly fitting" were appropriate to be included in the final research tool that was to be pilot tested. Those items that were classified as

‘‘somewhat fitting’’, experts were requested to make comments or modification as the case was and those that were classified as “clearly fitting” were retained in the tool. The determination of the items to be reviewed and those to be retained was facilitated by frequency counts to determine the levels of agreements following an analysis using SPSS which is the software that was used for the quantitative analysis. The following were the Delphi results of question items that were scored as either somewhat fitting or not fitting as shown in table 4.2..

Table 4.2: Profile of items and Fitting the Constructs

Section	**Distribution**	
Challenging factors encountered during implementation stage of Public Sector Construction Projects	***F***	***%***
Clearly fitting	6	33.3
Somewhat fitting	12	66.7
Total	18	100.0
Variables used to measure success during implementation of public sector construction projects		
Clearly fitting	10	55.6
Somewhat fitting	4	22.2
Not fitting	4	22.2
Total	18	100.0
Critical Success factors affecting success of implementation of Public Sector Construction projects		
Somewhat fitting	10	55.6
Not fitting	8	44.4
Total	18	100.0
Intervening Critical Success factors affecting success of implementation of Public Sector Construction projects		
Not Clearly fitting	18	100.0
Total	18	100.0
Success Indicators for implementation of public sector construction projects		
Clearly fitting	8	44.7
Somewhat fitting	4	22.2
Not fitting	4	22.2
Total	18	100.0
Strategies for improvement of implementation of public sector construction projects		
Not Clearly fitting	18	100.0
Total	18	100.0

Phase II

Once the items (Questions) of the questionnaire were appraised, a pilot study was done on the Lusaka Province in Ministry of Works and Supply. The pilot study was done with 15 respondents to validate the questionnaire (Polit et al., 2001; Teijlingen et al. 2001). Apart from validating the questionnaire, the pilot experience helped in assessing the feasibility of a (full-scale) study (Polit et al., 2001; Teijlingen et al. 2001). The pilot helped in determining that the research project was realistic and workable as it uncovered potential logistical problems which most pilot tests tend to show (Teijlingen et al. 2001). The researcher had an opportunity to perfect the questionnaire with a view to determine whether or not the items (questions) are inappropriate or too complicated (De Vaus, 2014; Baker 1994). During the pilot study, the researcher was in a position to eliminate or refine or re order the questions/items (van Teijlingen et al. 2015). The pilot exercise also allowed the possibility to test the recording process as well as the transcription.

4.7.2 Phase III Reliability Analysis

A reliability analysis based on determining the internal consistency of items was later performed during analysis of data. For this activity, Cronbach's Alpha Coefficient for Internal Consistency and set at ≥ 0.6 will be used (Nunnally and Bernstein, 1994; Bland and Altman, 1997; Burns and, 2002; Thanasegaran, 2009; Tavakol and Dennick 2011). The reliability analysis of the items in the questionnaire was undertaken and found to be reliable. Cronbach's alpha coefficients of 0.889 emerge for the non-financial variables and 0.715 for financial variables. Even though this study had a rigorous process of validating the data collection tool, the researcher went further to conduct a reliability analysis based on exploratory factor analysis. This was done to assess further the consistency and stability in the results of the questions that were asked domain by domain. The method of one test administration was used. The researcher desired to estimate reliability by focussing on how consistently the participants performed or scored across subsets of items on the single test/scale form. The reliability estimates generated the one test method that was used employed factor analysis to assess internal consistency.

Factor analysis was conducted to examine the underlying reliability patterns of the measurement scales. The researcher employed Cronbach`s α to measure the internal consistency of the variable. Following the analysis, inter item consistency was found to fall within the range of 0.70-0.97 as shown in table 4.3. The alpha reliability for the main domain of the questionnaire was as follows:

Table 4.3: Reliability Analysis

Factors	***Factor loading range for variables in each domain their variables***	***Variance Explained***	***Reliability***
Challenging factors encountered during implementation stage of Public Sector Construction Projects	0.841 - 0.926	49.67	0.878
Variables used to measure success during implementation of public sector construction projects	0.707 - 0.811	42.69	0.774
Critical Success factors affecting success of implementation of Public Sector Construction projects	0.816 - 0.926	39.07	0.888
Intervening Critical Success factors affecting success of implementation of Public Sector Construction projects	0.766 - 0.879	46.68	0.800
Success Indicators for implementation of public sector construction projects	0.833 - 0.976	49.32	0.821
Strategies for improvement of implementation of public sector construction projects	0.800 - 0.932	47.66	0.854

Looking at the factor loading ranges for the variables in each domain shows that the scores of the participants are consistent across elements of objects on the sole scale outline. We can conclude that the subsets of objects originated from the very substance sphere. It was also concluded that the same subsets were assembled in line with the very specifications, as such there was confidence the performance could generalize to any other possible items in the content domain.

4.8 Development of In-depth Interview Schedules

In-depth interview questions were developed relying on the logic of induction. Thematic concepts covering the main thematic components of the research objectives were considered.

4.9 Validation of Framework for Performance Measurement

Validation means testing elements for originality or legitimate confirming that adjudication was done by competent persons (Muya, 1999). Adjudicators are expected to competent in the specific area they are called upon to judge. Macal (2005) shared the fact that model development process could only be accepted and used when verification and validation has been adequately done. Martin and Henaff (2010) also stated validation of a model attempts to establish the adequacy for the reason it is to apply. Validation increases the extent of credibility and confidence of the model. Precisely, validation does not end into a validated model, but a model that has ultimately passed the validation tests (Macal, 2005).

For the developed Public sector construction projects implementation performance measurement framework, ten prepared questionnaires were administered on senior officers of organisations involved or have an interest in same projects. The organisations were: Road Development Agency, Ministry of Housing and Infrastructure Development; Buildings Department, Ministry of Works and Supply; National Council for Construction; Surveyors Institute of Zambia; Engineering Association of Zambia; Association of Consulting Engineers; Association of Building Contractors and Zambia Public Procurement Authority

To establish the Construction industry view of the project implementation performance measurement framework, a questionnaire survey was prepared and administered to Public sector construction projects key players who are directly involve with the sector. There were as follows: 15 client representatives; 15 public sector construction consultants, 15 Architects, 15 Quantity surveyors, and 15 Contractors. Data received was analysed using Descriptive statistics.

4.10 Data Analysis

Depending on the type of data collected, it could be categorized into three groups: interview data, questionnaire data, and secondary data. Mainly data collected using

questionnaire was quantitative data; interviews guide was qualitative data, whilst secondary data collected through literature review was both quantitative and qualitative data.

4.10.1 Qualitative Data Analysis

Depending on the type of methods used to collect data, there are basically two groups of qualitative data. There is primary data in case of this study which was collected through use of face to face interview. The other one is secondary data which in this case was collected using archived documents, electronic copy, and printed documents related to projects stocked by stakeholders. The purpose of interviews was exploring the entire pre-designed themes, which in the context of this study was to identify the challenges and CSFs for implementation of public construction projects in Zambia. Interviews accommodate follow up questions were first responses were not up to satisfying. Respondents also had a chance to ask for clarification where the messages were not clear. Qualitative data from the interviews was supplemented by data from various documents. Data from documents was cardinal for supporting and confirming statements from respondents which could be difficult to remember during the interviews like exact dates of events.

Using semi-structured interview guide meant there were both open ended and closed ended questions. Responses from the closed ended questions were directly coded. For the open ended questions the interview statements were transcribed with MS office Word processing software. After transcribing statements, each individual theme was given a unique code so that it can be easily traced without exposing identification of respondents. The data was analysed using Exploratory Factor Analysis (EFA) of the computer Software Stata 14.2 after being aggregated.

In statistics, Exploratory Factor Analysis statistical method is used to explore the hidden organisation of a comparatively bulky set of variables. EFA is a technique within factor analysis whose main target is to pinpoint the hidden associations among measured variables (Karamizadeh et al., 2013). Exploratory Factor Analysis (EFA) could be described as orderly simplification of interrelated measures. By performing EFA, the underlying factor structure is identified. EFA is one of the data reduction techniques, which allows the study to capture the variance in variables in a smaller set (Ngacho, 2013). The advantages of EFA range from having capacity to categorize data to having

ability to reduce data to manageable levels by removing information. It also resolves the common problem, in real contexts of non-zero cross-loading (Ibid). The disadvantage is that if not handle carefully, EFA can lead to the disadvantage that it removes information may be relevant information. Even if EFA present some disadvantages, several researchers consider this statistical method as the best for analysing the structure of a measurement tool (Ibid).

4.10.2 Quantitative Data Analyses

Quantitative data is mostly analysed using individual computer laboratory which is the unit of analysis. The quantitative data came from General Survey Questionnaire. Computer software SPSS version 22 was use to analyse quantitative data in this study.

Choosing the correct test

The greatest difficult the researchers experience is to choose the ideal statistical test for each hypothesis. Diamantopoulos &Schlegelmilch (1997) stated that choice of statistical tests was affected by various factors. Discussed earlier were two factors which affect type of statistics to use namely: sample type and sample size. The remaining two factors, which were relevant to this study, were level of measurement and distribution of population. The two factors are important in determining the statistical testing protocol to use, whether parametric or non-parametric. This protocol should be considered before deciding which statistical test to use.

Parametric versus non-parametric

In most cases researchers attempts to use parametric protocol because it is perceived to be more the powerful one as compared to non parametric one (Hair et al., 1998). Three fundamental considerations should be made to choose between the two protocols (Burns, 2000). The first fundamental consideration to be made is that data should be normally distributed. The second one is that data should be equally interval. None fulfilment of these two considerations means hypothesis could not be tested using parametric tests (Forza, 2002). The third fundamental consideration is level of measurement. It is assumed correct that the higher the order of measurement, the more complicated the likely analysis (Schlegelmilch, 1997). The four main orders of measurement beginning with the least are as follows: nominal, ordinal, interval and

ratio scales. Only data from the last two categories are valid for parametric test, while the first two are suitable for non-parametric tests.

It should be reaffirmed that the questionnaire used in the research comprised of Likert-scaled questions ranging from 1 to 5. Normally data obtained through use of Likert scaled questionnaires should be analysed using non-parametric tests. However, as Diamantopoulos &Schlegelmilch (1997) put it with aggregation of a number of separate items parametric tests could be used. It could be used because the result of aggregation is roughly constant and a parametric test is warranted. Burns (2000) supported the claim by attesting to the fact that Likert data could be assumed as equal interval. In this case questions were items as such summation of data collected from the question amounted to a particular variable (mean). It is assumed that the value of the variable is roughly constant signifying interval scale permitting use of parametric tests` options. Suggestion was made that data consisting of Likert scale aggregated data could be more meaningful than analysing it individually (Clason and Dormody, 1997). The view of these researchers was that when using parametric tests to analyse the data, summation of group of Likert items results into normally distributed data which provides accuracy in measurement. This entails that the more questions asked, the more discrete the data would be.

One sample t-test

Diamantopous & Schegelminch (1997) revealed the fact that one-sample t-test mostly compares the mean score of a sample to known value). Population mean is usually the known value. One sample t-test is suitable for parametric tests when items are normally distributed (i.e. ratio or interval scales). Likert scale from 1 to 5 used in the questionnaire is expected to yield the mean value of 2.5.

Hypothesis Testing

The null hypotheses were tested using multiple regressions (structural coefficient (rs) analysis and Beta (β) analysis). The procedure was that if significant relationship between independent variables (CSFs) and dependent variables (Success Criteria), automatically the study rejects the null hypothesis, confirming significant relationships.

The first phase of the study was Principal Component Analysis (PCA) to extract only critical factors and also to reduce the variables to manageable levels. Stepwise model

was used to check for variables with element of Multicollinearity. Despite both PCA and Exploratory Factor Analysis being both data reduction techniques and many other similarities, there is a fundamental difference between them. PCA is a Linear combination of variables. EFA is a measurement model of a latent variable. PCA is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables (entities each of which takes on various numerical values) into a set of values of linearly uncorrelated variables called Principal Components(Karamizadeh et al., 2013). In simple words, Principal Component Analysis is a method of extracting important features (in the form of components) from a large set of features available in a data set. Eigen values indicate the amount of variance explained by each principal component or each factor. The Principal Components with higher eigenvalues have higher predictability power for variance in the model (Ibid).

The choice of this data analysis tool was necessitated by the various advantages it posses like the following: 1) it removes correlate features in order to ensure that all the Principal Components are independent of one another, 2) improves Algorithm Performance, that is, PCA is a very common way to speed up your Machine learning algorithm by getting rid of correlated variables which contribute in any decision making, 3) reduces over fitting, that is, over fitting which mainly occurs when there are too many variables in the data set is avoided by reducing the number of features and 4) improves visualization, that is PCA transforms a high dimensional data to low dimensional data (2 dimension), so that it can be visualized easily (Ibid).

PCA faces disadvantages which should always be addressed as follows: 1) after implementing PCA on the data set, the Principal Components are not as readable and interpretable as original features, 2) data standardization is a must before PCA, otherwise it will not be able to find the optimal Principal Components and 3) information loss, that is, although Principal Components try to cover maximum variance among the features in a dataset, if the selection of number of Principal Components are not done with care it may miss some information as compared to the original list of features (Jahamane et al., 2011).

The extracted variables were then tested for relationship. Test of relationships between the independent variable (project implementation success/failure critical factors) and the

dependent variables (project success criteria) was done using statistical analysis. A multiple regression analysis (Structured coefficient analysis) was conducted to determine the degree of correlation between independent variables (critical factors) and dependent variables (project success criteria) at this stage of the study. Interpretations and conclusions were drawn from the analysis of data.

Multiple regressions was also employed to determine the collective relationship that exist between project implementation critical Success factor(s) as independent variable in Public Construction Sector and the various project implementation success criteria that were listed from the literature as dependent variables. Multiple regressions are the statistical model used to examine the relationships between several independent variables and dependent variables to the criterion value. The reason for its choice was based on the following advantages: 1) it has the ability to determine the relative influence of one or more predictor variables to the criterion value; 2) The second advantage is the ability to identify outliers, or anomalies (Ziglari, 2017)

4.11 Triangulation

Consulted literature seemed to be accepting the fact that application of many methods proves the theory and triangulating is most ideal way of ensuring validity and reliability of data (Bryman & Bell, 2003; Oka &Shaw, 2003; Miller & Brewer, 2003). Some authors define triangulation as application of several approaches and sources of data in order to cross check social phenomenon to get regularities (Bryman, 2004; Altricter et al., 2008). Creswell (2003) in support of use of mixed methods approach added that triangulation was meant to create under stable designs out of the complicated data and analysis. Previous literature revealed that there existed many reasons for researchers the use the mixed method. As earlier alluded to, the first one is to make the findings more reliable and credible by ensuring application of all possible sources of data (Ibid). Single method is possible in cases where data sources consist of various kinds of data. Questionnaire would be more suitable for data sources which represented big population (Gillham, 2000a). On the other hand, a qualitative approach through use of questionnaire or interview with open ended questions is mostly the best portion in obtaining data, when the small number of respondents represents data sources (Gillham, 2000b).

For this study findings from expert interview data`s analyses were used to refine the data collection tool (Questionnaire) for the main study which was the general survey because of the small size of the sample. The results of the analyses were indirectly merged in the sense that findings from expert survey were refined by General survey which gave the main findings (Altrichter et al., 2008)

4.12 Ethical considerations

The participants in this research study were volunteers solicited by the researcher, and informed of the purpose of the study via the invitation to participate letter. The purpose of ethics in research is to guarantee that respondents do not suffer unpleasant consequences from research process (Cooper & Schindler, 2006). An assurance was made to respondents that privacy was guaranteed during and after the study period. University of Lusaka`s ethical code of practice in research was the guiding principle of the research and was totally adhered to. As a necessary requisite a formal application for ethics approval was made before data collection process.

In order for participants (respondents) to make informed decisions on willingness to participate in the research project, Consent was requested for using the consent form designed by University of Lusaka. As per University of Lusaka research norms, the research ensured that any consent to participate in the study was informed or real and other people`s interest were taken on board as long as they were in tandem with the research requirements. All the participants were treated equally and in order to avoid harm the seven ethical rules were adhered to namely:

Veracity: that is all subjects in this research project were always told the truth.

Privacy: Privacy of participants and respondents were granted.

Confidentiality: Was assured.

Fidelity: Promises were kept and negligence with the information were avoided at all cost

Ethics: Research materials and procedures were made physical or emotional free.

Culture: Learning about the culture of the informants so that it was respected during data collection.

Sensitive Issues: Not exploring sensitive issues before the good relationship was established with the informant.

4.13 Summary

The empirical survey research was undertaken, mainly through use of quantitative design. Qualitative approach was also used mostly in terms of data collection and analysis. It was also established that mainly there were two sources of data namely secondary day originated from various documents related to the programme and primary data gotten through survey questionnaires and interviews. Both qualitative and quantitative analyses were used to analyse the data. Qualitative data was analysed using content analysis before exposing it to State 14.2 Software, in accordance with predetermined themes .The quantitative data was analysed with SPSS 22 software and Microsoft Excel. Different Research questions had different sets of methodologies as indicated in Table 4.4 below.

Table 4.4: Research Questions and Summarized Methodologies

Research Questions	**Research design**	**Sampling Method**	**Data Collection Method**	**Data Analysis Method**
RQ1: What challenges are experienced during "implementation phase" of PSCPs in Zambia?	Descriptive design	Probability Stratified random sampling	In-depth literature review and Questionnaire Survey	Principal Component Analysis (PCA)
RQ2: What are the CSFs for successful implementation of PSCPs in Zambia?	Descriptive design	Probability Stratified random sampling	In-depth literature review and Questionnaire Survey	Principal Component Analysis (PCA)
RQ3: To what extent does each of the identified factors influence successful implementation of PSCPs in Zambia?	Explanatory Research design	Probability Stratified random sampling	In-depth literature review and Questionnaire Survey	PCA & Multiple regression (Structural Coefficient Analysis)
RQ4: To what extent do all the identified CSFs collectively influence successful implementation of PSCPs in Zambia?	Explanatory Research design	Probability Stratified random sampling	In-depth literature review and Questionnaire Survey	PCA &Multiple regression (Structural Coefficient) Analysis
RQ5: What strategies can be used to improve the implementation of PSCPs?	Descriptive & Explanatory research designs	Probability Stratified random sampling	In-depth literature review and Questionnaire Survey	Descriptive & Multiple regression (Structural Coefficient) Analysis

CHAPTER 5

DATA ANALYSIS/ RESULTS/DISCUSSIONS

5.1 Introduction

In the previous chapter, the research methodologies used in this study were described. In this chapter presentation of data analysis, results and discussions for the two phases of study are done. Phase one covers presentation of data analysis, results and discussions from Exploratory study, whilst phase two covers presentation of data analysis, results and discussions from General survey. Data from expert survey was analysed using Exploratory Factor analysis (EFA) using Stata 14.5 version software, whilst data from general survey was analysed using PCA and multiple regression based Structured Coefficient analysis using SPSS 22 version software. In the next section, the data collected from expert survey interview is presented and analysed.

5.2 Data Analysis/Results for Exploratory Study

In this first phase of the study which was basically an exploratory study the response rate and the descriptive statistics for general information of respondents were given in order to demonstrate the level of response and the nature of respondents. An Exploratory Factor Analysis (EFA) for challenge factors was conducted in order to establish the Key Challenge factors in implementation of public sector construction projects in Zambia. Another EFA was conducted for Critical Success factors for implementation of Public sector construction projects in Zambia. Lastly an EFA was conducted for success measurement indicators (KPIs) for implementation of public sector construction projects. This was done to establish the key success indicators for implementation of public sector construction projects in Zambia.

In this section, the results for exploratory study is presented and analysed.

5.2.1 Response rate

Sixty three (63) respondents who were selected using purposive sampling technique participated in the interviews out of the targeted 75. Thus the response rate was 84%.

5.2.2 Descriptive Analysis for General Information

A) Position of respondents in their organization

Descriptive analysis of position of respondents in their organisations which were either public, private or quasi government showed that out of Sixty three (63), thirty (30) of them were senior managers, thirty(30) were middle managers, and three (3)were in junior management positions as shown in Figure 5.1. These results indicated that most of the interviewees were in positions were they could comprehend factors that affect implementation of public sector construction projects.

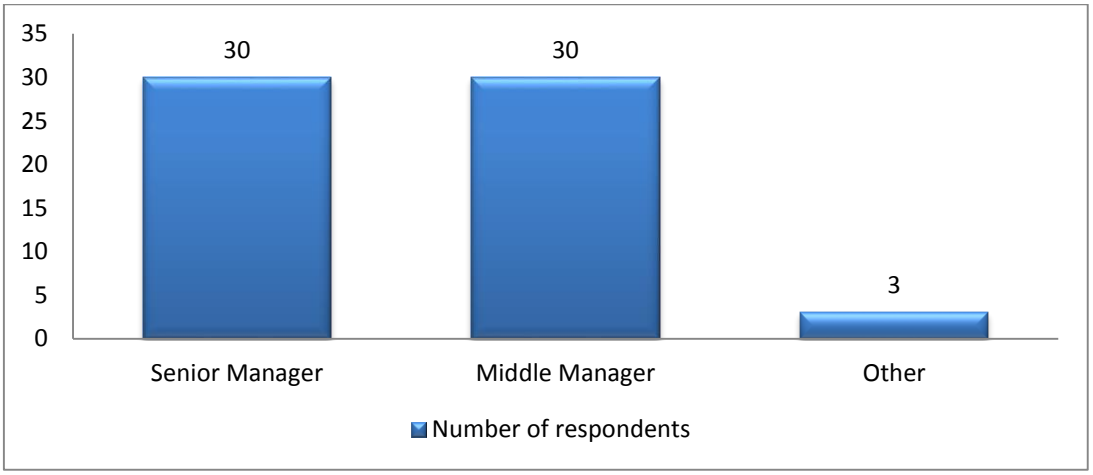

Figure 5.1: Position of respondents in organisations

B) Role played by respondents

The respondents represented key groups of stakeholders of public sector construction project industry in Zambia as shown in Figure 5.2. The government is the main client or promoter of public sector construction projects. The consultancy sector, also referred to as design, is concerned with employer advice and monitoring through decision, contractual documentation, and project supervision. The contractor sector or assembly sector is predominantly concerned with site activities and involves the physical erection of facilities. The supply sector is responsible for importation and supply of building materials, plant, and machinery (Sichombo et al., 2009).

Some clients were interviewed because of the bigger nature of representation by this group of stakeholders, as well as, being the receivers of complaints for failure of projects. The next large group was the contractors who were registered in two categories by National Council for Construction (NCC) as contractors for General Building and housing and also as contractors for General roads and earthworks. The third category

was represented by interested parties like Non-Governmental organizations such as Transparency International Zambia (TIZ). Consultants registered with Association of Consulting Engineers of Zambia followed being represented by 9 of the respondents. Finally, Material suppliers were represented by 3 members who were registered with both the NCC and Association of Suppliers of Zambia. This demonstrates the fact that all the main stakeholders of public sector construction projects were represented.

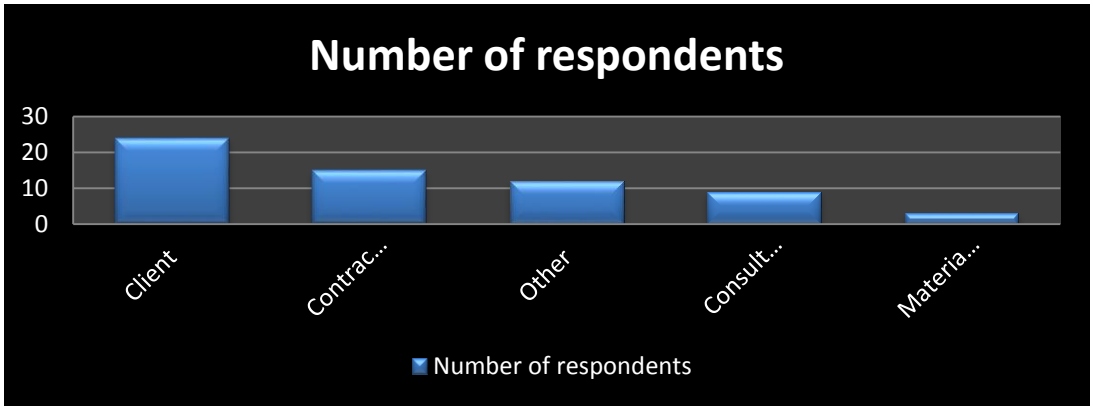

Figure 5.2: Role played by respondents

5.2.3 Results for Key Challenge Factors

In this section, dataset in Phase 1 of the study comprising 63 responses was used to carry out EFA on the project challenge variables in order to identify the Key Challenge factors causing the failure of implementation of public sector construction projects. First, the descriptive statistics of the performance variables are presented and subsequently the factorability of the variables is assessed before the variables are subjected to EFA.

5.2.3.1 Descriptive statistics of Challenge factors

The minimum score, maximum score, mean and standard deviation of each of the 47 project implementation challenging variables was computed in order to find out their importance in influencing the failure of implementation of public sector construction projects. Table 5.1 summarizes the descriptive of the above variables.

Table 5.1: Descriptive statistics of challenge variables

Challenge measurement variables	Total Score	Mini Score	Max Score	Mean Score	Std. Dev
DCV1: Fault project design	63	1.000	3.000	1.381	0.580
DCV2: Non-involvement of project participants	63	1.000	3.000	1.333	0.568
DCV3: Unanticipated design changes	63	1.000	3.000	1.429	0.665
DCV4:Design Complexity	63	1.000	3.000	1.746	0.621
DCV5: Fault project conceptualization	63	1.000	3.000	1.857	0.780
DCV6: Poor project scheduling	63	1.000	2.000	1.190	0.396
DCV7: Non-involvement of project beneficiaries	63	1.000	3.000	1.429	0.665
MCV1: Poor project management	63	1.000	3.000	1.381	0.658
MCV2: Incompetence of project managers	63	1.000	3.000	1.794	0.626
MCV3: Lack of suitable coordinating skills	63	1.000	3.000	1.476	0.800
MCV4: Lack of motivation of staff	63	1.000	3.000	1.571	0.797
MCV5: Ineffective monitoring and feedback mechanisms	63	1.000	3.000	1.460	0.758
MCV6: Dishonest conduct by management	63	1.000	3.000	1.905	0.756
MCV7: Non-involvement of project stakeholders	63	1.000	3.000	1.571	0.797
MCV8: Violation of health and safety rules	63	1.000	3.000	2.000	0.696
MCV9: Lack of authority by management	63	1.000	3.000	2.032	0.671
MCV10: Not working closely with the client	63	1.000	3.000	1.762	0.689
MCV11: Poor project planning	63	1.000	3.000	1.444	0.667
PCV1:Poor selection methods (i.e. Least prices)	63	1.000	3.000	1.238	0.530
PCV2:Corruption	63	1.000	3.000	1.476	0.800
PCV3: Unrealistic and dishonest variations	63	1.000	3.000	1.571	0.665
PCV4: Unavailability of specified materials	63	1.000	3.000	1.714	0.633
PCV5: Length approval procedure	63	1.000	3.000	1.333	0.648
PCV6: Competencies of suppliers	63	1.000	3.000	1.667	0.718
PPCV1: Lack of team work among participants	63	1.000	3.000	1.381	0.658
PPCV2: Excessive owner change orders	63	1.000	3.000	1.730	0.653
PPCV3: Increased conflict among project participants	63	1.000	3.000	1.857	0.780
PPCV4: Participants violation of health and safety rules	63	1.000	3.000	1.952	0.658
PPCV5: Negligence of duty by participants	63	1.000	3.000	1.810	0.737
PPCV6: Fraudulent certification of works in order to conceal errors	63	1.000	3.000	1.587	0.710
PPCV7: Collusion to defraud the client by contractors and consultants	63	1.000	3.000	1.619	0.792
FCV1: Low client financing capacity	63	1.000	3.000	1.095	0.429
FCV2:Delay in clearance of stage completion certificates	63	1.000	3.000	1.286	0.551
FCV3:Deliberate delay in payments to induce corruption and bribes	63	1.000	3.000	1.714	0.705
FCV4:Insufficient working capital for	63	1.000	3.000	1.190	0.503

Challenge measurement variables	Total Score	Mini Score	Max Score	Mean Score	Std. Dev
Contractors					
FCV5:Misallocation of funds by contractors	63	1.000	3.000	1.286	0.551
FCV6:Lack of accountability and transparency	63	1.000	3.000	1.333	0.568
FCV7:Inaccesibility to funds by contractors due to institutional lender`s rigidities	63	1.000	3.000	1.286	0.551
ECV1: Political interference in contracts determination	63	1.000	3.000	1.333	0.718
ECV2:Bureaucracy in public sector projects	63	1.000	3.000	1.143	0.470
ECV3: Climate change effects (droughts, hailstorms, landslides, etc.)	63	1.000	3.000	1.730	0.574
ECV4:Unanticipated policy changes	63	1.000	3.000	1.381	0.580
ECV5:Escalation of project costs due to inflationary pressures	63	1.000	3.000	1.190	0.503
ECV6 :Adverse social aspects (e.g., poor working culture)	63	1.000	3.000	1.333	0.568
ECV7 :Changes in government rules and regulations	63	1.000	3.000	1.667	0.568
ECV8: Lack of supporting infrastructure(e.g. Markets)	63	1.000	3.000	1.524	0.737
ECV9 :Frequent changes in government	63	1.000	3.000	1.619	0.580

Responses collected on a three point Likert scale (1-agree, 2-don`t agree, 3-don't know).

From Table 5.1 it can observe that, minimum and maximum values were 1 and 3 respectively for 47 variables, indicating that, in general, respondents used the entire 3-point survey scale. The mean score ranged between 1.095(*FCV1: Low client financing capacity*) and 1.952(*PPCV4: Participants violation of health and safety rules*). Standard deviations were found to be above 0.5 except in three variables; "*ECV2: Bureaucracy in public sector projects*" (0.470), "*FCV1: Low client financing capacity*" (0.429) and "*DCV6: Poor project scheduling*" (0.396). This shows that the "means" represent a good measure of the distribution of scores in the survey data.

Descriptive statistics was arrived at in order to allow amalgamating the data collected from Likert style questionnaire which in individual states provides ordinal data which are non-parametric. With amalgamation they tend to change to interval scale which is parametric and could be used in inferential statistics (Burns, 2000). In this form the data can be passed through the stages for Exploratory Factor Analysis, which includes assessing the factorability of the variables, and factor analysis following Varimax Rotation.

5.2.3.2 Assessing the factorability of challenge variables

For assessing the factorability of 47challenge variables, the researcher found out the correlation for each pair of 47 variables that is demonstrated with the help of a correlation matrix. With the exception of a few variables, a large number of significant correlations are found amongst different pair of variables in this matrix. This gives the researcher an indication that exploratory factor analysis (EFA) could be carried out in the whole dataset. The values in the correlation matrix suggest that the sample is characterized by high degree of related variables, which could be grouped together. This provides evidence of factorability of the challenge measurement variables.

Bartlett's test statistics was found significant at 0.000 levels, which indicates the presence of non-zero correlations in the correlation matrix. Further, the KMO measure of the sampling adequacy turns out to be 0.515. Despite the first two stated stages satisfying the minimum criteria for carrying out Factor Analysis in the dataset, it could not be undertaken. Factor Analysis could not be undertaken because observation of the correlations along the diagonal of the anti-image correlation matrix revealed that 6 variables had their KMO values less than 0.4.This indicated that the dataset, in its current form, was still not suitable for factor analysis (Hair et al., 2006). These variables were iteratively removed one after another starting with the one with the lowest correlation along the diagonal of the anti-image matrix (Jahmane et al., 2011).

After the removal of 6 variables, it was found that all variables had individual KMO values greater than 0.5. This resulted in the improvement of overall KMO measure of sampling adequacy from 0.515 to 0.530. Furthermore, Bartlett's test statistics was found significant at 0.000 levels. These measures indicate that the reduced set of variables was appropriate for factor analysis.

5.2.3.3 Factor Analysis following Varimax Rotation

Principal components analysis (PCA) was used with varimax rotation given that the primary purpose was to identify the underlying factors. Initially all 41 variables were allowed to load freely on various factors so long as they had eigenvalue greater than one. This approach, together with the scree plot generated (figure 5.3) enabled the researcher to fix the number of factors to be extracted at 7.Therefore, while identifying

the final factors underlying the Key Challenges , the process was subjected to four conditions: (i) the number of factors fixed at seven(ii) deletion of items with loadings of less than 0.4 or cross loadings of greater than 0.4, (iii) retention of only those factors with at least two items and (iv) the number of factors extracted should account for at least 60% of the variance (Field, 2005; Hair et al. 2006; Malhotra and Dash, 2011).

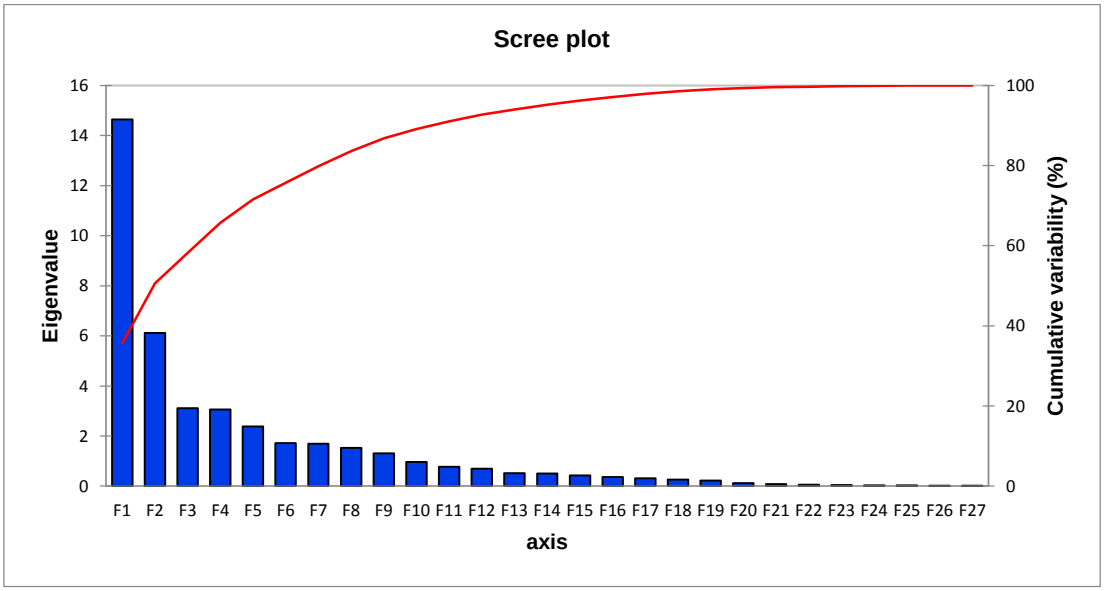

Figure 5.3: Scree Plot of challenge variables

Based on these conditions, Factor analysis was iteratively repeated and items deleted sequentially resulting in a final instrument of 41items. The 41- item 7-factor instrument accounted for 65.672% of the variance in the dataset and the results were given as shown in Table 5.2 below.

Table 5.2: Results of Factor Analysis of challenge variables

Cronbach`s alpha (α)	**Components**			
	0.758	**0.923**	**0.911**	**0.925**
	1	**2**	**3**	**4**
MCV1: Poor project management	0.803			
MCV6: Dishonest conduct by management	0.602			
MCV9: Lack of authority by management	0.541			
MCV11: Poor project planning	0.719			
PCV2: Corruption	0.716			
DCV3: Unanticipated design changes		0.736		
PCV3: Unrealistic and dishonest variations		0.577		

Cronbach`s alpha (α)	Components			
	0.758	**0.923**	**0.911**	**0.925**
	1	**2**	**3**	**4**
FCV1: Low client financing capacity		0.786		
FCV2 : Delay in clearance of stage completion certificates		0.666		
FCV6 : Lack of accountability and transparency		0.689		
FCV7 :Inaccessibility to funds by contractors due to institutional lender`s rigidities		0.699		
ECV2 :Bureaucracy in public sector projects		0.772		
ECV5 : Escalation of project costs due to inflationary pressures		0.781		
ECV6 : Adverse social aspects (e.g poor working culture)		0.638		
ECV7 :Changes in government rules and regulations		0.741		
ECV8: Lack of supporting infrastructures (e.g. Markets)		0.633		
ECV9 : Frequent changes in government		0.657		
DCV2: Non-involvement of project participants			0.788	
DCV7: Non-involvement of project beneficiaries			0.818	
MCV7: Non-involvement of project stakeholders			0.807	
PPCV1: Lack of team work among participants			0.734	
PPCV2: Excessive owner change orders			0.486	
ECV1: Political interference in contracts determination			0.608	
MCV8: Violation of health and safety rules				0.704
PCV1 :Poor selection methods (i.e. Least prices)				0.679
PCV5: Length approval procedure				0.673
PPCV4: Participants violation of health and safety rules				0.762
PPCV7:Collusion to defraud the client by contractors and consultants				0.795
FCV4 :Insufficient working capital for Contractors				0.753
FCV5 : Misallocation of funds by contractors				0.703
Eigenvalue	**14.637**	**6.117**	**3.112**	**3.059**
Variability (%)	**35.700**	**14.920**	**7.591**	**7.460**
Cumulative %	**35.700**	**50.621**	**58.212**	**65.672**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. Rotation converged in iterations.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy= 754,545,

Significance =0.00

From the analysis in Table 5.2 above, it is evident that 5 variables loaded under factor 1 seem to be associated with Project Management related challenges. The second factor comprises twelve variables, which reflect mainly Financial and External Environment related challenges. The six variables under factor 3 represent mainly Project design and Project participants related challenges, whereas the seven variables under factor 4 attempt to capture mainly Procurement, Project participants, and financial related challenges.

5.2.3.4Validation of the KCFs

Reliability of KCFs scale: The 30- item scale had a reliability of 0.928 (standardized value of 0.808) which is well above 0.70 recommended for similar studies (Hair et al., 2006; Malhotra and Dash, 2011). The Cronbach's alpha coefficient for each factor was as follows: Project Management related challenges: 0.758; Financial and External Environment related challenges: 0.923; Project design and Project participants related challenges: 0.911; and Procurement and financial related challenges: 0.925. This demonstrates that the factors extracted from the analysis are considered adequate in the unsuccessful implementation of public sector construction projects.

Content validity*:* The content validity of the instrument measuring KCFs was achieved while designing the interview guide. This was carried out through extensive literature review followed by securing opinions from the experts comprising academics and practitioners through in-depth interviews. This is discussed in detail in the Research Methodology section (Chapter 4, Section 4.7)..

Convergent and Discriminant validity: The inter-item correlation of the scale had a mean of 0.100, while the smallest inter-item correlation within each performance measure are as follows: Project Management related challenges: 0.364, Financial and External Environment related challenges: -0.026, Project design and Project participants related challenges: 0.000, Procurement and financial related challenges: 0.000.These correlations are significantly greater than or equal to zero ($p \leq 0.000$), providing evidence for convergent validity.

The results show that 30 key challenges were extracted from the initial 47 challenges gathered through in-depth literature review and the 30 was instrumental to the development of the Questionnaire for General survey which was the main study.

5.2.4 Results for Critical Success Factors (CSFs)

In this study, the same dataset containing 63 responses was utilized to carry out EFA on the Success variables in order to identify the CSFs influencing the success of implementation of public sector construction projects.

5.2.4.1 Descriptive Statistics of CSFs

The maximum score, minimum score, mean and standard deviation of the 56 project success variables was computed in order to find out their importance in influencing the success of implementation of public sector construction projects. Table 5.3summarizes the descriptive statistics of the above variables.

Table 5.3: Descriptive Statistics of Project Success Criteria

Critical Success Variables(CSV)	Total Score	Min Score	Max Score	Mean Score	Std. dev
DCSV 1: Minimal changes in design and specifications	63	1.000	5.000	3.571	1.411
DCSV2: Need for adequate schedule	63	2.000	5.000	4.000	0.823
DCSV3: Need for quality designs	63	3.000	5.000	4.238	0.689
DCSV4: Requirement for realistic cost estimates	63	3.000	5.000	4.190	0.800
DCSV5: Team members involvement during design	63	1.000	5.000	3.952	1.224
DCSV6: Need for realistic scope	63	2.000	5.000	3.952	0.906
DCSV7: Clearly established success criteria	63	2.000	5.000	4.143	0.840
DCSV8: Need for clearly defined goals	63	2.000	5.000	4.238	0.875
DCSV9: Need for clearly specified materials	63	3.000	5.000	4.286	0.633
MCSV1: Project Manager`s competence	63	2.000	5.000	4.476	0.800
MCSV2: Need for an on-site Project Manager	63	1.000	5.000	4.095	1.118
MCSV3: Need for Managers with necessary authority	63	2.000	5.000	4.190	0.737
MCSV4: Requirement for manager`s understanding of Project Mission	63	2.000	5.000	4.429	0.856
MCSV5: Top down commitment	63	3.000	5.000	3.905	0.817
MCSV6: Project team motivation and good orientation	63	3.000	5.000	4.000	0.762
MCSV 7: Monitoring, feedback and control mechanisms	63	2.000	5.000	4.381	0.792
MCSV8: Effective project schedule application	63	2.000	5.000	4.048	0.958
MCSV9: Management of supply chain and	63	2.000	5.000	3.905	1.027

Critical Success Variables(CSV)	Total Score	Min Score	Max Score	Mean Score	Std. dev
logistics					
MCSV10: Risk management	63	2.000	5.000	4.143	0.780
MCSV11: Effective Communication	63	1.000	5.000	4.476	0.965
PCSV1: Effective procurement planning	63	1.000	5.000	4.476	1.014
PCSV2: Contract monitoring and Control	63	1.000	5.000	4.286	1.038
PCSV3: Choice of procurement procedure	63	1.000	5.000	3.857	1.045
PCSV4: Need for competent procurement team	63	1.000	5.000	4.238	1.118
PCSV5: Need for honest procurement team members	63	1.000	5.000	4.381	1.099
PCSV6: Need for corrupt free procurement system	63	1.000	5.000	4.524	0.965
PCSV7: Availability of specified materials	63	2.000	5.000	3.810	0.913
PCSV8: Availability of suitable equipment	63	2.000	5.000	4.000	0.933
PCSV9: Need for clearly specified materials	63	2.000	5.000	4.048	0.906
PCSV10: Contracting philosophy on environment, health and safety	63	1.000	5.000	3.762	0.979
PCSV11: Competent suppliers	63	1.000	5.000	3.762	1.241
PPCSV1: Competence of project participants	63	2.000	5.000	4.190	0.913
PPCSV2: Size of available labour	63	1.000	5.000	3.667	1.136
PPCSV3: Skills of available labour force	63	3.000	5.000	4.238	0.689
PPCSV4: Type of participants	63	1.000	5.000	3.095	1.201
PPCSV5: Size of participants` organisations	63	1.000	5.000	2.810	1.268
PPCSV6: Participants` emphasis on goal achievements	63	1.000	5.000	3.524	1.306
PPCSV7: Goal commitment of project team	63	1.000	5.000	3.905	1.160
PPCSV8: Effective communication channels between participants	63	1.000	5.000	4.190	1.229
PPCSV9: Coordination between project participants	63	1.000	5.000	4.143	1.216
FCSV1: Financial capacity of client	63	1.000	5.000	4.524	0.965
FCSV2: Adequacy of working capital of Contractors	63	1.000	5.000	4.286	0.991
FCSV3: Need for timely clearance of stage completion certificates	63	1.000	5.000	4.048	1.300
FCSV4: Availability of resources as planned through project execution	63	1.000	5.000	4.476	0.965
FCSV5: Cash flow of Contractor to enable steady payments	63	1.000	5.000	4.476	0.965
FCSV6: Financial accessibility to Contractors	63	1.000	5.000	4.238	1.027
FCSV7: Need for Accountability and transparency	63	2.000	5.000	4.238	0.928
FCSV8: Timely release of counterpart funding	63	2.000	5.000	4.238	1.027
ECSV1: Economic conditions prevailing at a time	63	2.000	5.000	4.095	0.979
ECSV2: Social and cultural orientation of the community	63	1.000	5.000	3.381	1.099
ECSV3: Political conditions prevailing at a time	63	3.000	5.000	4.095	0.817

Critical Success Variables(CSV)	Total Score	Min Score	Max Score	Mean Score	Std. dev
ECSV4: Bureaucracy	63	1.000	5.000	3.714	0.991
ECSV5: Climate conditions	63	1.000	5.000	3.333	1.136
ECSV6: Ecological conditions	63	1.000	5.000	3.095	1.201
ECSV7: Laws and regulations governing contracts	63	1.000	5.000	3.952	1.184
ECSV8: Technological standard	63	3.000	5.000	4.095	0.875

Responses collected on a five point Likert scale (1- Strongly disagree, 2-Disagree, 3-Indifferent, 4-Agree, 5-Strongly agree)

From Table 5.3, it can be observed that the minimum score among the variables was 1 whereas the maximum was 5. However, the highest score on all the project success variables was 5. These scores indicate that the respondents used the entire 5-point survey scale, implying adequate variability amongst the responses.

5.2.4.2 Assessing the factorability of project success variables

Assessment of factorability of project success variables was done based on correlation matrix. This suggested that inter-correlation matrix contained sufficient common variance to allow for factor analysis. Similarly, the KMO value 0.690 for the entire matrix was found to be above the suggested threshold of 0.500 (Hair et al., 2006). However, observation of the anti-image correlation matrix revealed that seven success variables had individual KMO values below 0.5, which indicated that the dataset, in its current form, was still not suitable for factor analysis (Hair et al., 2006). These values were sequentially eliminated one after another, starting with the one whose KMO value was lowest, until 49-item scale with an overall KMO value of 0.737 and individual KMO value of at least 0.5 was obtained for each item.

5.2.4.3 Factor Analysis following Varimax Rotation

Having established that factor analysis could be applied on the 49 project success variables, principal component analysis (PCA) was employed with varimax rotation in order to identify the underlying structure of relationships. Due to lack of a priori basis on the number of factors to be extracted, initially all 49 variables were allowed to load freely on various factors so long as they had eigenvalue greater than one. Further a scree plot for different components was obtained (as shown in figure 5.4) in order to have an idea about the amount of variance explained by each factor**.**

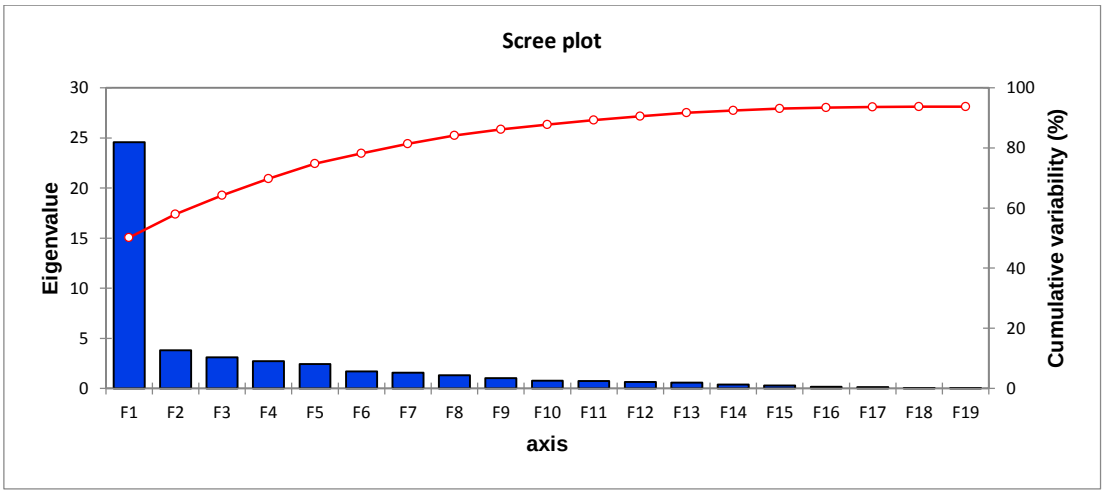

Figure 5.4: Scree Plot of project success factors

Observation of the shape of the scree plot generated (Figure 5.4) revealed that six factors could adequately capture variance amongst the success variables. While conducting factor analysis, the process was subjected to the four conditions as discussed in section 5.2.3.3.

During factor analysis, all success variables loaded appropriately based on the four conditions (already mentioned in the previous section) which yielded a 7-factor 49-item instrument, accounting for 76.087% of the variance in the dataset. In this study, factors were named as Design related Critical Success Variables, Project Management related Critical Success Variables, Procurement related Critical Success Variables, Project participants related Critical Success Variables, Financial related Critical Success Variables and Intervening External Environment related CSFs. Table 5.4 summarizes the factor loadings for the 49-item instrument and the labelling of those items, i.e., project success variables.

Table 5.4: Results of the Factor Analysis of project success variables

Cronbach's alpha(α)	Components				
	0.962	0.947	0.947	0.877	0.912
	1	2	3	4	5
MCSV1: Project Manager`s competence	0.594				
MCSV11: Effective Communication	0.663				
PCSV3: Choice of procurement procedure	0.620				
PPCSV1: Competence of project participants	0.683				
PPCSV7: Goal commitment of project team	0.825				
PPCSV8: Effective communication channels between participants	0.873				
PPCSV9: Coordination between project participants	0.880				
FCSV1: Financial capacity of client	0.794				
DCSV4: Requirement for realistic cost estimates		0.714			
DCSV6: Need for realistic scope		0.750			
DCSV9: Need for clearly specified materials		0.543			
MCSV8: Effective project schedule application		0.737			
MCSV9: Management of supply chain and logistics		0.696			
PCSV10: Contracting philosophy on environment, health and safety		0.717			
DCSV5: Team members involvement during design			0.823		
DCSV6: Need for realistic scope			0.786		
MCSV10: Risk management			0.819		
PPCSV4: Type of participants				0.590	
ECSV2: Social and cultural orientation of the community				0.797	
ECSV5: Climate conditions				0.843	
MCSV2: Need for an on-site Project Manager					0.538
FCSV8: Timely release of counterpart funding					0.652
Eigenvalue	**24.702**	**3.919**	**3.236**	**2.845**	**2.580**
Variability (%)	**50.413**	**7.997**	**6.605**	**5.807**	**5.266**
Cumulative %	**50.413**	**58.410**	**65.014**	**70.822**	**76.087**

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0.737.
Bartlett's Test of Sphericity=1097.382 Significance =0.000

The factor analysis results shown in table 5.4 reveal that "Project participants and Management critical related success factors' is the most important construct of project success, having the highest eigenvalue of 24.702 and accounting for 50.413% of the variance in the data set. The five factors extracted indicate different dimensions of success amongst construction projects.

5.2.4.4 Validation of CSFs

Reliability of CSFs scale: The 22-item CSFs scale had a reliability coefficient of 0.936 which is above the recommended value of 0.70 (Hair et al, 2006; Malhotra& Dash, 2011).The Cronbach`s alpha coefficient for each factor was as follows: "Design related factors"=0.947; "Design and Management related critical success factors"=0.947; "Environmental related critical success factors"=0.877; and "Financial related success factors"=0.912. This demonstrates that the factors extracted from the analysis are considered adequate in the successful implementation of public sector construction projects.

Content validity: The content validity of the instrument measuring CSFs was achieved while designing the interview guide. This is discussed in detail in the Research Methodology section (Chapter 4, section 4.7), page 92.

The result indicated that 22 CSFs were extracted out of the initial 56 as indicated in Table 5.4. The 22 extracted variables were used to formulate the questionnaire for the general survey in order to expose them to critical studies.

5.2.5 Results for success measurement variables

In this section, the same dataset containing 63 responses was utilized to carry out descriptive statistics on the project implementation success measurement criteria variables in order to establish the Success Indicator scale. This was done to examine the statements from literature reviewed that contemporary measures of project performance (Time, Cost, Quality, Client satisfaction, Health and safety considerations, site disputes and environmental impact) was suitable for measurement of project performance along the project life cycle(Amade and Ogbonna, 2012; Ngacho, 2013; Dakhi et al, 2016; Dang and Le-Hoai, 2016). The process followed is described below.

5.2.5.1 Descriptive statistics of Success Criteria measure

The responses on 7 variables relating to project success criteria provided by the respondents were included in the present study. The findings regarding the minimum score, maximum score, mean and standard deviations of the scores on responses to success measure variable are presented in table 5.5.

Table 5.5: Descriptive statistics of measures of success variables

Variable	Total Score	Mini Score	Max Score	Mean Score	Std. dev
TSI: Projects executed within schedule (Time)	63	1.000	5.000	1.810	0.965
CSI: Projects implemented within the planned budget	63	1.000	5.000	2.143	0.998
QSI: Project executed as per specifications	63	2.000	5.000	3.095	1.073
CSSI: Projects implemented to client satisfaction	63	1.000	5.000	3.143	1.045
SSI: Projects executed with minor health and safety incidences	63	2.000	5.000	3.429	0.962
DSI: Projects implemented within manageable disputes	63	2.000	5.000	3.476	1.014
ESI: Projects implemented sustainably	63	2.000	5.000	3.429	1.011

Responses collected on a three point Likert scale (1=strongly disagree, 2=disagree, 3=indifferent, 4=agree, 5=strongly agree).

The minimum and maximum values were 1 and 5 respectively for 7 variables, indicating that, in general, respondents used the entire 5-point survey scale. Standard deviations were found to be above 1 except in three variables; “SSI: Projects executed with minor health and safety incidences” (0.962), “CSF: Projects implemented within the planned budget” (0.998) and “TSF: Projects executed within schedule (Time)” (0.965). This shows that the means represent a good measure of the distribution of scores in the survey data.

5.2.5.2 Reliability test for success Indicators

As was found that the 7- item scale had a reliability coefficient of 0.881 which is above the recommended value of 0.70 (Hair et al., 2006; Malhotra &Dash, 2011). The Cronbach’s alpha coefficient was 0.881 and Standardized Cronbach's Alpha was 0.882.This demonstrates that the factors extracted from the analysis are considered adequate in the successful implementation of Public construction projects

5.2.6 Strategies for improvement of implementation of PSCPs

When asked to state what strategies could be employed to overcome challenges at implementation stage of public sector construction projects, the interviewees prominently gave the following strategies in the order of importance:

- Introduction of output based budgeting and funding model
- There should be a clear policy on the construction project financing system
- Established specialized lending institution for construction projects
- Contracts offer should be based on value for money principle
- Stiffer punishment on offenders
- Streamline work processes to minimize bureaucracy
- There should be separation of powers between the client management, the client board of directors, consultants, contractors and suppliers
- There should be a clear policy on strengthening pre-implementation phase of projects which is planning
- Strengthened monitoring and feedback mechanisms which includes strengthened third party monitoring
- Strengthened technical auditing of construction projects
- Empowerment, improvement and up-scaling the current skills of local contractors
- There should be clear guidelines for execution of projects

As part of triangulation these findings were used to develop the questionnaire for General survey.

5.3 Data analysis and Results of General Survey

In the preceding section (phase 1), qualitative data from expert in-depth face-to-face interviews were presented and analysed which was mainly an exploratory study conducted in order to establish the key factors to be carried forward for study in the General survey. In this Phase 2 section, presentation and analyses of data from General Survey was done. Further PCA was done to reduce the variables to manageable levels and extraction of variables with higher predictability power of outcome. This analyse therefore, started with exploratory and then proceeded to explanatory study. Explanatory study was conducted on established Critical Success factors (Independent

variables) in order to establish their relationships with Successful implementation of public sector construction projects (Dependent variable) through regression analysis.

The aim of this phase is to analyse data from General survey which is expected to give ultimate findings.

5.3.1 Response rate

Three hundred and eighty four (384) questionnaires were prepared for the sample of 384 respondents selected using a probability stratified random sampling method as discussed in detail in the Research Methodology section (Chapter 4, Section 4.5). These were either sent by email or hand delivered to the sampled population. Reminder emails and follow-up phone calls were made to the persons who received the questionnaires. 110 sampled populations could not be located making it possible for administering of only 274 questionnaires. 183 were returned completed giving the response rate of 62%. The reasons for failure to respond to the questionnaire by non-respondents were not given.

Neumann (2000) stated that the response rate in research is calculated by the formula:

Response rate= (total number of responses)/ (total number in sample-ineligible)

Using this formula, the response rate was:

Response rate =183/ (384-(274-183)) =62 %

Therefore, a response rate of 62 percent was acceptable for the study.

However this response rate is supported by Easterby-Smith et al. (2006) who stated that, he expected industry norm is of the order 25 to 30 percent if appropriate measures for increasing responses are undertaken.

5.3.2: Respondents' profile

Table 5.6attempts to capture the respondents' profile in terms of their position on the project, their experience in the construction industry and how long they have been involved in construction projects.

Table 5.6: Respondents' Profile.

	Total	Respondent's Position on the construction project			
		Client	Consultant	Contractor	Other
Period involved with the Public Sector Construction Projects					
Below 5 years	21	6	3	3	9
5-10years	66	27	15	24	0
11-15 years	24	6	6	12	0
16-20 years	24	0	6	18	0
above 20	48	15	15	12	6
Age Bracket (Years)					
18-20	3	3	0	0	0
21-30	15	9	0	3	3
31-40	45	15	15	12	3
41-50	75	15	12	39	9
above 50	45	12	18	15	0
Gender					
Male	150	42	42	57	9
Female	33	12	3	12	6
Education Level					
Masters/PhD	54	18	15	15	6
First degree	105	33	27	39	6
Diploma/ Technician	18	3	3	12	0
Other	6	0	0	3	3
Profession					
Architect	39	3	30	6	0
Engineer	57	24	9	24	0
Quantity Surveyor	30	9	6	9	6
Other/specify	57	18	0	30	9
Category of organisation					
Construction company: Buildings	21	6	3	12	0
Construction company: Roads	30	9	3	18	0
Consulting firm	24	0	21	3	0
Donor Agency	0	0	0	0	0
Public Sector Organisation	36	21	9	0	6
Quasi government organisation	30	15	6	3	6
Private Company/organisation	42	3	3	33	3
TOTAL	**183**	**54**	**45**	**69**	**15**
TOTAL (%)	**100**	**29.508**	**24.590**	**37.705**	**8.197**

The respondents comprised 54 clients (29.508%), 45 consultants (24.590%), 69 contractors (37.705%) and 15 'Other' category (8.197%). This demonstrates the fact that all the main stakeholders of public sector construction projects were represented.

Of the projects surveyed, 42 respondents were involved in Private company/organization, 36 in Public Sector organisation, 30 in quasi government organisation and 24 respondents in Consulting firms.

This information indicates that apart from having adequate experience in terms of years the respondents have been involved in construction projects, respondents had handled projects of different sizes.

5.3.3 Principal Component Analysis (PCA)

In this section further EFA was conducted in order to establish the key Challenges, Critical Success factors and success measurement variables for implementation of Public Sector Construction Projects in Zambia.

The procedure for this data analysis included PCA Correlations, Anti-image matrices, Communalities, Factor Matrix loadings, PCA Rotated Components matrix, KMO & Bartlett`s test, PC Matrices after selecting items, PC items confirmed by regression factor and Reliability of Group variables test. For factors used in explanatory study like CSFs which was independent variables further test for collinearity was done borrowing from Ziglari (2017) who pointed that Philosophy Degree (PhD) scholars always link data analysis with realistic models and they should report statistic values for collinearity conditions in their research study. Regression research analytical model was used to investigate further the multi-collinearity between independent variables and stepwise method applied in SPSS to separate the high bivariate correlated variables present and include only that had conformity at 95% confidence interval. After testing for Factor Analysis Matrix variable Multicollinearity, Factor Analysis Matrix and Factor Matrices were established.

Principal Component Analysis (PCA) was done to reduce the large number of variables per group of items; the composite dependent variable (DV) "Success of implementation of public sector construction projects" comprised six (6) groups of DVs, each having differing number of items per group scrutinized. The frequency runs of the variables that had achieved component loadings of 60% or more of the variable total variance;

and reliability test was undertaken testing each of the four broad groups (DVs), for at least Cronbach`s Alpha of 70% ('Intervening Environmental Factors' Cronbach`s Alpha=0.714) was achieved.

For CSFs regression research analytical model was used to investigate further the Multicollinearity between independent variables and stepwise method applied in SPSS 22 to separate the high bivariate correlated variables present and include only that had conformity at 95% confidence interval.

5.3.3.1Principal Component Analysis for Challenges

30 Challenges under broad categories of Design, Management , Procurement, Project participants, Financial and External environment related factors extracted from expert interview data using EFA was exposed to further study in general survey and the data was analysed using PCA as follows:

5.3.3.1.1 Descriptive Statistics of Challenges

The minimum, maximum score, mean, standard deviation of each of the 30 project implementation challenging variables was computed in order to find out their importance in influencing the failures of implementation of Public sector construction projects. Table 5.7 summarises the descriptive of the above variables.

Table 5.7: Descriptive statistics for Challenges

Variable	Scores	Min Score	Max Score	Mean Score	Std. dev
DCV1: Non-involvement of project participants during design	183	1.000	5.000	3.607	1.181
DCV2: Unexpected design changes	183	1.000	5.000	3.607	1.138
DCV3: Non-involvement of project beneficiaries during design	183	1.000	5.000	3.082	1.386
MCV1: Poor project management	183	1.000	5.000	3.885	1.164
MCV2: Poor project planning	183	1.000	5.000	3.410	1.223
MCV3: Lack of authority by management	183	1.000	5.000	2.967	1.358
MCV4: Non-involvement of project stakeholders	183	1.000	5.000	3.836	1.014
MCV5: Violation of health and safety rules by management	183	1.000	5.000	3.344	1.203
MCV6: Dishonest conduct by Management	183	1.000	5.000	3.328	1.379
PCV1: Poor bidder selection method based on least cost	183	1.000	5.000	3.082	1.249
PCV2: Increased levels of corruption	183	1.000	5.000	3.902	1.331

Variable	Scores	Min Score	Max Score	Mean Score	Std. dev
PCV3: Length of approval procedure	183	1.000	5.000	3.902	1.227
PVC4: Unrealistic and dishonest variations	183	1.000	5.000	2.836	1.122
PPCV1: Lack of team work among participants	183	1.000	5.000	2.885	1.206
PPCV2: Excessive owner change orders	183	1.000	5.000	2.951	1.140
PPCV3: Participants` violation of health and safety rules	183	1.000	5.000	3.443	1.198
PPCV4: Fraudulent certification of works in order to conceal errors	183	1.000	5.000	3.459	1.304
FCV1: Reduced client financing capacity	183	1.000	5.000	4.033	1.176
FCV2: Delay in clearance of stage completion certificates	183	1.000	5.000	3.836	1.299
FCV3: Insufficient working capital for contractors	183	1.000	5.000	4.295	1.048
FCV4: Misallocation of funds by contractors	183	1.000	5.000	4.049	1.154
FCV5: Inaccessibility to funds by contractors	183	1.000	5.000	3.885	1.150
FCV6: Lack of accountability and transparency	183	1.000	5.000	4.311	1.098
ECV1: Political interference in contracts determination	183	1.000	5.000	4.230	1.250
ECV2: Bureaucracy in public sector construction projects	183	1.000	5.000	4.000	1.271
ECV3: Frequent Changes in Government	183	1.000	5.000	3.016	1.211
ECV4: Escalation of project costs due to inflationary pressures	183	1.000	5.000	3.934	1.057
ECV5: Adverse Social aspects(e.g., poor working culture)	183	1.000	5.000	3.639	1.090
ECV6: Changes in Government rules and regulations	183	1.000	5.000	3.131	1.352
ECV7: Lack of needed supporting infrastructures (like roads)	183	1.000	5.000	3.590	1.301

Responses collected on a five point Likert scale (1=strongly disagree, 2=disagree, 3=indifferent, 4=agree, 5=strongly agree).

The minimum and maximum values were 1 and 5 respectively for 30 variables, indicating that, in general, respondents used the entire 5-point survey scale.

5.3.3.1.2 Assessing the Factorability of Challenge Variables

For assessing the factorability of challenge variables, the researcher found out the correlation for each pair of 30 variables that is demonstrated with the help of correlation matrix. This provides evidence of factorability of challenge measurement variables.

Bartlett's test statistics was found significant at 0.000 levels, which indicates the presence of non-zero correlations in the correlation matrix. Further, the KMO measure of the sampling adequacy turns out to be 0.582. Although both tests met the minimum criteria for carrying out factor analysis in the dataset, observation of the correlations along the diagonal of the anti-image correlation matrix revealed that some variables had their KMO values less than 0.4, which indicates that the dataset, in its current form, is still not suitable for factor analysis (Hair et al., 2006). These variables were iteratively removed one after another starting with the one who's correlation along the diagonal of the anti-image matrix was the lowest (Jahmane et al., 2011).

After the removal of 18 variables, it is found that all variables had individual KMO values greater than 0.5. This resulted in the improvement of overall KMO measure of sampling adequacy to 0.582. Furthermore, Bartlett's test statistics was found significant at 0.000 levels. These measures indicate that the reduced set of variables is appropriate for factor analysis.

5.3.3.1.3 Factor Analysis following Varimax Rotation

Principal Components Analysis (PCA) was used with Varimax Rotation given that the primary purpose was to extract the underlying factors. Initially the 30 variables were allowed to lad freely on various factors so long they had eigenvalue greater than one. As explained in 5.3.3, the frequency runs of the variables that achieved component loadings of 60% or more of the variable total variance was undertaken. The result of factor Analysis of Challenge variables varimax rotation was as shown in Table 5 .8 below.

Table 5.8: Results of Factor Analysis of Challenge Variables

Key challenges	**Component**		
	1	2	3
Non-involvement of project participants during design(DCV1)	0.710	0.136	-0.001
Reduced client financing capacity(FCV1)	0.822	-0.077	0.118
Lack of accountability and transparency (FCV5)	0.837	0.042	0.252
Bureaucracy in public sector construction projects(ECV2)	0.638	0.474	-0.012
Escalation of project costs due to inflationary pressures(ECV4)	0.755	0.114	0.177
Fraudulent certification of works in order to conceal errors (PPCV4)	-0.075	0.731	0.33

Key challenges	Component		
Political interference in contracts determination(ECV1)	0.253	0.762	0.067
Changes in Government rules and regulations(ECV6)	-0.049	0.837	-0.061
Lack of needed supporting infrastructures (like roads)(ECV7)	0.238	0.735	-0.183
Non-involvement of project beneficiaries during design(DCV3)	-0.054	-0.218	0.761
Poor project management(MCV1)	0.407	0.228	0.706
Poor project planning(MCV2)	0.257	0.125	0.828

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 5 iterations.

From analysis in Table 5.8 it is evident that 5 variables loaded under factor 1 seem to be associated with Financial and Design related Challenges. The second factor comprises four variables, which reflect External and Project Participants related challenges, whereas the three variables under factor 3 attempts to capture Project Management related factors. Three constructs of challenges constitute the key challenges. Ranking the results using individual eigenvalue which shows predictability power gives results as shown in 5.9.

5.3.3.1.4 Validation of the KCFs

Reliability of the scale comprising KCFs was established through Cronbach`s Alpha coefficient which tested internal consistency of the items. The 12-item scale had a reliability of 0.802 which is well above 0.70 recommended for similar studies (Hair et al, 2006; Malhotra and Dash, 2010). The Content Validity of the instrument measuring challenges was achieved while designing the survey instrument. This was carried out through extensive literature review followed by securing opinions from the experts as discussed in detail in Research Methodology section (Chapter 4, section 4.7), page 92.

5.3.3.1.5 Ranking Critical Challenges

The Eigenvalue is used here to determine clients, consultants, contractors, manufacturers and construction material suppliers and interests groups` perception of challenges affecting implementation of public sector construction projects in Zambia.

According to these key players of public sector construction projects *poor project planning* was the most predominant challenge causing failure of implementation of projects in Zambia as demonstrated by having the highest eigenvalue (predictability

power of variance) of 85.1 percent in table 4.4. The 12 factors were established as the factors which had more influence on the failure of projects. The ranking of the established 12 key challenges using individual Eigenvalue in order of importance were as shown in Table 5.9 below. Going further Cronbach`s alpha coefficient of 0.802 demonstrated that the 12 factors extracted from the analysis were adequate in the determination of failure of implementation of Public Sector Constriction Projects.

Table 5.9: Results indicating Ranking of Key Challenges using Individual Eigenvalue

Challenges	Eigenvalue	Rank Score
Poor Project planning *(MCV2)*	0.851	1
Changes in Government rules and Regulations *(ECV6)*	0.847	2
Lack of accountability and transparency *(FCV6)*	0.830	3
Escalation of Project Costs due to inflationary pressures *(ECV5)*	0.815	4
Lack of needed supporting infrastructures like roads *(ECV9)*	0.814	5
Non-involvement of Project participants during design *(DCV1)*	0.754	6
Bureaucracy in Public Sector Construction Projects *(ECV2)*	0.740	7
Fraudulent certification of works in order to conceal errors*(PPCV4)*	0.727	8
Poor Project Management *(MCV1)*	0.721	9
Reduced Client financing capacity*(FCV1)*	0.718	10
Political interference in contracts determination *(ECV1)*	0.700	11
Non-involvement of Project beneficiaries during design *(DCV3)*	0.662	12

The above table (5.9) reveals that *Poor project planning* is the most important challenge faced during implementation of public sector construction projects, having the highest eigenvalue of 0.851 which accounts for most of variance in the dataset. This result conforms to findings by various researchers (Kogi, 2013; Burke, 2012). The second higher eigenvalue for *Changes in government rules* entails that most of the respondents felt that it was one of the major key challenges experienced during this stage of the project. This finding is supported by Amade et al (2012) and Sweis (2014) who found the same in their studies. The third category was financial related challenges represented by *Lack of accountability and transparency* and *Reduced Client financing capacity*. Lack of accountability and transparency had a tendency of siphoning the much needed

resources for the project thereby creating problems during implementation of the project. As various researchers had observed, lack of accountability and transparency are recipes for failures of many projects (Sichombo et al, 2009; Alsolaiman, 2014 and Mukumbwa, 2013).

Escalation of projects costs due to inflationary pressures was found to be negatively affecting projects in terms of time, cost and quality. Similar results were found by Shaban (2008) and Amade et al (2012). *Lack of needed supporting infrastructures like roads* was also identified as one of the factors hampering smooth implementation of projects in terms of time and cost. This was in agreement to the findings by Salleh (2009). *Non-involvement of project participants* brings in disjointedness between designers and implementers of the designed plans. This is seen as a challenge because the contractors may misunderstand the plans there by making mistakes or delay in implementation. The finding was contrary to those of various earlier researchers (Kaliba et al., 2009; Sichombo et al., 2009; and Odoyi, 2016) who found Non-involvement of participants during design as one of the major contributing factor to failures of projects.

Bureaucracy in public sector construction projects was also identified as one of the key external environment challenges affecting smooth implementation of projects. This finding was in agreement with findings of various earlier researchers (Ali, 2010). *Fraudulent certification of works in order to conceal errors* was found as one of the major challenge by Sichombo et al. (2009) and Mukumbwa (2015).Poor project management as a challenge was in agreement with earlier researchers` finding that (Hendrickson, 2008; Alsolaiman, 2014 and Odoyo, 2016).

Reduced client financing mainly because of bloating the number of projects and increased pressure on the treasury was found to be one of the hindering factors of smooth implementation of projects because of triggering non-funding. This was in agreement with findings by earlier researchers (Enshassi et al., 2009; Alsolaiman, 2014 and Joseph and Muturi, 2015) who blamed failure of implementation of projects on reduced client financing capacity. *Political interference in contracts determination* was voted to be one of the key challenges interfering with smooth implementation of projects. This finding was in agreement with the one by Alsolaiman (2014). Least is *Non-involvement of project beneficiaries during design* which has an eigenvalue of

0.662 only demonstrating less explanation in variance in failure of projects. The result is contrary to the finding by Odoyi (2016) and Kaliba et al., (2009).

This finding shows that only twelve (12) out of the thirty (30) challenges were applicable to Zambian`s public sector construction projects.

5.3.3.2 Principal Component Analysis for CSFs

25 CSFs under broad categories of Design, Management, Procurement, Project Participants and Financial CSFs extracted from expert interview data using EFA was exposed to further study in general survey and the data was analysed using PCA as follows:

5.3.3.2.1 Descriptive Analysis of CSFs for implementation of PSCPs

25 CSFs extracted from phase 1 through EFA were exposed to further study under general survey and data is presented and analysed in Table 5.10 as follows:

Table 5.10: Descriptive Statistics of CSFs

Variable	Total Score	Mini Score	Max Score	Mean Score	Std. dev
DCSV 1:Reduced design changes reduces the cost of implementation of project	183	1.000	5.000	4.049	1.050
DCSV2: Project implementation schedule affects accuracy of the project	183	1.000	5.000	3.475	1.266
DCSV3: Project documentation (drawings and bills of quantities) is usually accurate and complete	183	1.000	5.000	3.246	1.129
D**CSV4:** The cost of material is dependent on their availability	183	1.000	5.000	3.951	0.933
DCSV5: Project team site inspections are held bi-weekly	183	1.000	5.000	2.885	1.272
MCSV1: Recruitment of Managers on the basis of education, training and experience increases success of projects	183	1.000	5.000	4.230	0.897
MCSV2: Top project managers are given weekly reports	183	2.000	5.000	3.525	0.882
MCSV3: Risk Management	183	2.000	5.000	3.869	0.934
MCSV4: Relevant information is usually communicated within reasonable time	183	2.000	5.000	3.770	0.840
MCSV5: Relevant project control measures are usually in place	183	1.000	5.000	3.541	1.098
MCSV6: There is constant flow of needed materials to project sites	183	1.000	5.000	3.213	1.150
PCSV 1: Project delivery is done within	183	1.000	5.000	2.541	1.113

Variable	Total Score	Mini Score	Max Score	Mean Score	Std. dev
estimated time					
PCSV2: There is reduced reliability on price on the awards of contracts	183	1.000	5.000	3.131	1.224
PCSV3: The tender board committee members are fairly motivated in order to deter corruption	183	1.000	5.000	2.689	1.341
PCSV4: The process of procurement is open to all eligible bidders	183	1.000	5.000	3.393	1.275
PPCSV1: Engagement of project participants on the basis of education, training and experience increases success of projects	183	1.000	5.000	3.770	1.049
PPCSV2: Size and experience of client affect success of the project	183	1.000	5.000	3.508	1.128
PPCSV3: Ways used to motivate personnel (such as bonuses, time-off, training opportunities) affect productivity levels	183	2.000	5.000	4.180	0.822
PPCSV4: Increased collaboration affect success of projects	183	1.000	5.000	3.918	0.931
PPCSV5: Increased commitment affect success of projects	183	1.000	5.000	3.984	1.035
FCSV1:Client`s level of capital base affects progress of projects	183	2.000	5.000	4.115	0.962
FCSV2: Loans are easily processed by banks and other financial institutions	183	1.000	5.000	2.164	1.151
FCSV3: Payment certificates are honoured within the stipulated two weeks period	183	1.000	5.000	2.246	1.279
FCSV4: Plans and records of income and expenditure are updated on a weekly basis	183	1.000	5.000	2.508	1.037
FCSV5: Counterpart/community contribution funds are honoured in time as pledged	183	1.000	5.000	2.492	1.114

Responses collected on a three point Likert scale (1=strongly disagree, 2=disagree, 3=indifferent, 4=agree, 5=strongly agree).

The minimum and maximum values were 1 and 5 respectively for 25 variables, indicating that, in general; respondents used the entire 5-point survey scale. The mean score ranged between 2.164 (FCSV2: Loans are easily processed by banks and other financial institutions) and highest being 4.230 (MCSV1: Recruitment of Managers on the basis of education, training and experience increases success of projects).

5.3.3.2.2 Assessing the Factorability of Critical Success Factors

In order to assess the factorability of CSFs variables, the researcher found out the correlation of each pair of 25 variables that is demonstrated with the help of Correlation Matrix to show the strength of relationship between every pair of items. The correlation matrix suggested presence of high degree of related variables as shown in Table 5.11.

Table 5.11: Original Matrix of Critical Success Factors (CSFs)

	DCSV 1	DCSV 2	DCSV 3	DCSV 4	DCSV 5	MCSV 1	MCSV 2	MCSV 3	MCSV 4	MCSV 5	MCSV 6	PCSV 5	PCSV 2	PCSV 3	PCSV 4	PPCSV 1	PPCSV 2	PPCSV 3	PPCSV 4	PPCSV 5	FCSV 1	FCSV 2	FCSV 3	FCSV 4	FCSV 5
DCSV1	1																								
DCSV2	0.392	1																							
DCSV3	0.139	0.102	1																						
DCSV4	0.103	0.159	-0.082	1																					
DCSV5	-0.193	0.044	0.192	0.314	1																				
MCSV 1	0.163	0.107	0.302	-0.124	0.121	1																			
MCSV 2	-0.046	0.13	0.267	0.372	0.333	0.368	1																		
MCSV 3	0.141	0.165	0.203	0.238	0.32	0.292	0.564	1																	
MCSV 4	0.088	0.15	0.338	0.217	-0.009	0.377	0.564	0.424	1																
MCSV 5	-0.08	-0.091	0.358	0.107	0.009	0.392	0.42	0.198	0.654	1															
MCSV 6	0.155	0.202	0.358	0.117	0.276	0.304	0.409	0.548	0.512	0456	1														
PCSV1	0.104	0.039	0.391	0.232	0.475	0.156	0.515	0.481	0.398	0.339	0.682	1													
PCSV2	0.059	0.013	0.392	0.049	0.2	-0.028	0.15	0.03	0.094	0.119	0.039	0.19	1												
PCSV3	-0.059	-0.029	0.179	0.067	0.278	0.169	0,32	0.099	0.2	0.305	0.139	0.357	0.176	1											
PCSV4	-0.015	-0.004	0.116	0.155	0.058	0.022	0.27	0.016	0.193	0.342	0.246	0.337	0.03	0.361	1										
PPCSV 1	0.4	-0.042	0.326	0.089	-0.089	0.389	0.327	-0.014	0.277	0.294	0.068	0.206	0.143	0.3	0.361	1									
PPCSV 2	- 0.021	-0.089	0.121	0.243	0.11	-0.002	0.244	0.032		-0.024	-0.059	0.134	0.214	0.367	0.193	0.378	1								
PPCSV 3	0.628	-0.067	-0.013	-0.031	-0.232	0.301	-0.131	0.031	0.036	0.165	-0.076	-0.143	-0.253	-0.038	-0.052	0.373	0.078	1							
PPCSV 4	0.19	-0.163	-0.075	0.204	-0.004	-0.017	-0.088	0.025	-0.003	0.076	-0.107	0.027	-0.048	0.283	0.152	0.183	0.008	0.062	1						
PPCSV 5	0.228	-0.159	0.6	0.289	-0.214	-0.014	0.082	0.117	0.299	0.08	0.017	0.094	0.106	0.056	0.03	0.163	0.021	0.1	0.546	1					
FCSV1	0.239	-0.031	0.308	0.245	0.078	0.179	0.162	0.127	0.155	0.019	0.022	0.111	0.225	0.156	0.003	0.418	0.295	0.057	0.195	0.267	1				
FCSV2	0.048	0.172	-0.057	0.115	0.137	0.043	0.304	0.112	0.193	0.242	0.135	0.123	-0.05	0.29	0.282	0.072	-0.052	0.125	0.243	0.058	-0.151	1			
FCSV3	0.003	0.202	0.232	0.272	0.382	0.152	0.425	0.11	0.252	0.351	0.39	0.635	0.127	0.516	0.466	0.079	0.096	-0.089	0.045	-0.009	-0.13	0.454	1		
FCSV4	-0.049	0.129	0.118	0.264	0.257	0.157	0.23	0.103	0.078	0.409	0.406	0.232	0.012	0.197	0.185	-0.059	-0.011	0.047	-0.076	-0.13	-0.125	0.234	0.34	1	
FCSV5	-0.119	-0.026	0.1	0.245	0.249	0.051	0.424	0.284	0.456	0.577	0.497	0.436	0.134	0.258	0.339	0.012	-0.161	-0.043	0.119	0.0179	-0.022	0.528	0.528	0.467	1

Correlation Coefficient and p values as follows: p>0.15 denotes, p-value <0.05 or significance at 5% level; p>0.20 denotes p-value<0.01: Significance at the 1% level: Overall Keizer-Meyer-Olkin (KMO) measure of sampling Adequacy: 0.555 Bartlett's Test of Sphericity: Approx. Chi –square: 2434.898, degrees of freedom=300; Significance: 0.000

Table 5.11 above indicated that the sample had high degree of related variables which could be grouped together. This indicated that PCA could be carried out on all the all data set. It provides evidence of factorability of CSFs.

To be certain, before carrying out PCA, the overall significance of the correlation matrix and its factorability was tested with the help of Bartlett`s test of Sphericity and Kaiser –Meyer-Olkin (KMO) measure of sampling adequacy respectively. Bartlett`s test statistics was found to be significant at 0.000 levels which indicated the presence of non-zero correlations in the correlation matrix. Further, the KMO measure of the sampling adequacy turns out to be 0.555. Although both tests met the minimum criteria for carrying out factor analysis in the dataset, observation of the correlations along the diagonal of the anti-image correlation matrix revealed that some variables had their KMO values less than 0.4 which indicated that the dataset in that form was not suitable for factor analysis (Hair et al., 2006). These variables were iteratively removed one after another starting with one which had the lowest correlation along the diagonal of anti-image matrix (Jahmane et al., 2011).

After the removing the total of 17 variables, it was found that all variables had individual KMO values greater than 0.5. This resulted in the improvement of overall KMO measure sampling adequacy to 0.555. Furthermore, Bartlett`s test statistics was found significant at 0.000 levels. These measures indicate that the reduced dataset of variables is appropriate for factor analysis.

5.3.3.2.3 Factor Analysis following Varimax Rotation

Principal Component Analysis (PCA) was used with Varimax Rotation given that the primary purpose was to extract the underlying factors. Initially the 25 variables where allowed to load freely on various factors so long they had Eigenvalue greater than one. As explained in Table 5.12, the frequency runs of variables that achieved component loadings of 60% or more of the variable total variance was undertaken. The result of the factor Analysis of Critical Success factors variables after Varimax rotations are shown in Table 5.12 and below.

Table 5.12: Results of factor Analysis of CSFs variables

Critical Success Factors	**Components**			
	1	2	3	4
The Tender Board Committee members are fairly motivated to deter corruption (PCSV3)	0.647			
The process of procurement is open to all eligible bidders (PCSV4)	0.629			
Payment Certificates are honoured within the stipulated two weeks period(FCSV3)	0.668			
There is constant flow of needed materials to project sites (MCSV6)		0.745		
Project delivery is done within estimated time (PCSV1)		0.645		
Top Project managers are given weekly reports (MCSV2)			0.676	
Risk Management (MCSV3)			0.727	
Project team Site Inspections are held bi-weekly (DCSV5)				0.651

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 9 iterations.

From analysis in Table 5.12, it is evident that 3 variables loaded under factor 1 seem to be associated with Financial and Procurement related Critical Success Factors. The second factor comprises two variables, which reflect Project Management related Critical Success Factors. The third factor comprises two variables which mainly reflect Management related Critical Success Factors, whereas the one variable under factor 4 attempts to capture Design related Critical Success factors. Four constructs of success factors constitute the Critical Success factors. Ranking results using eigenvalue which signify predictability power gives the results as shown in Table 5.13.

5.3.3.2.4 Validation of CSFs

Reliability of the scale comprising CSFs was established through Cronbach`s Alpha Coefficient which tested internal consistency of the items. The 8 item scale had a reliability of 0.808 which is well above 0.70 recommended for similar studies (Hair et al, 2006; Malhotra and Dash, 2010). The Content validity of the instrument measuring CSFs was achieved while designing the survey instrument.

5.3.3.2.5 Ranking of Internal CSFs

The Eigenvalue is used here to determine clients, consultants, contractors, manufacturers and construction material suppliers and interests groups` perception of

internal CSFs affecting implementation of public sector construction projects in Zambia.

According to these key players of public sector construction projects Team members` involvement during design stage was the most predominant internal CSFs causing success of implementation of projects in Zambia as demonstrated by having the highest eigenvalue (predictability power of variance) of 81.5 percent in table 5.13. Through PCA, 8 variables were extracted as internal CSFs experienced during the implementation stages of Public Sector Construction projects in Zambia. The 8 factors were established as the factors which had more influence on the success of projects. The ranking of the established 8 CSFs using individual Eigenvalue in order of importance were as shown in Table 5.13 below. Going further Cronbach`s alpha coefficient of 0.808 demonstrated that the 8 factors extracted from the analysis were adequate in the determination of success of implementation of Public Sector Constriction Projects.

Table 5.13: Results indicating Ranking of CSF

Critical Success Factors	**Eigenvalue**	**Rank**
Project team site inspections are held bi-weekly*(Team members involvement)(DCSV5)*	0.815	1
Project delivery is done within estimated time*(Procurement planning) (PCSV1)*	0.800	2
Top project managers are given weekly reports*(Top management commitment)(MCSV2)*	0.791	3
Risk Management *(MCSV3)*	0.772	4
Payment certificates are honoured within the stipulated two weeks period*(Progress payment process) (FCSV3)*	0.769	5
There is constant flow of needed materials to project sites*(Supply chain management) (MCSV6)*	0.747	6
The tender board committee members are fairly motivated in order to deter corruption*(Corruption free) (PCSV3)*	0.694	7
The process of procurement is open to all eligible bidders *(Transparency) (PCSV4)*	0.615	8

The above table (5.13) reveals that *Team members' involvement at design stage* was the most important success factor at implementation stage of public sector construction project, having the highest eigenvalue of 0.851 which accounts for most of variance in the dataset. Involving all team members from design stage allows all players to have in-depth understanding of the project there by avoiding conflicts and problems in translating the plans. This is similar to the finding of Abdullar and Yassim (2012) and

Ismail (2012).*Procurement planning* as a way to envision and organize the procurement activities in an orderly and systematic manner to avoid shortcomings was seen as one of the major success factors as could be confirmed by looking at a higher eigenvalue of 0.800. Various researchers (Lysons and Farrington, 2010; Aftab, 2012; Tawil, 2013; Barasa, 2014; Cherop, 2016 and Share, 2016) were in agreement to this finding suggesting that procurement planning ensures that project delivery is done within estimated time.

Top management commitment was selected as one of the most important factors for successful implementation of projects in the sense that it ensures steady support of the project by top management. Site supervisors and workers are also made alert. Most of the researchers (Ismail, 2012; Amade and Ogbonna, 2012 and Bubu and Sudharkar, 2015) suggested that Top management commitment was a key to successful implementation of projects. *Risk Management* which emphasizes on taking care of unexpected incidences during the project schedule was also chosen by respondents as one of the key factors for success of projects. Similar results were found by various earlier researchers (Ismail, 2012; Amade and Ogbonna, 2012; Ngoma et al., 2014; and Bubu and Sudharkar, 2015).

Progress payment process was also found to be one the major factor for success of projects. The result is agreement to various researchers (Kaliba, 2009; Kogi, 2013 and Joseph and Muturi, 2015) who revealed that honouring payments certificates within stipulated period of two weeks was important for successful implementation of projects. *Supply chain Management* which ensures constant flow of needed materials to project sites also came out as one of the key factors during implementation of projects. Various researchers (Berawi et al., 2012; Ismail, 2012) also identified it as one of the most important factors which propels projects to success. *Corruption free tender system* was understood to be allowing contractors with needed capacities to be taking up contracts and also concentrating the resources to the project. Various researchers identified Corruption free tender system as one of the most important factors affecting success of projects (Sweis et al., 2007; Azhar et al., 2008; Le-Hoai et al., 2008; Kaliba et al., 2009).

Transparency in the procurement system meant to broaden the number of participants to strengthen competition and also restrict usage of resources towards planned activities in order to direct a lot of resources towards the real project. Any misuse of resources has potential to create shortages towards projects. Transparency will not only ensure capable operatives like contractors but also materials at a normal price and expected price. Various researchers see Transparency as a necessary factor to successful implementation of projects (Oladinrin et al., 2013; Oppong, 2013; Kogi. 2013 and Cherop, 2016).This finding shows that only eight (8) out of the twenty-five (25) project internal success factors were applicable to Zambian`s public sector construction projects.

5.3.3.3 PCA for External Environment Factors

PCA for external environment at this level was established separate from the Critical Success Factors because of the different role of intervening variable in this study model. Following almost the same steps followed for Critical Success Factors established was first Communalities, then descriptive statistics, Principal Component Analysis and Reliability as follows:

Table 5.14: Communalities

External Environmental Factors	Initial	Extraction
ECSV1-Income levels in the country affect success of projects	1	0.536
ECSV2- Some prevailing culture affect the speed of doing work	1	0.335
ECSV3- Stable political atmosphere in the country increases level of government commitment to projects	1	0.647
ECSV4-Reduced levels of bureaucracy positively affect success of project	1	0.506
ECSV5- Project sites richly endowed in required natural resources positively affect success of project	1	0.401
ECSV6- Reduced number of hazards during project implementation positively affect project success	1	0.211

The above (Table 5.14) analysis demonstrates that stable political atmosphere in the country increases level of government commitment to projects was explaining the most variation of about 64.7 %, whilst Reduced number of hazards during project implementation was only having an individual influence of variation of 21.1%.

No further process was taken as it was realized that the variables were few and different from each other. As such all of them were taken for further analysis. Ranking results using eigenvalue gives results as shown in Table 5.15.

5.3.3.3.1 Ranking of External CSFs

The 6 factors were established as the factors which had more influence on the success of projects. The ranking of the established 6 Key intervening variables using individual Eigenvalue in order of importance were as shown in Table 5.15 below.

Table 5.15: Results indicating Ranking of Critical External Environment Related Success Factors

External CSFs	Eigen value	Rank
Stable political atmosphere in the country increases level of government commitment to projects*(Political status)* ***(ECSV3)***	0.647	1
Income levels in the country affect success of projects*(Economic status)* ***(ECSV1)***	0.536	2
Reduced levels of bureaucracy positively affect success of project*(Bureaucracy)* ***(ECSV4)***	0.506	3
Project sites richly endowed in required natural resources positively affect success of project *(Natural endowment/Ecological)* ***(ECSV5)***	0.401	4
Some prevailing culture affect the speed of doing work (*Social Status*) (**ESV2**)	0.335	5
Reduced number of hazards during project implementation positively affect project success (Climatic conditions)(ECSV6)	0.211	6

The above table (5.15) reveals that *Stable political atmosphere in the country increases level of government commitment to projects (Political status)* is the most important CSFs faced during implementation of public sector construction project, having the highest eigenvalue of 0.647 which accounts for most of variance in the dataset. Political status was also supported by various researchers (Jha and Iyer, 2006; Blake, 2006; Gangolells, 2011 and Amade et al., 2012). Being stable in the country was said to be increasing the level of government commitment to projects which is one of the most necessary requisites for success of projects.

Economic status or Income levels of the country was supported by various researchers (Frimpong et al.,2003; Ibnu, 2006; Le-Hoai et al., 2008; Abudullar et al., 2009 and Ameh et al.,2010) which was said to be having positive impact on success of projects.

On Bureaucracy it was established just like other researchers (Cooke-Davies, 2004 and Ali, 2010) that reduced levels of bureaucracy by removing undesired delays positively affect success of project. Minor External Environments going by eigenvalue less than 0.5 were *Natural endowment* (0.401), *Prevailing culture/Social status* (0.335) and *Reduced number of hazards (Climatic conditions)* (0.211). Respondents felt these had less impact on success of projects as demonstrated by reduced eigenvalue. This finding was contrary with the findings by earlier researchers (Koushki et al, 2005 and Alsolaiman, 2015) who found natural endowment as one of the major factors that affect success of implementation of projects.

Other researchers (Ali, 2010; Ameh et al., 2010; and Baumann, 2013) also confirmed that some prevailing culture affect the speed of doing work. Various researchers (Koushki et al., 2003; Jha and Iyer, 2006; Le-Hoai, 2008; Enshassi et al., 2009 and Alsolaiman, 2015) stated that reduced number of hazards during implementation of projects positively affect projects success. The lesser rating of reduced number of hazards is mainly because most of the respondents had not witnessed the real effect of hazards on projects since Zambia has never experienced extreme climate change effects.

It was established that though six (6) External Environment factors were prominently proposed by previous researchers only three (3) were mostly applicable to Zambia due to difference in environment.

5.3.3.4 PCA for Success Measurement Variables

Following almost the same steps followed for other variables above PCA was established and shown are some steps followed like establishment of Communalities in Table 5.16, PCA and reliability test as follows:

Table 5.16: Communalities

Success Measurement Variables	Initial	Extraction
Project execution is done within schedule**(TSV1)**	1	0.788
Timely delivery of resources**(TSV2)**	1	0.777
No delays in securing funds**(TSV3**)	1	0.875
No delays due to design changes**(TSV4)**	1	0.69
Clear plans are formulated**(TSV5)**	1	0.764
Project execution are done within the stage approved cost**(CSV1)**	1	0.796
No increase in material costs**(CSV2)**	1	0.676
Minimum variation costs incurred **(CSV3)**	1	0.764
Stable labour costs **(CSV4)**	1	0.724
No financial claims at end of implementation stage **(CSV5)**	1	0.698
Equipment at pre-budgeted costs **(CSV6)**	1	0.765
No serious dispute due to specifications **(DSV1)**	1	0.773
Minimized disputes due to the frequent changes**(DSV2)**	1	0.715
Harmonious relationship on site**(DSV3)**	1	0.805
No incidences of trade union agitation**(DSV4)**	1	0.772
Dispute resolution meetings **(DSV5)**	1	0.811
Reduced air pollution from project site **(ESV1)**	1	0.726
Reduced solid waste **(ESV2)**	1	0.688
Use of environmentally friendly methods on site**(ESV3)**	1	0.835
Reduced depletion of natural resources **(ESV4)**	1	0.761
No effect on weather and climate conditions**(ESV5)**	1	0.662
Projects executed conform to specifications**(QSV1)**	1	0.798
Right material used for construction work**(QSV2)**	1	0.741
A sound Quality Management system adhered to**(QSV3)**	1	0.751
Workers trained on Quality Culture**(QSV4**)	1	0.802
No observed apparent defects at stage end**(QSV5)**	1	0.667
Accidents were reported**(SSV1)**	1	0.715
Minimal occurrence of fatalities **(SSV2)**	1	0.897
Minimal losses of resources due to thefts**(SSV3)**	1	0.747
Increased client support to projects **(CSSV1)**	1	0.848
Increased level of client cooperation**(CSSV2)**	1	0.831
Increased client appreciation**(CSSV3)**	1	0.77

Extraction Method: Principal Component Analysis

The above analysis demonstrates that *minimum occurrence of fatalities* (SSV2) was explaining the most variation of about 89.7% whilst *no effect on weather and climate conditions* (ESV5) was only having an individual influence on variation of 66.2%

5.3.3.4.1 Factor Analysis following Varimax Rotation

Following the procedure indicated above before PCA was conducted a test for factorability was done and found with Kaiser-Meyer-Olkin measure of sampling adequacy of 0.620, Bartlett's test of sphericity of approximately chi-square 5021.628, degree of freedom of 496 and significance of 0.000. Observations from communalities were that some variables had their KMO values less than 0.4 which indicated that the

dataset in its form was not suitable for factor analysis (Hair et al., 2006). Two variables were iteratively removed one by one until all variables had individual KMO values greater than 0.5. These measures indicate that the reduced dataset of variance is appropriate for factor analysis.

Principal Component Analysis (PCA) was then used with Varimax Rotation given that the primary purpose was to extract the underlying factors. Initially the 30 variables where allowed to load freely so long they had eigenvalue greater than 1. The result of factor Analysis of Success measurement variables (Dependent variables) varimax rotation was as shown in Table 5.17.

Table 5.17: Results of Success Measurement Factors

Success Measurement Factors	**Component**			
	1	**2**	**3**	**4**
Reduced air pollution from project site **(ESV1)**	0.842			
Reduced Solid waste **(ESV2**)	0.850			
Use of environmentally friendly methods on site **(ESV3**)	0.790			
Reduced depletion of natural resources **(ESV4)**	0.674			
Workers trained on Quality Culture **(QSV4)**	0.785			
Project execution is done within schedule **(TSV1)**		0.831		
Timely delivery of resources **(TSV2)**		0.761		
No delays in securing funds **(TSV3)**		0.863		
Minimized disputes due to frequent changes**(DSV2)**		0.779		
Stable labour Costs **(CSV4)**			0.692	
Increased client support to projects **(CSSV1)**			0.858	
Increased level of client cooperation **(CSSV2)**			0.759	
Increased client appreciation **(CSSV3)**			0.705	
Clear plans are formulated **(TSV5)**				0.837
Project execution are done within stage approved cost **(CSV1)**				0.774
Minimum variation costs incurred **(CSV3)**				0.670

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

A Rotation converged in 5 iterations

From analysis in Table 5.17, it is evident that 5 variables loaded under factor 1 are associated with Environmental impact and Quality measurement related factors. 4 variables loaded on factor 2 are associated with time success measurement related factors. Other 4 variables loaded under factor 3 are associated with client satisfaction measurement factors; whereas the 3 variables loaded under factor 4 are associated with

Cost success measurement factors. Four construct of Success Measurement variables constitute key success measurement variables.

5.3.3.4.2 Validation of Success Measurement Factors

Reliability of scale comprising of Success measurement variables was established through Cronbach`s Alpha Coefficient which tested internal consistency of the items. The 16 item scale had a reliability of 0.866 which is well above 0.70 recommended for similar studies (Hair et al, 2006; Malhotra and Dash, 2010). The Content Validity of the instrument measuring Success measurement related Dependent variables was achieved while designing the survey instrument. This was carried out through extensive literature review followed by securing opinions from the experts as discussed in detail in Research Methodology section (chapter 4, section 4.7).

The extracted 16 variables for performance measurements were operationalized success criteria obtained to aid in establishment of Critical success factors. These factors represented time, cost, quality, client satisfaction, site disputes and environmental impact. The ones representing safety and Health were redundant on the meaning confirming that the remaining 6 success criterion was the key success indicators for public sector construction projects as the remaining ones are already taken care of by the exiting legislation. This finding confirmed that contemporary measures of project performance can be used to measure and evaluate performance of implementation of public sector construction projects in Zambia (Tsoulfas and Pappas, 2008).

5.3.4 Results on Relationship of CSFs and Implementation of PSCPs

To analyse the relationship between Critical Success Factors (Independent variables) and Successful implementation of Public Sector Construction projects (Dependent variable), Structure Coefficient analysis (regression) was used as explained in chapter 3.

To have a conceptual understanding on which independent variable (predictor) has strong predictive power, there is B-weights and structure coefficients (rs) analysis that should be undertaken to have a grip on salient features in interpreting regression results.

Used in explanatory study was data collected from through general survey questionnaire. The data was first analysed using Principal Component Analysis in order to eradicate element of Multicollinearity and reduction of the data to manageable levels by isolating only critical factors. Extracted variables were 8 CSFs *(Independent*

variables), 4 External Environment CSFs *(Interactive variables)* and 16 success measurement variables *(Dependent variables).*

In order to come up with Independent variables which were correlated to the Dependent variable, variables were entered/ removed using the stepwise method. The model ensured that only correlated variables were entered as it removed uncorrelated ones. The summary results from analysis were as shown below.

5.3.4.1Project Management CSFs and Implementation of PSCPs

In the test results for relationship between Project Management related CSFs and successful implementation of projects, Poject Management related CSFs was represented by the following factors: 1) Top project managers are given weekly reports(*Top management commitment*) (MCSV2); 2) *Risk Management* (MCSV3); 3) There is constant flow of needed materials to project sites(*Supply chain management*)(MCSV6), on Successful implementation (cost, time, quality, client satisfaction, site dispute satisfaction and environmental impact) of Public sector construction was tested using single factor Multiple regression (Structure Coefficient Analysis). In order to establish the relationship between Project Management related CSFs and Successful implementation of public sector construction was *(H_1a: There was no significant relationship between Project Management related CSFs and Successful implementation of public sector constructions).*The results were as indicated in Table 5.18below.

Table 5.18: Effect of Project Management CSFs on Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2) %	(R^2) %	Rank
Project Cost					
Project execution are done within the stage approved Cost (CSV1)	MCSV2	38.8	70	21	1
Minimum variation Cost incurred (CSV3)	MCSV2	60.3	36.5	23	1
Stable labour Costs (CSV4)	MCSV2	18.3	62.2	8.3	2
Project Time					
Clear plans are formulated (TSV5)	MCSV3	24.5	19.9	32	3
Project Quality					
Workers trained on Quality culture (QSV4)	MCSV6	22.9	52.2	37	2
Client Satisfaction					
Increased level of client cooperation (CSSV2)	MCSV2	11.8	47.8	13	2
Environmental Impact					

Dependent Variable	CSFs Entered	B%	(rs^2) %	(R^2) %	Rank
Environmentally friendly methods on site (ESV3)	MCSV3	-27.4	4.6	27.0	3
Reduced depletion of Natural resources	MCSV6	27.5	100	8.3	1

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

The result had shown that project management related CSFs had significant effect on project cost, time, quality, client satisfaction and Environment impact. The squared structure coefficient (rs^2) of *Top Management Commitment (MCSV2)* which is 70% explains the 21% of variability in ensuring that Project *execution is done within the stage approved cost (CSV1).* 62% of squared structure coefficient of *Top Management commitment* explains the 23% variability in *stable labour costs (CSV4).* The results also shows that 36.5% of the squared structure coefficient of *Top Management Commitment* explains the 8.3 % (R^2) variability in ensuring that *minimum variation costs are incurred (CSV).*The above interpretation of results means that Top Management commitment had more effect on determination of project implementation and labour costs as opposed to determination of variation costs .Various researchers (Ismail,2012; Amade and Ogbonna, 2012; and Bubu and Sudharkar , 2015) who had conducted the studies in other countries, confirmed the significant effect of Top management commitment on determination of project cost by making sure that resources are used as planned without pilferage.

The results also shows that 19.9% of the squared structure coefficient of *Risk Management (MCSV3)* explains the 32% (R^2) variability in ensuring that *clear plans are formulated (TSV5).* This weak relationship is contrary to earlier researchers (Ali, 2010; Ismail, 2012; and Ngoma et al., 2014) who felt it just affects Safety / Health and environmental impact. Earlier researchers did not relate Risk management to time, because the relationship is indirect in the sense that it directly influence clear plan

preparation in order to come up with safe precaution and applied procedures which later influence project time by making operations smooth.

It was also established that 52.2% of the squared structure coefficient of *Supply Chain Management (MCSV6*) explains the 37% (R^2) variability in ensuring that workers are trained on Quality culture (QSV4). This demonstrates that there is significant relationship between Project Management and Project quality. The positive relationship between Supply chain management and project quality was also established by earlier researchers (Nawi et al., 2011; Berawi et al., 2012 and Anand, 2015) by stating that timely provisions of needed materials to site deter compromise in quality.

In terms of relationship with Client satisfaction it was established that 47.8% of squared structured coefficient of *Top management commitment (MCSV2)* explains the 13% (R^2) variability in ensuring *increased level of client cooperation*. This shows that there is positive relationship between Project management and client satisfaction though weak. Earlier researchers (Ismail, 2012; Amade and Ogbonna, 2012 and Bubu and Sudharkar, 2015) had not related Top management commitment to Client Satisfaction because of their concentration on the traditional success criteria of basing success on Time, Cost and Quality.

On effect on Environmental Impact the results indicated that there was a significant relationship between *Supply chain management (MCSV6)* and *reduced depletion of natural resources (ESV4).* This is demonstrated by the result which shows that 100% of the squared structure coefficient of *Supply chain management* was explaining the 8% variability in ensuring *reduced depletion of natural resources (ESV4).* This relationship was not depicted by earlier researchers who restricted their test for success on time, cost and quality.

It was also established that 4.6% of the squared structure coefficient of Risk *Management* explains the 27 % variability in ensuring *use of environmentally friendly methods on site (ESV3).* This proves that there is positive relationship between Project Management and Project site environmental impact, though weak. The weak relationship was not in line with earlier researchers` findings (Ngoma et al. 2014; Bubu and Sudharkar, 2015; and Share, 2016) who had established strong relationship between the two variables. The difference could be justified by contingency theory which propounds that there is no one optimum state.

From the above, it could be confirmed that Project management related CSFs through Top management commitment has potential to predict outcome for project cost and client satisfaction success criteria. On determination of project cost it could ensure that projects are implemented within budget (No budget overrun), it could safe cost of variations by minimizing the vice and it could ensure stable labour costs as there is steady communication between employer and employee. Top management commitment on the other hand has potential of increasing the level of client cooperation, in the sense that the clients` investments seem secured.

Risk management to some extent has potential of influencing both project time and environmental impact. On project time predictability power lies in its ability to ensure clear plans are formulated. Environmental impact is influenced through its ability to that environmentally friendly methods are applied on site. Supply chain management was found with potential to predict project quality and environmental impact. On project quality it was capable of influencing outcome by ensuring that workers are trained on quality culture. Supply chain was capable of influencing environmental impact through ensuring reduced depletion of natural resources.

The above finding confirms that Project management related CSFs indeed has significant impact on cost, time, quality, client satisfaction and environmental impact, apart from site disputes. This result leads to the rejection of the null hypothesis in the test.

5.3.4.2 Design related CSFs and Implementation of PSCPs

The influence of Design related CSFs [Project team site inspections are held bi-weekly-DCSV5 (Team members involvement during design)] on Successful implementation (cost, time, quality, client satisfaction, site dispute satisfaction and environmental impact) of Public sector construction was tested using Structure coefficient analysis (regression). Testing the null hypothesis (H_1b: There was no significant relationship between Design related CSFs and Successful implementation of Public sector construction projects) yielded the following results.

Table 5.19: Results of Test of relationship between Designs related CSFs and Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2)%	(R^2) %	Rank
Project Cost					
Project execution are done within the stage approved Cost (CSV1)	DCSV5	14.8	41	21	3
Project Time					
Project execution is done within schedule (TSV1)	DCSV5	57.0	62.6	34	1
Timely delivery of resources (TSV2)	DCSV5	41.6	61.7	36	1
No delays in securing funds (TSV3)	DCSV5	59.5	73.8	29	1
Clear plans are formulated	DCSV5	29.0	52.1	32	2
Client Satisfaction					
Increased Client appreciation (CSSV3)	DCSV5	22.4	16.4	30	3
Project Site disputes					
Minimized disputes due frequent changes (DSV2)	DCSV5	47.1	60	39	1
Environmental Impact					
Reduced Solid Waste (ESV2)	DCSV5	-26.5	11.9	13	2

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

The result had shown that project design related CSFs had significant effect on project cost, time, site disputes, client satisfaction and Environment impact as opposed to project quality. The squared structure coefficient (rs^2) of *Team members` involvement (DCSV5)* which is 41% explains the 21% of variability in ensuring that Project *execution is done within the stage approved cost (CSV1).* The above demonstrates that Team members' involvement has significant effect on cost of implementation of public sector construction projects though weak. Various researchers (Abudullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) were in agreement with this finding by establishing that the relationship between the two were either weak or insignificant.

The results proved stronger relationship between Design related CSFs and time for implementation of projects with *Team member`s involvement (DCSV5)* explaining most

variability in *Project execution is done within schedule (TSV1), Timely delivery of resources(TSV2), No delays in securing funds(TSV3)* and *Clear plans are formulated(TSV5).* The result shows that Team members' involvement explains 62.6 % of the 34 % variability in ensuring that project execution is done within schedule. It also explains 61.7 % of the 36% variability Timely delivery of resources, 73.8% of the 29% variability in ensuring no delays in securing funds and it also explains 52.1% of the 32% variability in ensuring clear plans is formulated. The result confirms strong significant effect of design related CSF on Project time. Strong relationship between Team members` involvement was in agreement with earlier researchers findings (Abdullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) who stated that it reduces contradictions between players thereby saving time. It was also explained that involvement of the players like contractors from design stage makes contractors own and interpret the plans with less difficulties and time of sensitization is reduced.

The results demonstrated significant but weak relationship between CSF and Client satisfaction by showing that *Team member`s involvement (DCSV5)* was explaining 16.4% of the 30% variability in ensuring *increased client appreciation (CSSV3*). The weak relationship was in line with earlier researchers (Abdullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) who did not find any relationship between the two. Strong relationship between Design related CSF and site dispute was shown by demonstrating that *Team members` involvement (DCSV5)* was explaining 60% of the 39% variability in *minimized disputes due to frequent changes (DSV2).*Various researchers (Abdullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) were in agreement with this finding that strong relationship between Team members` involvement and site disputes existed. Misunderstandings which cause disputes on site may be avoided by involving all the team players from the design stage.

Significant but weak relationship between Design related CSFs and Environmental impact was established by the results which revealed that Team member`s involvement (DCSV5) was explaining 11.9 % of the 13% variability in ensuring *reduced solid waste* (ESV2). The weak relationship was not in line with earlier researchers (Abdullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) who did not find any relationship between the two. The difference in results was that the earlier researchers focused much on the golden triangle as the success criteria as such no critical analysis on the environmental impact was done.

The above discussion confirms that Design related Critical Success factors through "*Team members` involvement during design*" had potential to predict outcomes for project cost, time, client satisfaction, site disputes, and environment impact, apart from quality success criteria. Results show that promotion of team members` involvement during design is likely to yield positive results maintaining the estimated cost, time, client satisfaction, site disputes and environmental impact. Though the five success criteria are affected by Team members involvements during design, the impact was found more on determination of project time and project site disputes than the other two with which it had relatively weaker impacts. The result of test of Null Hypothesis led to the rejection of the null hypothesis, confirming that indeed there was significant relationship between the two variables.

5.3.4.3 Procurement CSFs and Successful Implementation of PSCPs

The influence of Procurement related CSFs [Project delivery is done within estimated time(*Procurement planning*)-PCSV1, The Tender Board Committee members are fairly motivated to deter corruption(*Corruption free*)-PCSV3 and The process of procurement is open to all eligible bidders(*Open bidding/Transparency*)- PCSV4] on Successful implementation(cost, time, quality, client satisfaction, site dispute satisfaction and environmental impact) of Public sector construction was tested using regression. Testing the null hypothesis (H_1c: There was no significant relationship between the Procurement related CSFs and successful implementation of public sector construction projects) yielded the following results:

Table 5.20: Results of Test of Relationship between Procurement related CSFs and Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2) %	(R^2) %	Rank
Project Cost					
Project execution are done within the stage approved Cost (CSV1)	PCSV3	18.1	49.3	21	2
Minimum variation Costs incurred(CSV3)	PCSV1	33.0	11	23	2
Stable labour Costs (CSV4)	PCSV3	13.3	69.5	8.3	1
Project Time					
Project execution is done within schedule (TSV1)	PCSV1	45.0	16.6	34	2
Timely delivery of resources (TSV2)	PCSV1	49.0	26.5	36	2
	PCSV3	18.6	20.3	36	3

Dependent Variable	CSFs Entered	B%	(rs^2) %	(R^2) %	Rank
No delays in securing funds (TSV3)	PCSV3	26.8	18.3	29	2
Clear plans are formulated (TSV5)	PCSV3	33.8	60.6	32	1
	PCSV1	-19.6	12.7	32	4
Project Quality					
Workers trained on Quality culture (QSV4)	PCSV1	50.4	59.7	37	1
Client Satisfaction					
Increased client support to projects (CSSV1)	PCSV4	16.2	55.2	14	1
	PCSV3	15	36.3	14	2
Increased level of client cooperation (CSSV2)	PCSV3	13.2	82.1	13	1
Increased Client appreciation (CSSV3)	PCSV3	14.9	32.2	30	1
	PCSV4	27.2	30.3	30	2
Project Site disputes					
Minimized disputes due frequent changes (DSV2)	PCSV3	17.3	35.8	39	2
	PCSV4	16.8	19.5	39	3
Environmental Impact					
Reduced air pollution from project site (ESV1)	PCSV1	40.9	62.6	16	1
Reduced Solid Waste (ESV2)	PCSV1	38.0	43.9	13	1
Environmentally friendly methods on site (ESV3)	PCSV1	79.9	75.2	27.0	1

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

The result had shown that Procurement related CSFs had significant effect on project cost, time, quality, site disputes, client satisfaction and Environment impact. The results showed impact of Procurement related CSFs on Cost as follows: *Corruption free tender system (PCSV3)* explains 69.5% of the 8.3% variability in Stable labour cost (CSV4) and 49.3% of the 21% variability in ensuring *project execution is done within the stage approved cost (CSV1).* Various researchers (Abdullar et al., 2009; Azhar et al., 2008 and Kaliba et al., 2009) stated that having motivated, skilled, experienced and honest workers enables corruption free tender system which guards against pilferage of the resources meant for implementation of projects. *Procurement planning (PSCV1)* explains 11% of the 23% variability in ensuring that *minimum variation costs incurred*

*(CSV1).*The results confirmed that Procurement had a weak impact on ensuring minimum variation costs are incurred, indicating minimal effect on project cost. The finding was contrary to the findings by earlier researchers (Barasa, 2014; Share, 2016 and Cherop, 2016) who established strong relationship between procurement planning and cost of project mainly because in Zambia materials are procured only when progress payment certificates are cleared by the client.

On predicting project time, the results indicated that *Corruption free tender system* (PCSV3) had predictability of 60.6 % of the 32% variability in ensuring *clear plans are formulated (TSV5),* 20.3% of the 36% variability in *timely delivery of resources (TSV2)* and 18.3% of the 29% variability in ensuring *no delays in securing funds (TSV3).* This shows that Corruption free tender system has strong effect on ensuring clear plans are formulated and weak relationship with ensuring timely delivery of resources and no delays in securing funds. The finding is supported by researchers (Abudullar et al., 2009; Kaliba et al., 2009) who confirmed strong relationship between Corruption free tender system and project time. *Procurement planning (PCSV1*) was found to be explaining 26.5% of the 36% variability in *timely delivery of resources (TSV2),* 16.6% of the 34 % variability in ensuring *project execution is done within schedule (TSV1)* and 12.7% of the 32% variability in ensuring *clear plans are formulated (TSV5).* The above shows more procurement related CSFs having significant effect on time, thereby confirming that there was a positive relationship between the two. Confirmation of strong relationship was made by earlier researchers (Barasa, 2014; Share, 2016 and Cherop, 2016) who established strong relationship between Procurement planning and project time.

Test of relationship with project quality yielded the result that *Procurement planning (PCSV1)* explains 59.7 % of the 37% variability in ensuring *workers is trained on quality culture (QSV4).* This strong relationship was confirmed by earlier researchers (Aftab, 2012; Tawil, 2013 and Wambui et al., 2015) between procurement planning and Quality of the project because of making available specified materials when needed. It was also established that *Corruption free tender system (PCSV3)* was explaining 13.9% of the 37% variability in ensuring that *workers are trained on quality culture (QSV4).* The result confirms that there was significant relationship between Corruption free tender system and Project quality, though weak one. The finding is in agreement with

earlier researchers (Sweis et al., 2007; Le-Hoai et al., 2008 and Azhar et al., 2008) who confirmed the relationship between the two variables.

Results of test of relationship between Procurement related CSFs and Client satisfaction indicated that *Corruption free tender system (PCSV3)* was explaining 82.1% of the 13% variability in *increased level of client cooperation (CSSV2),* 36.3% of the 14% variability in *increased client support to projects* (CSSV1) and 32.2% of the 30% variability in *increased client appreciation (CSSV3).* The results shows that Corruption free tender system had a stronger effect on ensuring increased level of client cooperation, followed by ensuring increased client support to projects and the least impact being on ensuring increased client appreciation. Earlier researchers' (Azhar et al., 2008; Le-Hoai et al., 2008 and Abdullar et al., 2009) concentration was on time, cost and quality as success criteria. *Transparency in procurement system (PCSV4)* was found explaining 55.2% of the 14% variability in *increased client support to projects (CSSV1)* and 30.3 % of the 30% variability in *increased client appreciation (CSSV3).* Transparency in procurement system was found having a stronger effect on ensuring increased client support to projects and a weaker relationship with ensuring increased client appreciation. Earlier researchers tested the relationship with client satisfaction because of concentration on the traditional time, cost and quality success criteria.

On relationship between Procurement related CSFs and Site disputes, it was established that *Corruption free tender system (PCSV3)* explains 35.8 % of the 39% variability in ensuring *minimized disputes due to frequent changes (DSV2)*. It was also established that *Transparency in procurement system (PCSV4)* explains 19.5% of the 39% variability in *minimized disputes due to frequent changes*. The result proves that there were significant relationships between Procurement related CSFs and Site disputes although weak. Literature reviewed concentrated on test of time, cost and quality to determine success of project. As for the results on relationship of Procurement related CSFs and Environmental impact strong relationship was established with *Procurement planning* explaining 75.2% of the 27% variability in *use of environmentally friendly methods on site* , 62.6% of the 16% variability in ensuring *reduced air pollution from project site* and 43.9 % of the 13% variability in ensuring *reduced solid waste*. Procurement planning was found to be having stronger effect on ensuring use of environmentally friendly methods on site followed by ensuring reduced air pollution from project site and the least impact being on ensuring reduced solid waste.

The above discussion confirms that three Procurement related CSFs namely procurement planning, corruption free procurement system and transparent tender systems had potential to influence outcome of successful implementation of public sector construction projects. Procurement planning had more potential to influence outcomes of environmental impact, project cost and quality success criteria. On the other hand procurement planning was found having minor influence on determination of project time, whilst it had no relation with client satisfaction and project site disputes site criteria. Corruption free procurement system higher potential of predicting outcomes for client satisfaction, project cost and project time. On the other hand it had minimal potential of influencing outcome for project site disputes, whilst on the contrary there was no established relationship with project quality and environmental impact success criteria. Transparent procurement system was found having more potential to influence client satisfaction, through ensuring increased client support to projects and minor influence on determination of project site disputes through ensuring increased client appreciation.

These (3) Procurement related CSFs together confirms that there is significant relationship between Procurement related CSFs and successful implementation of projects (cost, time, quality, client satisfaction, site disputes and environmental impact), the finding which leads to the rejection of the developed null hypothesis above.

5.3.4.4 Financial CSFs on Successful Implementation of PSCPs

To examine the influence of financial related critical success factors, multiple regressions was used to test the null hypotheses and the results were as indicated below. The influence of Financial related CSFs [Payment certificates are honored within the stipulated two weeks period (Progress payment process)-FCSV3] on Successful implementation (environmental impact) of Public sector construction projects was tested using multiple regression. Testing the null hypothesis (H_1d: There was no significant relationship between the Financial related CSFs and successful implementation of public sector construction projects) yielded the following results shown in Table 5.21.

Table 5.21: Results of Test of Relationships between Financial related CSFs and Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2) %	(R^2) %	Rank
Environmental Impact					
Environmentally friendly methods on site (ESV3)	FCSV3	-28.6	14.5	27.0	2

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

The results on test of effect of financial related CSFs on Successful implementation of public sector construction projects yielded the findings which were contrary to the findings of various earlier researchers (Frimpong et al., 2003; Koushki et al., 2005; Abuddular et al., 2009; and Dikert, 2016) that financial related factors had significant relative impact on success of public sector construction projects. In this study established was only a weak relationship with environmental impact. Progress payment process had predictability power of only 7.8% of the 27% variability in use of environmentally friendly methods on site. This finding means that progress payment process had no significant impact on determination of cost, time, quality, client satisfaction and site disputes. The difference in result is because in this study only contractors from category 1 to 3 were part of the population under study. Category 1 to 3 Contractors in Zambia are those with National character and mostly composed of foreign companies like those from Chinese origin. To the foreign contractors finance was never a factor because they have access to cheaper sources of capital, like Bank of China. Financial problems are usually faced by Zambian contractors who are usually between category 4 and 6 and these were not covered in this study. Another reason could be that payments are made upon certification of works.

The discussion above confirms that only one financial related CSF which is progress payment process had potential to influence environmental impact through ensuring friendly methods use on site in contrast to earlier studies which blamed failure of

projects on lack of funds (Aghimien et al., 2018; Kaliba et al., 2009). The results entails that apart from having minor influence of environmental impact Financial related CSFs had no impact on project cost, time, quality; site disputes an client satisfaction success criteria of successful implementation of public sector construction projects in Zambia. Test result for the null hypothesis above led to the acceptance of the null hypothesis, indicating that indeed there was no significant relationship between financial related CSFs and successful implementation of public sector construction projects in Zambia

5.3.4.5 External Environment factors and Implementation of PSCPs

To quantify the strength of association between external environments related CSFs (Intervening variables) and success indicating factors for implementation of projects (dependent variables), Multiple linear Regressions was used. Extracted External Environment related CSFs were as follows: 1) ECSV1: Income levels (Economic status) ; 2) ECSV2: Prevailing Culture(Social status); 3) ECSV3: Stable political atmosphere (Political status); 4) Reduced levels of Bureaucracy(Bureaucracy); 5) ECSV5: Project Sites richly endowed in required natural resources (Natural Endowments/Ecological status); and ECSV6: Reduced number of Hazards (Climatic conditions), while the dependent variables were the product output consists of Implementation within estimated cost, Implemented within scheduled time period, implemented within expected quality, signifying client satisfaction, Site dispute minimization and less destruction to the environment. Testing the null hypothesis (H_1e: There was no significant relationship between the External Environment related CSFs and successful implementation of public sector construction projects) yielded the following results:

Table 5.22: Results of Test of Relationship between External related factors and Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2)%	(R^2)%	Rank
Project Cost					
Project Cost	ECSV1	47.0		21.8	1
	ECSV2	-25.0		21.8	2
Project Time					
Project Time	ECSV1	59.0		28.7	1
	ECSV2	-33.8		28.7	2
Project Quality					
Project Quality	ECSV1	15.2		12.4	1
	ECSV2	-26.4		12.4	2
Client Satisfaction					
Project Client	ECSV2	16.1		11.3	1

Satisfaction	ECSV1	13.7		11.3	2
Project Site disputes					
Environmental Impact					
Project Environmental Impact	ECSV2	29.7		17.1	1
	ECSV3	-50.4		17.1	2

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

To test the contribution of the External Environment interactive variables all the 6 extracted External Environment variables from Expert interview data were exposed to multiple regressions against Cost, Time, Quality, Client satisfaction, site disputes and environmental impact success criteria and the interpretation and discussion of the findings were as follows:

Test against cost gave the relationship [*Project Cost=2.920 +0.470 (ECSV1)-0.260(ECSV2)]* of the model. Given (R^2) being Correlation of determination, the interpretation of the result is only two variables were found to be significant that is Economic conditions of the country (ECSV1) and Prevailing culture (ECSV2). The result is that Economic conditions of the country had predictability of 47% of the 21.8% variability in the outcome which was project cost , whilst prevailing culture had decreasing effect of 26% on the 21.8% variability of the same outcome. The relatively weak effect of Economic conditions on cost of implementation of projects was contrary to the findings of earlier researchers (Ibnu, 2006; Le-Hoai et al., 2008; Azhar et al., 2008 and Ameh et al., 2009) who found income levels of the country to be having strong relationship with project cost in the sense of deflationary and inflationary pressures affecting the prices of construction materials.

The weak relationship in Zambia could mean no acute changes in economic conditions have been recorded. Prevailing culture was found having negative effect on project implementation cost mainly because of poor working culture in most African countries as opposed to workers from developed countries. This was supported by earlier

researchers (Long et al., 2004; Koushki et al., 2005; Ameh et al., 2010; Baumann, 2013) who did not find any relationship between the two.

Project time model [Project time=3.456 +0.590 (ECSV1)-0.338(ECSV2)] arrived at demonstrates that only two external variables had significant relationship with project time. The interpretation is that Economic conditions of the country (ECSV1) had credit of about 59% in predicting outcome or 28.7% variability of project time, while prevailing culture had decreasing effect of 33.8% on the 28.7% variability of the same outcome which is project time. Various earlier researchers (Ibnu, 2006; Le-Hoai et al, 2008; Azhar et al., 2008 and Ameh et al., 2009) confirmed the strong relationship of economic conditions and project time. It was observed that implementation of projects is smooth when the economy is stable and improving as opposed to the other way round. Prevailing culture was once again found having negative impact on project implementation time contrary to findings by various researchers (Koushki et al., 2005; Ameh et al., 2010; and Abuddular et al., 2009) who established positive relationships. The difference could be due to difference in prevailing cultures of the areas in which studies were conducted.

Project quality model [Project Quality=4.798 +0.152(ECSV1)-0.264(ECSV6)] showing the result of test of relationship between External Environment and Project quality, indicates that only Economic conditions of the country (ECSV1) and Climatic conditions (ECSV6) had significant relationship, though the later had a negative one. The result meant that Economic conditions of the country had credit of about 15.2% in predicting 12.4% variability in project quality, while Climatic conditions had decreasing effect of 26.4% on the same outcome. The result shows that economic conditions of the country had a weak positive interactive influence on project quality, while Climatic conditions had negative impact on the same outcome. Weak relationship between Economic conditions and Quality was contradicting the findings by various researchers (Frimpong et al., 2003; Ibnu, 2006 and Le-Hoai et al., 2008) who found strong relationships between the two.

The difference in findings is that in Zambia, Public sector constructions are usually done on contract basis with strict and rigid contract sum which is not directly affected by changes in economic conditions. Negative impact by climatic conditions in tropical countries with harsh climatic conditions like floods, heavy winds and the others which

are hazardous to construction industry affects quality of projects. This was also observed by earlier researchers (Jha and Iyer, 2006; Enshassi et al., 2009 and Alsolaiman, 2014)

In terms of Client satisfaction, the results shows that two variables had significant relationships and these were Economic condition of the country (ECSV1) and Prevailing culture (ECSV2) giving the model [Client Satisfaction=3.501 +0.137(ESV1) +0.161(ECSV2)]. The model entails increase of ECSV1 by 1 will increase ECSV2 by 16.1%. Interpretation is that Economic condition of the country had credit of about 13.7 % in predicting 11.3% variability in Client satisfaction and prevailing culture had credit of 16.1% predictability of 11.3% variability in the same outcome. It was found that economic conditions and prevailing culture had weak positive relationships with client satisfaction. Earlier researchers (Enshassi et al., 2009; Ameh et al., 2010; Abuddular et al., 2009 and Baumann, 2013) also found no relationship.

As with the Environmental impact, it was established that prevailing culture had a positive interactive effect on Environmental impact, by demonstrating that it had predictability of 29.7% of the 17.1% variability in the Environmental impact, while Political conditions of the country (ECSV3) had decreasing effect of 50.4% on the 17.1% variability of project Environmental impact. The weak relationship between Prevailing culture and environmental impact was not in agreement with earlier researchers (Ali, 2010; Ameh et al., 2010; and Baumann, 2013) who found strong relationship.

The difference could be explained by the fact that there is no one optimum state. Political conditions of the country had a strong negative relationship with environmental impact. The failed state fails to control destruction of environment and stable democratically elected governments allows people to destruct the environment as one of their rights in order to gain support. This finding was opposed to the findings by earlier researchers (Marosszeky et al., 2002; Syed et al., 2003; Gangolells, 2011 and Amade et al., 2012) who found strong positive relationships between them. The difference in results is because of not having an optimum state as contingent proponents put it.

From the above discussion, it could deduce that only economic status had higher significant effect on project time in the positive sense. In the negative sense political status was found having significant effect on environmental impact through its negative

predictability potential of outcomes. Another worrying External Environmental related factor is Prevailing culture in the project site (social status), which was found significant negative effects on project cost, project time and project quality though minimal. Prevailing culture was found having significant minimal positive impact on project client satisfaction and project environmental impact. The trio external related factors were found having both positive and negative effects though relatively minimal on successful implementation of projects (cost, time. Quality, client satisfaction and environmental impact) apart from site disputes success criteria which was not affected.

5.3.5 Collective Effect of CSFs on Implementation of PSCPs

In response to **RQ2**, the test result for developed hypothesis has been given in this section. The test results of collective effect of Critical Success factors and Interactive factors on Successful implementation of public sector construction projects using multiple regressions. Testing the null hypothesis (H_1c: There was no significant collective effect of all identified CSFs on successful implementation of public sector construction projects) yielded the following results:

Table 5.23: Results of Test of Collective effect of all CSFs on Successful implementation of Projects

Dependent Variable	CSFs Entered	B%	(rs^2)%	(R^2)%	Rank
Project Cost					
Project execution are done within the stage approved Cost (CSV1)	MCSV2	38.8	70	21	1
	PCSV3	18.1	49.3	21	2
	DCSV5	14.8	41	21	3
Minimum variation Cost incurred (CSV3)	MCSV2	60.3	36.5	23	1
	PCSV1	33.0	11	23	2
Stable labour Costs (CSV4)	PCSV3	13.3	69.5	8.3	1
	MCSV2	18.3	62.2	8.3	2
Interactive Variables	**External Environment related Entered**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**
Project Cost	ECSV1	47.0		21.8	1
	ECSV2	-25.0		21.8	2
Project Time					
Project execution is done within schedule (TSV1)	DCSV5	57.0	62.6	34	1
	PCSV1	45.0	16.6	34	2
Timely delivery of resources (TSV2)	DCSV5	41.6	61.7	36	1
	PCSV1	49.0	26.5	36	2
	PCSV3	18.6	20.3	36	3
No delays in securing funds (TSV3)	DCSV5	59.5	73.8	29	1
	PCSV3	26.8	18.3	29	2

Dependent Variable	CSFs Entered	B%	(rs^2)%	(R^2)%	Rank
Clear plans are formulated (TSV5)	PCSV3	33.8	60.6	32	1
	DCSV5	29.0	52.1	32	2
	MCSV3	24.5	19.9	32	3
	PCSV1	-19.6	12.7	32	4
Interactive Variables	**External Environment related Entered**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**
Project Time	ECSV1	59.0		28.7	1
	ECSV2	-33.8		28.7	2
Project Quality					
Workers trained on Quality culture (QSV4)	PCSV1	50.4	59.7	37	1
	MCSV6	22.9	52.2	37	2
Interactive Variables	**External Environment related Entered**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**
Project Quality	ECSV1	15.2		12.4	1
	ECSV2	-26.4		12.4	2
Client Satisfaction					
Increased client support to projects (CSSV1)	PCSV4	16.2	55.2	14	1
	PCSV3	15	36.3	14	2
Increased level of client cooperation (CSSV2)	PCSV3	13.2	82.1	13	1
	MCSV2	11.8	47.8	13	2
Increased Client appreciation (CSSV3)	PCSV3	14.9	32.2	30	1
	PCSV4	27.2	30.3	30	2
	DCSV5	22.4	16.4	30	3
Interactive Variables	**External Environment related Entered**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**
Project Client Satisfaction	ECSV2	16.1		11.3	1
	ECSV1	13.7		11.3	2
Project Site disputes					
Minimized disputes due frequent changes (DSV2)	DCSV5	47.1	60	39	1
	PCSV3	17.3	35.8	39	2
	PCSV4	16.8	19.5	39	3
Interactive Variables	**External Environment related Entered**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**
Project Site Disputes	^^				
Environmental Impact					
Reduced air pollution from project site (ESV1)	PCSV1	40.9	62.6	16	1
Reduced Solid Waste (ESV2)	PCSV1	38.0	43.9	13	1
	DCSV5	-26.5	11.9	13	2
Environmentally friendly methods on site (ESV3)	PCSV1	79.9	75.2	27.0	1
	FCSV3	-28.6	14.5	27.0	2
	MCSV3	-27.4	4.6	27.0	3
Reduced depletion of Natural resources	MCSV6	27.5	100	8.3	1
Interactive Variables	**External Environment**	**B%**	**(rs^2)%**	**(R^2)%**	**Rank**

Dependent Variable	CSFs Entered	B%	(rs^2)%	(R^2)%	Rank
	related Entered				
Project Environmental Impact	ECSV2	29.7		17.1	1
	ECSV3	-50.4		17.1	2

rs=r/R, where $R=R^{0.5}$

r=the correlation between Dependent variable (TSV2) and Independent variable i

R^2= Multiple correlation (Correlation of Determination)

B= Regression coefficients of Independent variaables

rs=Structure coefficient

rs^2=Squared structure coefficient

After the others became redundant on the way it was found that CSFs affecting successful implementation of projects were Management, Design, Procurement and Financial related factors. Also established was weak interactive role of external Environment related factors. The interpretation and discussion of collective effect of CSFs and intervening variables on Successful implementation of projects (cost, time, quality, client satisfaction, site disputes and environmental impact) was done below.

5.3.5.1 Collective effect of CSFs on Project Cost

The results revealed that project implementation cost was mostly positively affected by Management and Procurement related CSFs with the least effect coming from Design related CSFs. This is demonstrated by the first one being Project management related CSFs represented by *Top Management Commitment* explaining 70 % of the 21% variability in ensuring project execution are done within the stage approved cost (CSV1). It was also explaining 62.2% of the 8.3% variability in ensuring stable labour costs (CSV4) and 36% of the 23% variability in ensuring minimum variation costs incurred (CSV3). Strong positive effect of Top Management Commitment on project implementation cost was confirmed by various earlier researchers (Ali, 2010; Amade and Ogbonna, 2012 and Ismail, 2012) who found the same. It was followed by Procurement related CSFs represented by *Corruption free tender system* which was explaining 69.5% of the 8.3% variability in ensuring Stable labour costs (CSV4) and 49.3 % of the 21% variability in ensuring project execution are done within the stage approved Cost (CSV3). This strong relationship between Corruption free tender systems was in agreement with earlier researchers (Sweis et al., 2007; Le-Hoai et al., 2008;

Kaliba et al., 2009; Azhar et al., 2008 and Abdullar et al., 2009) who came up with the same results as shown in the literature review.

Design related CSFs represented by Team members` involvement (DCSV5) only had predictability of 41% of the 21% variability in ensuring execution are done within the stage approved cost (CSV1). This relatively weak relationship was in conformity with earlier researchers (Abudullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) who established relationship between the two variables. Interactive (Intervening) variables (External Environment related factors) found affecting Project Cost was found to be Economic conditions of the country (ECSV1) with positive effect and Prevailing culture (ECSV2) with negative effect. Economic conditions of the country was found having credit on determination of 47% of the 21.8% variability in project cost , while Prevailing culture had decreasing effect of 25% of the 21.8 % variability on the same outcome. Generally the effects of External environment on Project cost though significant were weak. Relatively weak relationship was not in agreement with earlier researchers (Abdullar et al., 2009; Ameh et al., 2010 and Baumann, 2013) who established strong relationship. The difference is mainly due to differences in study areas` conditions.

The observation from the above discussions is that Project cost is determined by *top management commitment, procurement planning, corruption free tender system, team members involvement during design stage, economic status and the prevailing culture in the project site*. These project management CSFs, Design related CSFs, Procurement related CSFs and Environment related factors collectively determine the project cost. Much contribution comes from Project management related CSFs and Procurement related CSFs.

The above results shows that Project Cost is the function of Project Management CSFs, Procurement related CSFs, Design related CSFs and Environment related Factors [Project Cost = f (Management, Procurement ,Design and Environment)] .

5.3.5.2 Collective effect of CSFs on Project Time

On Collective effect of CSFs and intervening variables the results shows that significant effects on successful implementation of public sector construction projects came from Design, Procurement and Management related CSFs and also External Environment factors as intervening variables.

Design related CSFs represented by *Team members` involvement (DCSV5)* had predictability of 73.8% of the 29% variability in ensuring *no delays in securing funds (TSV3).* It was also found explaining 62.6% of the 34% variability in ensuring *Project execution is done within schedule (TSV1),* 61.7% of the 36% variability in timely *delivery of resources (TSV2),* and 52.1% of the 32% variability in ensuring *clear plans are formulated (TSV5).* The findings indicates that Team members` involvement had high or stronger influence on ensuring that no delays in securing funds is experienced during implementation of the project, project is executed within planned schedule, timely delivery of resources and also ensuring that clear plans are formulated. The strong relation between Team members` involvement and project time was confirmed by earlier researchers (Abudullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016) who established strong relationship between the two.

Procurement related CSFs represented by Procurement planning (PCSV1) and, Corruption free tender system (PCSV3) was found having relationship as follows: Corruption free tender system had credit of predicting 60.6% of the 32% variability in ensuring *clear plans are formulated (TSV5),* 20.3% of the 36% variability ensuring *timely delivery of resources (TSV2)* and 18.3% of the 29% variability in ensuring *no delays in securing funds (TSV3).* The relatively strong effect of Corruption free tender system was confirmed by various researchers (Sweis et al., 2007; Le-Hoai et al., 2008; Azhar et al., 2008 and Abudullar et al., 2009) who found strong relationship. Procurement planning explaining 26.5% of the 36% variability in ensuring timely delivery of resources (TSV2), 16.6% of the 34% variability in ensuring that Project execution is done within schedule (TSV1) and 12.7% of the 32% variability in ensuring clear plans are formulated (TSV5). The relationship was relatively weak though the impact was significant. The finding was not in agreement with earlier researchers (Barasa, 2014; Share, 2016 and Cherop, 2016) who established strong relationship. The difference in result could be due to variations in Strengths and weaknesses in planning of public sector construction projects.

The least on CSFs was Management related CSFs represented by Risk Management (MCSV3) predicting only 19.9% of the 32% variability in ensuring *clear plans are formulated (TSV5).* Risk Management was found having the weakest relationship with project time, the result which was compliant to earlier researchers (Ngoma et al., 2014;

Bubu and Sudharkar, 2015 and Share, 2016) who never established relationship between the two variables.

Intervening variables affecting Project time was found to be External Environment in either positive or negative ways. It was found that Economic conditions of the country (ECSV1) had a positive impact by having 59% predictability on the 28.7% variability in Project time, while Prevailing culture (Social and cultural issues of the community) had -33.8% predictability on the 28.7% variability in Project time. This means Economic conditions had the strong positive relative effect on Project time as opposed to prevailing culture which had relatively weak negative impact on project time. The strong relationship between economic conditions and project time is in agreement with various earlier researchers (Frimpong et al., 2003; Ibnu, 2006; and Ameh et al., 2010) who found the same.

Above discussions reveals that Project time is dependent upon team members` involvement during design stage of the project, procurement planning, corruption free procurement system, risk management , economic status and prevailing culture of the project site. Team members' involvement, corruptions free procurement systems and economic status are the major determinant of project time. Procurement plan and risk management happened to have minor potential to influence outcome of project time. Prevailing culture was found negatively deciding project time.

The general picture is that results proved that Project time was the function of Design, Procurement, Management CSFs and External Environment related factors [Project time = f (Design, Procurement, Management and External Environment factors)] though dominated by Design, procurement and external environment related factors.

5.3.5.3 Collective effect of CSFs on Project Quality

At implementation stage of the project, deduced was that Procurement and Management related CSFs had more effect on project quality as opposed to others whose relationship was even insignificant. The major effects on quality came from Procurement and management though Procurement had more effect than Management.

The interpretation of the result was that Procurement planning had predictability of 59.7% of the 37% variability in ensuring workers are trained on quality culture (QSV4). Strong relationship between procurement planning and quality was also established by

earlier researchers (Aftab, 2012; Tawil, 2013; Barasa, 2014 and Wambui et al., 2015). Supply Chain Management (MCSV6) had 52.2 % of the 37% variability in deciding the same outcome. This meant that there was a strong relationship between supply chain and quality of the project was also established by various earlier researchers (Cooke-Davies, 2004b; Jha and Iyer, 2005 and Ali, 2010).

External Environment was found to be having more negative effect than positive effect on determining project quality. Interpretation of the results is that two variables were found having significant relation with Economic conditions of the country having positive effect in form of explaining 15.2% of the 12.4% variability in the outcome which was project quality. In contrast prevailing culture had a negative impact by having decreasing effect of 26.4% of the 12.4% variability in the same outcome. Either positive or negative External environment related CSFs were found having weak relationship with determination of project quality. The weaker effect of Economic conditions on quality was not in agreement with various researchers (Abuddular et al., 2009; and Ameh et al., 2010) who found strong relationship between the two. For prevailing culture, the weak relation was supported by the findings of earlier researchers (Long et al., 2004; Koushki et al., 2005; and Baumann, 2013).

The above discussions points to procurement planning, supply chain management, economic status and prevailing culture in the project sites as the factors that determine project quality. Among the four (4) factors procurement planning and supply chain management was found having more influence than the other two. Economic status had weaker effect on project quality determination, whilst prevailing culture was found having significant negative effect on project quality.

Generally the results indicated that Project Quality was the function of Procurement, Management and External environment factors [Project Quality=f (Procurement, Management and External related factors)] though dominated by Procurement and Project Management related CSFs.

5.3.5.4 Collective effect of CSFs on Client Satisfaction

The interpretations of the results are that Procurement related CSFs represented by *Corruption free tender system (PCSV3)* and *Transparency in procurement system (PCSV4)* had more effect on Client satisfaction as follows: *Corruption free tender system* had predictability of 82.1 % of the 13% variability in ensuring *increased level of*

client cooperation (CSSV2). It also had predictability of *36.3*% of the 14% variability in ensuring *increased client support to projects (CSSV1)* and 32.2% of the 30% variability in ensuring *increased client appreciation (CSSV3).Transparency in procurement system (Choice of procurement procedure)* had predictability of 55.2% of the 14% variability in ensuring increased client support to projects (CSSV1) and 30.3% of the 30% variability in ensuring increased client appreciation (CSSV3). Literature reviewed had only focused on use of traditional success criteria (Abudullar et al, 2009; Kaliba et al., 2009; Cherop, 2016) to test the effects of Corruption free system and Transparency in procurement systems on success of projects.

Minor effect came from Management related CSFs represented by Top Management commitment which was found explaining 47.8% of the 13% variability in ensuring increased level of client cooperation (CSSV2) . The other minor effect came from Design related CSFs represented by Team members` involvement which had predictability of 16.4% of the 30% variability of increased client appreciation. Various researchers (Ismail, 2012; Amade and Ogbonna, 2012; Kogi, 2013; and Ismail, 2016) concentrated on the traditional success criteria to establish effect of Top management commitment and Team member`s involvement on success of projects.

The two interactive variables were established to have significant positive effect on Client satisfaction, although the effects were weak. This was shown by External Environment related factors being represented by Prevailing culture and Economic conditions of the country as follows: Prevailing culture predicting 16.1% of the 11.3% variability in ensuring client satisfaction and Economic conditions of the country, explaining 13.7% of the 11.3% variability in the same outcome (Client satisfaction). Though significant the impacts of the two variables were weak contrary to earlier researchers` findings (Abuddular et al., 2009 and Baumann) who found strong relationship between them.

Above discussions points at transparent tender system, corruption free procurement system, top management commitment , team members` involvement during design stage, prevailing culture in the project site and economic status as the factors that predetermine outcome of client satisfaction success criteria. The ones with dominating influence are transparent tender system and corruption free procurement system.

Generally, the result established that Client satisfaction was the function of Procurement, Management, Design CSFs and External Environment related factors [Client satisfaction = f (Procurement, Management, Design and External Environment)] though dominated by Procurement related CSFs.

5.3.5.5 Collective effect of CSFs on Site Disputes

The two major factors affecting site disputes appeared to be Design related factors and Procurement related factors, with design related factors having the major effect on this outcome. Design related CSFs represented by Team member`s involvement was found having predictability of 60% of the 39% variability in ensuring minimized disputes due frequent changes (DSV2). Procurement related CSFs represented by Corruption free tender system was found predicting 35.8% of the 39% variability in the same outcome and 19.5% of the 39 % variability in the same outcome.

Design related challenges had a strong impact on site disputes demonstrated by strong relationship of Team members` involvement with minimizing disputes due to frequent changes. The strong relationship is confirmed by earlier researchers (Abudullar and Yassin, 2012; Kogi, 2013 and Ismail, 2016). Corruption free tender system had relatively weak relationship with minimizing disputes due to frequent changes. The findings were that there was no significant relationship between External Environment related factors and site disputes.

The above discussion point to the fact that team members` involvement at design stage, corruption free procurement system and transparent tender system are the factors with potential to determine outcome of site dispute success criteria. The one with high potential to influence site disputes was found to be team member's involvement at design stage, whilst the other two had weaker effect on the same success criteria.

The results demonstrated that site disputes was the function of Design and Procurement related CSFs [Site disputes = f (Design, Procurement related factors), though Design related was dominating.

5.3.5.6 Collective effect of CSFs on Environmental impact

It was deduced from the results that environmental impact was significantly affected by Procurement, Management, Financial, Design and External Environment related factors. Procurement related factors was found to be having the major effect on Environmental

impact, followed by Project management and the least being Design related CSFs. As for effect of intervening variables on environmental impact it was found that prevailing culture had a positive effect on environmental impact, while Political conditions in the country had negative impact on the same outcome.

Interpretation of the results are that Procurement related CSFs represented by Procurement planning had predictability of 75.2% of the 27% variability in ensuring use environmentally friendly methods on site (ESV3). It was also explaining 62.6% of the 16% variability in ensuring reduced air pollution from project site (ESV1) and 43.9% of the 13% variability in ensuring reduced solid waste. This confirms the fact that Procurement planning had a relatively strong effect on environmental impact. Earlier researchers (Barasa, 2014 and Share, 2016) on similar study focused on golden triangle success criteria to measure success of projects.

Project Management represented by Supply chain Management had predictability of 100% of the 8.3% variability in ensuring reduced depletion of natural resources. This finding entails that Supply chain management had relatively stronger effect on sustainable utilizing of natural resources. Risk Management was explaining 4.6% of the 27% variability in ensuring use of environmentally friendly methods on site. This was a weak relationship. The other minor effect came from financial related CSFs represented by Progress payment process (FCSV3) which was explaining 14.5% of the 27% variability in ensuring use of environmentally friendly methods on site (ESV3). Design related CSFs being represented by team members` involvement was explaining 11.9% of the 13% variability in ensuring reduced solid waste. As already explained, literature reviewed focused on golden triangle success criteria.

On intervening variables External Environment represented by Prevailing culture was found explaining 29.7% of 17.1% variability in Environmental impact which was a relatively weak relationship. The finding was contrary to earlier researchers, who found strong relationship between the two (Koushki et al., 2005; Ali, 2010 and Baumann, 2013). The difference could be caused by inability by the respondents to differentiate cultural dynamics due to limited exposure.

Worry should be on Political conditions of the country which came up with stronger decreasing predictability of 50.4% of the 17.1% variability of the same outcome which was environmental impact. In a more democratic state there is freedom which makes

people feel free to use the environment in a way deemed suitable and in a failed state there is literally no control of usage of natural resources. Despite earlier researchers (Marosszeky et al., 2002; Syed et al., 2003; Jha and Iyer, 2006 and Amade et al., 2012) establishing strong positive relationship between Political conditions and environment impact, this study established a relatively strong negative relationship which can turn around the efforts of the Critical success factors. The difference could be the fact that there is no optimum state, respondents answered according to their experiences.

The above discussions reveals that procurement planning, team members' involvement at design stage, progress payment process, risk management, supply chain management, prevailing culture and political status were the factors found with potential to determine changes in environmental impact. The ones with higher positive influence of environmental impact were procurement planning and supply chain management, whilst political status had a higher negative influence on the same outcome. The other five had weaker relationship with environmental impact.

From the results it was established that Environmental impact was the function of Procurement, Management, Financial, Design related CSFs and External Environment related factors [Environmental impact =f (Procurement, Management, Financial, Design and External environment)] though Procurement related was dominating, followed by Project Management related CSFs. External environment related factor, namely Political status had a potential to neutralize all the efforts of the other factors by its huge negative effect.

Test of the null hypothesis (*H_1c: There was no significant collective effect of all identified CSFs on successful implementation of public sector construction projects*) yielded the following result. It was established that project cost was being determined by project management, procurement, design and environment related factors. Project time was being decided by design, procurement, management and external environment related factors. Project quality was being determined by procurement, management and external environment factors. Client satisfaction was being influenced by design and procurement related factors and Environmental impact was being affected by procurement, management, financial, design and external environment factors. The above finding proves that all the success criteria were determined by factors from different groupings, there causing rejection of the null hypothesis. Rejection of the null

hypothesis meant indeed there were significant collective effect of all identified CSFs on successful implementation of projects.

5.3.6 Results on Strategies for Improvement of Implementation of Public Sector Construction Projects

The results from the descriptive analysis of strategies ranked using mean scores to signify level of importance are shown in table 5.25 below. The result gives the triangulated results by refining the data gathered from expert survey using General survey data. The results from the collective effects of CSFs on implementation of public sector construction projects in Zambia have been developed into the framework for measurement and evaluation of performance at implementation stage of projects as shown in Table 5.24.

Table 5.24: Results on Strategies for implementation of PSCPs in Zambia

Strategies for Improving implementation of PSCPs based on Experts` views	Mean Score	Standard Deviation	Rank Score
Government should ensure appropriate planning and adequate finance of projects	4.672	0.720	1
Allow technocrats to make decision on the technical issues of the projects as opposed to political stakeholders	4.607	0.662	2
Local financial institutions for construction projects should be created to enable easy access of funds by local players	4.459	0.803	3
A deliberate policy should be put in place were foreign Contractors should work hand in hand with local contractors to allow technology transfer	4.459	0.882	4
Effective Monitoring and feedback mechanisms should be put in place to avoid collusion between consultants and contractors	4.344	0.810	5
Development of policies which encourages need for all stakeholders to adhere to the value for money Principle	4.311	0.881	6
Skills training and capacity building of stakeholders that are directly involved in projects implementation	4.246	0.803	7
Encouragement of Private Sector participation through Public –Private Partnerships (PPP)	4.131	1.066	8
Enforcement of Output based budgeting and financing of projects rather than activity based model	4.016	1.066	9
Establishment of data base of experienced and competent Project Managers	4.000	1.074	10
Encouragement of Private Sector Participation through Contract financing initiatives among other things	3.984	1.035	11
Encouragement of Private Sector Participation through Contract Engineering Initiatives (CEI) among other things	3.951	1.018	12

Based on the ranking (R) of the weighted average of the mean item score (μ) for the listed strategies for improvement of implementation stage of public sector construction projects , 5 major strategies were established. These were as follows: Government should ensure proper planning and adequate finance of projects(μ=4.672,R=1), Allow technocrats to make decisions on technical issues of the projects as opposed to political stakeholders (μ=4.607, R=2), Local financial institutions for projects should be created to enable easy access of funds by local players (μ=4.459, R=3), A deliberate policy should be put in place were foreign Contractors should work hand in hand with local contractors to allow technology transfer (μ=4.459, R=4) and Effective Monitoring and feedback mechanisms should be put in place to avoid collusion between consultants and contractors (μ=4.344, R=5). The minor strategies identified were Encouragement of Private Sector Participation through contract financing initiatives among other things (μ=3.984, R=11) and Encouragement of Private Sector participation through Contract Engineering Initiatives (CFI) among other things.

Strategies established through descriptive study and some resulting from explanatory studies have been blended together to come up with strategies for improvement of public sector construction projets in Zambia. The developed strategies are as follows:

- *A deliberate policy should be put in place which would compel key stakeholders to work together along all stages of project life cycle of projects*

  The finding confirmed the fact that the project was affected by both internal and external factors, the situation which demands that all key stakeholders should be taken on board from inception to closure stage of the projects either as active participants or observers to avoid budget overrun. The importance of all stakeholders at all levels of the project could be deduced from collective impacts of project management, procurement, design, financial CSFs and External environment related factors on determination of successful implementation of public sector construction projects. These factors are controlled by different key stakeholders who in their wisdom if put in the best could foster success of projects (Amade et al., 2012).

- *For optimal mix to be realized, resource allocation should be concentrated on factors with potential to yields more positive results, but without leaving out the rest entirely.*

Depending on the targeted success criteria, management should be able to direct resources where high positive outcome is expected. Different potentials established for different critical success factors on various success criterion, demonstrates that some of them have high efficient utilization of resources than other ones.

- *An appointed Consultant should be given a coordination role to ensure harmonization of operations of all key stakeholders towards the project.*

Realizing the fact that public sector construction projects have many stakeholders with divergent experiences, it is proposed that the consultant should not only represent the client but also should have extra task of coordinating the different parts of the project. Fragmentation of sectors involved as been observed to negatively affect management of public sector projects, all in the name of bureaucracy (Ali, 2010).

- *Project planning should be based on contemporary measures of project performance which includes project time, cost, quality, client satisfaction, site disputes and environmental impacts as focused success criteria.*

It was confirmed from the findings that planning based on traditional criteria with time, cost and quality as key performance indicators have been leaving out other equally important success criterion. It is from the above consideration that it has been decided that the focus should be widened from planning and carried on to monitoring and evaluation of the projects (Rawlinson and Farrell, 2010). Observation was made that contemporary measures of project performance were found to be suitable for measurement of project performance at the implementation stage (Amade et al., 2012; Ngacho, 2013; Dakhi et al., 2016 and Dang and Le-Hoai, 2016).

- *A Joint specialized multi-displinary monitoring and Evaluation team should be consolidated to monitor and evaluate implementation of public sector construction projects.*

The specialized joint team would manage to measure all the parameters for performance of project, rather than just involving Architects and Quality Surveyors in the team. The team should be representative to all key participants who are directly involved in the public construction projects (Ngocho, 2013).

- *Effective monitoring and feedback mechanisms which should enable use of the developed performance measurement and evaluation framework by this study as a standardised tool for assessing performance at implementation stage of the projects.*

In an attempt to promote effective monitoring and feedback mechanisms, the framework for performance measurement and evaluation at implementation stage of public sector construction was developed. The framework formulated from collective effects of CSFs on successful implementation has been developed in order to provide a checklist as the project stakeholders are monitoring and evaluation the projects. The framework shown in Table 5.25 shows expected relationships between Critical Success Factors and various success criteria representing successful implementation of projects.

- *De-politicization policy for public construction projects should be put in place*

The financings reveals that stable political condition in the contrary has significant negative impact on environmental impact success criteria. This entails that stable political conditions in a democratic state gives freedom to citizens which includes freedom of degrading the environment. De-politicization of public sector construction projects would enable safeguard of natural resources.

- *Incentives should be put in place in order to trigger top management commitment, corruption free procurement system and team members' involvement during design.*

The study finding confirms that the tri are the most effective Critical success factors as far as implementation of public sector construction projects are concerned.

- *Local financial institutions for construction projects should be created to enable easy access of funds by local contractors who seemingly are affected negatively by economic status of the country.*

Since the findings have confirmed that financial related CSFs have no influence on public sector construction projects in Zambia, the presupposing is that local

financial institutions for construction projects should be formed for them to have the same privileges like foreign contractors have (mostly in grade 1 to 3).

- *A deliberate policy should be put in place where foreign contractors should be compelled to work in partnerships with local contractors to enable technology transfer.*

Transfer of technology is usually needed in construction projects in order to learn and domestic foreign technologies for the betterment of tomorrow when the foreign contractors would not be needed. The deliberate policy should compel foreign contractors to adopt and retain the necessary technology. Most of the studies conducted in Zambia have established that 20 percent sub-contraction of contracts to local contractors was not assisting in technology transfers as foreigners are not eager to share for fear of losing market (Kaliba et al., 2008; Mukumbwa, 2013; and Mukuka et al., 2016).

- *Planners should figure in effects of external environment related factors when planning to avoid upsets during implementation of projects.*

Recording both significant positive and negative impacts from External Environment related factors on successful implementation of projects, was reason enough not to underrate them. Since planners have no control over external environment factors, they could do better to plan for them in order to avoid future problems. Results have demonstrated that apart from Economic status which had mostly positive effects the other two being prevailing culture in the project sites and political status were mostly on the opposite site. Prevailing culture was mostly found with minor negative influences whilst political status was found having major negative influence on environmental impact. Taking in consideration the fact that project stakeholders usually do not have control over external environment it could just be principally right to make sure that contingency for shocks from external environment should be put in place to avoid shocks. Also managers should always be on the lookout for external environment effects for the sake of quick trouble shooting.

Table 5.25: Framework for Measuring Performance during implementation of PSCPs

S/n	Critical Success Factors	Successful Implementation of PSCPs					
		C	**T**	**Q**	**C S**	**S D**	**EI**
	Project Management related						
1	Top management commitment	***	^^^	^^^	**	^^^	^^^
2	Supply Chain Management	^^^	^^^	***	^^^	^^^	***
3	Risk Management	^^^	**	^^^	^^^	^^^	**
	Procurement related						
1	Corruption free tender system	***	***	**	***	^^^	^^^
2	Procurement Planning	**	**	***	^^^	^^^	^^^
3	Transparency in procurement	^^^	^^^	^^^	^^^	**	^^^
	Financial related						
1	Progress payment process	^^^	^^^	^^^	^^^	^^^	**
	Design related						
1	Team members involvement	**	***	^^^	**	***	**
	External Environment						
1	Economic conditions(progressive)	**	***	**	**	^^^	^^^
2	Prevailing culture(e.g work culture)	**	**	^^^	**	^^^	**
3	Climatic conditions(Reduced Hazards)	^^^	^^^	**	^^^	^^^	^^^
4	Political conditions (Stable)	^^^	^^^	^^^	^^^	^^^	(***)
5	Bureaucracy (Minimized)	^^^	^^^	^^^	^^^	^^^	^^^
6	Natural endowments	^^^	^^^	^^^	^^^	^^^	^^^

C= Cost; T=Time; Q=Quality; CS= Client Satisfaction; SD= Site Disputes; EI=Environmental impact

*** P≥0.5 Strong Positive effect

(***) P≥-0.5 Strong Negative effect

** P<0.5 Weak Positive effect

(**) P<-0.5 Weak Negative effect

^^^ Not Significant

The framework in Table 5.27 could not only be used as standard performance measurement tool but can strategically inform the project managers on ideal ways of allocating resources. The validated tool through expert survey has been proven to be a worthwhile tool for improvement of implementation of public sector constructions projects in Zambia.

5.3.7 Validation of framework

The just developed framework needed to be validated in order to test applicability and acceptability of the too. In this case validation meant that the tool is tested for applicability by competent judges (experts) (Muya, 1999). Someone to judge should have competence in the area being judged. Macal (2005) stated that the model development process should be validated and verified the process to be supported and accepted. As Martin and Henaff (2010) put it validation of the framework was done to ascertain adequacy in performing the purpose it was developed for. It was also meant to examine the frameworks` theoretical accuracy and statistical uprightness.

Ten questionnaires were prepared and hand delivered to senior officers of organisations involved in or have interest in performance measurement and evaluation of implementation of public sector construction projects. The organisations were : Buildings Department, Ministry of Works and Supply; RDA, Ministry of Housing and Infrastructure Development; National Council for Construction; Surveyors Institute of Zambia; Engineering Association of Zambia; Association of Building Contractors; Zambia Public Procurement Authority; Internal Audit, Ministry of Finance and Zambia Institute of Architects.

5.3.7.1 Experts View of Framework

The ten respondents to validate the framework for performance measurement and evaluation at implementation stage of public sector construction projects were asked to state the functionality, user-friendliness and usefulness of the framework. They were further asked whether they had used or come across a framework for performance measurement and evaluation in public sector construction industry. The results of the validation process are presented below.

a) Experience with Performance Measurement and Evaluation Frameworks

The ten respondents were asked to state whether they had previously "come across" a framework for measuring and evaluating performance at implementation stage of public sector construction projects. Seven of the respondents disagreed and three agreed. The respondents that agreed stated that they likened it to programme of works for the project, though different in the way it was framed.

The result indicated that seven out of the ten respondents had never had any experience with any framework for measuring and evaluating of performance at the implementation stage of public sector construction projects based on contemporary measures of performance (time, cost, quality, client satisfaction, site disputes and environmental impact). A gap therefore existed in the measuring and evaluating of performance of projects at implementation stages.

b) Usefulness and Usability of framework

The respondents were requested to state the usefulness and applicability of the framework to their organisations. Overwhelmingly, respondents indicated that the developed framework could be applicable to their organisations. All the respondents found the framework useful. Kululanga (1999) explained that degree to which users are able to use the tool without assistants from experts determines the usability. It is also determined by the level of application to various groups in the same industry.

c) Improvement of implementation of Public Sector Construction Projects

The ten respondents were asked to state whether the framework could be use to improve implementation of public sector construction projects in Zambia. All the ten respondents agreed.

5.3.7.2 Industry View of the Framework

A follow-up questionnaire was prepared to establish industry –wide view of framework. The follow-up questionnaire was sent to 75 professionals in the construction industry. Fifty-five professionals responded to the follow-up question. The follow-up questionnaire was to establish whether the framework was clear and unambiguous; useful; and could be used in measuring and evaluating performance of implementation of public sector construction projects in Zambia.

The results were that 92 percent of the respondents stated that the framework was clear and unambiguous; 100percent stated that it was useful while 97 percent agreed that it could be used to measure and evaluate performance of implementation of public sector construction projects. From these results, the respondents agreed that the framework was clear and unambiguous, useful and could be used to measure and evaluate performance of implementation of public sector construction projects in Zambia.

5.3.7.3 Other Comments on the Framework

The respondents were asked to provide any other comments with respect to the framework for measuring and evaluating performance of implementation of public sector construction projects in Zambia. They stated that the framework:

a) Was comprehensive and could improve implementation of public sector construction projects in Zambia.
b) Needed to be simplified and popularized in all sub-sectors of the construction industry including small scale organisations; and
c) Was more suitable, especially for big construction organisations and regulators in the construction sector.

The framework for measuring and evaluating performance of implementation of public sector construction projects was developed and validated in this chapter. The industry-wide view of the framework was also established. Respondents stated that the framework was clear and unambiguous, useful and could be used to measure and evaluate performance of implementation of public sector construction projects in Zambia.

5.4 Summary

This chapter is made up of two phases, that is, phase one for exploratory study based on expert interview with 63 experts of public sector construction projects in Zambia. Phase two is for descriptive and explanatory studies based of general survey, with data collected using structure questionnaire. Data from exploratory study was first presented and then analysed , after which the results were triangulated through inputting into the designing of the questionnaire for the second study which was the main general survey study , with data collected from 183 key players of the sector. The data from general survey was presented, analysed and findings discussed. Results discussed were for

identified and documented key challenges and Critical success factors. Another one was established relationships between individual Critical success factors and success implementation of projects. There results discussed were established relationship between Critical success factors collectively and successful implementation of projects based on the contemporary measures of project performance.

Key to the study was establishment of strategies for improvement of implementation of public sector construction projects which were formulated and discussed. Added to the strategies was the developed framework for measuring performance of implementation of public sector construction projects based on the contemporary measures of project performance. The developed framework was validated by administering the questionnaire to 10 experts and 75 key participants of the sector in order to get the expert view and industry view of the tool.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusion of the study in several sections. The first section summarizes the findings of the study in relation to the objectives. The second section discusses the managerial implications of this study while the third section provides recommendations. The fourth section highlights the limitations of the study and finally, the last section suggests future research directions.

6.2 Major Findings and Insights

The major findings are structured around the research objectives.

6.2.1To analyse the challenges experienced during the "implementation phase" of public sector construction projects in Zambia.

In the order of importance the study found (12) key challenges causing failure of most public sector construction projects in Zambia were as follows: 1) poor project planning , 2) changes in government rules and regulations, 3) lack of accountability and transparency by the key players, 4) escalation of project costs due to inflationary pressures, 5) lack of needed supporting infrastructures, 6) non-involvement of project participants during design stage of projects, 7) bureaucracy in public sector construction projects, 8) fraudulently certification of works in order to conceal errors by clients` representatives and contractors, 9) poor project management, 10)reduced client financing capacity, 11) political interference in contracts determination and non-involvement of project beneficiaries during design.

6.2.2 To analyse the Critical Success factors affecting successful implementation of public sector construction projects in Zambia.

In order of importance the found perceived eight (8) internal CSFs of implementation of public sector construction projects in Zambia were as follows: 1) team members` involvement at design stage of projects, 2) procurement planning, 3) top management commitment, 4) risk management, 5) progress payment process, 6) supply chain

management, 7) corruption free construction industry, 8) transparency of the procurement system. The major external environment related CSFs were as follows: 1) political status, 2) economic status and efficient public sector (reduced bureaucracy).

6.2.3 To examine the relative impacts of various identified factors on successful implementation of Public Sector Construction Projects.

The findings showed that the five main groupings, namely : project management related CSFs, design related CSFs, procurement related CSFs, financial related CSFs and external environment related factors had factors that had relative impacts on inclusive success criteria (cost, time, quality, client satisfaction, site disputes and environmental impact.

- Project management related CSFs was found with potential to determine outcomes of project cost, time, quality, client satisfaction and environmental impact apart from site disputes. Project management related CSFs supporting this finding was risk management, supply chain management and top management commitment.

- Design related CSF, which was team members` involvement during design stage was found having significant relationship with project cost, time, client satisfaction, site disputes and environmental impact apart from quality success criteria.

- Financial related CSFs was found not having significant relationship with project time, cost, quality, client satisfaction and site disputes. Financial related CSFs supporting this finding was progress payment process which only had weaker relationship with environmental impact and no relationship with the others.

- Procurement related CSFs was found having relative impacts on project cost, time, quality, client satisfaction, site disputes and environmental impact. Procurement related CSFs supporting this finding were procurement planning, corruption free procurement system and transparent tender system.

- Finally, External related factors were found having significant positive and negative effects on cost, time, quality, client satisfaction and environmental impact, though weak. External environment factors supporting this finding were economic conditions of the country, prevailing culture in the project site and political conditions.

6.2.4 To examine the collective impact of identified factors on successful implementation of public sector construction projects in Zambia

Project cost was found collectively being determined by project management, procurement, design and environmental impact related factors. The individual factors grouped under the (4) main groups are top management commitment, procurement planning, corruption free procurement system, team members` involvement during design stage, economic status and the prevailing culture in the project site. Project Time was found being a function of collective impact from design, procurement, management and external related factors. The factors deciding project time outcomes grouped under the four main groups are team members` involvement during design stage of the project, procurement planning, corruption free procurement system, risk management, economic status and prevailing culture of the project site.

Project quality was found collectively being determined by procurement, management and external related factors. The factors in support of this finding are procurement planning, supply chain management, economic status, and prevailing culture of the project sites. Client satisfaction was found being influenced collectively by procurement, management, design and external environment factors. Individual factors deciding outcome of project client satisfaction are transparent tender system, corruption free procurement system, top management commitment, team members` involvement during design stage, prevailing culture of the project site and economic status. Site disputes were found being determined collectively by design and procurement related factors. Factors supporting this finding are team members` involvement during design stage, corruption free procurement system and transparent tender system.

Environmental impact was being determined collectively by procurement, management, financial, design and external environment related factors. Individual factors deciding outcome of environmental impact are procurement planning, team members`

involvement during design stage, progress payment process, risk management, supply chain management, prevailing culture and political status.

Collective impacts on all the success criteria signifies collective impacts of all identified factors on successful implementation of public sector construction projects in Zambia. Establishment of collective effect confirms the fact that the project is a system with various components which all work together for the benefit of the entire project which is attained of the desired target.

6.2.5 To develop strategies that could be applied to improve the implementation of Public sector construction projects in Zambia

The following strategies for improvement of implementation of public sector construction projects were developed:

1) A deliberate policy should be put in place which would compel key stakeholders to work together along all stages of project life cycle of projects
2) For optimal mix to be realized, resource allocation should be concentrated on factors with potential to yield more positive results, but without leaving out the rest entirely.
3) An appointed Consultant should be given a coordination role to ensure harmonization of operations of all key stakeholders towards the project.
4) Project planning should be based on contemporary measures of project performance which includes project time, cost, quality, client satisfaction, site disputes and environmental impacts as focused success criteria.
5) A Joint specialized multi-displinary monitoring and Evaluation team should be consolidated to monitor and evaluate implementation of public sector construction projects.
6) Effective monitoring and feedback mechanisms which should enable use of the developed performance measurement and evaluation framework by this study as a standardised tool for assessing performance at implementation stage of the projects.
7) De-politicization policy for public construction projects should be put in place

8) Incentives should be put in place in order to trigger top management commitment, corruption free procurement system and team members' involvement during design.
9) Local financial institutions for construction projects should be created to enable easy access of funds by local contractors who seemingly are affected negatively by economic status of the country.
10) A deliberate policy should be put in place where foreign contractors should be compelled to work in partnerships with local contractors to enable technology transfer.
11) Planners should figure in effects of external environment related factors when planning to avoid upsets during implementation of projects.

6.3 Contribution to the body of Knowledge

The contribution of this study to literature lays in the development of strategies which include formulation of the framework for measurement and evaluation of performance at implementation stage of the project. The study also contributes to the body of knowledge by enriching the knowledge on locally established failure and success factors for implementation of public sector construction projects. The study also introduces use of contemporary measures of project performance known to be inclusive with use time, cost, quality, client satisfaction, site disputes, health and safety, and environment impact as success criteria to be used when establishing success or failure factors in Zambia. The study also contributes towards establishment of relative individual and collective effects of CSFs on successful implementation of projects. Relationships were established based on contemporary measures of project performance known to be inclusive with time, cost, quality, client satisfaction, site disputes, and environmental success criteria. On methodology gap, this study introduces use of Principal component Analysis as a tool for selecting the key factors from wider sources.

These findings have added to the gaps in knowledge on PSCPs in Zambia. The knowledge in this field has not been progressing in Zambia, but, to some extent, this study will also contribute to improving the practice of construction and project management. This is true in particular when we all desire to understand the factors influencing project management. The evidence generated in this study could foster successful adoption of measures that would allow relevant parties and these could be either the Government or the private sector service providers, to take the necessary

measures as an effort in overcoming the identified constraints to ensure maximum benefit is achieved from the projects.

The fact that there are poor contractual arrangements, mismanagement, and unclear policy directions among other critical factors, these point to lack of government guidelines on procedures. Looking at the evidence provided so far, it is clear that project implementation and management is still a problem in Zambia even though it is progressing.

6.4 Managerial Implications of the findings

The findings of the current study have several implications to the managers and stakeholders involved in the implementation of Public sector construction projects. Below is a brief description of these implications.

- The findings of the study on challenges implies that managers should cast their focus wide as they identify cause of failure of projects, as sources can be from twelve (12) identified key challenges under 6 groupings(i.e. Project Management-related challenges, Procurement-related challenges, Project participants-related challenges, Design- related challenges, Financial- related challenges and External Environment-related challenges).
- The findings on CSFs imply that when implementing public sector construction projects, there are eleven (11) CSFs that influence the success of public sector construction projects. Project success can, therefore, be evaluated on the basis of each individual success variables which may be used as a checklist.
- The findings of the study on strategies would enable all key participants apply them to improve implementation of public sector construction projects.
- The developed performance measurement and evaluation framework would be used by key participants as a standardized tool for assessing performance at implementation stage of the project, It could also be used as planning tool for ensuring effective allocation of resources
- Established relationships of CSFs with successful implementation of public construction projects would help managers in decision making in terms of trouble shooting of the project.

6.5 Recommendations

The project stakeholders can use the above findings to clarify their understanding or performance of public sector construction projects during construction and be able to take corrective action in order to improve successful implementation of projects. It is therefore, recommended that stakeholders should be able to do the following:

- Should adopt and apply the developed strategies by this study
- Should adopt the developed framework for measurement and evaluation of performance of implementation of projects.
- Develop framework for operationalization of proposed strategies in order to improve successful implementation of projects.
- Understand established relationships of factors and make decisions based on them
- Should adopt the documented challenges and Critical success factors for reference during management of projects.

6.6 Limitations of the study

The current study suffers the following limitations

- The scope of the study was narrowed to only implementation stage of public sector construction projects.
- The current study was limited to key stakeholders as respondents , leaving out the community which contributes the actual beneficiaries of the projects
- The study was conducted in Zambia only, indicating that generalization of the results may only be to Zambia
- The study did not consider connecting successful implementation of public sector construction projects to overall success of the entire project.
- Only contractors in Grades 1to 3 participated in the study because of their national character

6.7 Directions for future Research

This section recommends some potentially useful future research that can address some of the limitations of this study.

- Future researchers could undertake similar studies along other stages of the construction industry project life cycle in order to come up with checklist of challenges and CSFs on each stage.
- Researchers could undertake a study on factors that affect implementation of projects from the perspectives of the community which constitutes the actual beneficiaries of the projects. In such a study, the level of community satisfaction with the projects implemented can be addressed.
- Future researchers could advance the current study research findings and test their applicability within the context of other African countries and those projects in other developing countries. There is, therefore, an important need to undergo cross cultural validation of the instrument using data gathered from other African countries and other developing countries as well in order to enhance the generalization of items.
- Finally, a study incorporating the direct effect of successful implementation of projects on overall performance of the projects is of great importance. This is because the intended objective of successful implementation of public sector construction projects is ultimately success of the entire project.

References

Abudayyeh, O., Fredericks, T., Butt, S. & Share, A. (2006) An Investigation of management`s commitment to construction safety. *International Journal of Project Management*, 24 (2), pp. 167-174.

Abudullah, M.R.., Abdul, A.A.A. & Abdul, R.I. (2009) Potential effects on Large MARA projects due to construction delay. *International Journal of Integrated Engineering*, 1(2): pp. 53-62.

Aftab, H.M., Ismail, A.R. and Ade, A.A.A. (2012) Time and Cost Performance in Construction Projects in Southern and Central Regions of Peninsula Malaysia. *International Journal of Advances in Applied Sciences*, 1 (1), pp. 45-52.

Aghimien, D.O., Aigbavboa, C., Oke, A.E and Musenga, C (2018) Barriers to sustainable Construction Practices in the Zambian Construction Industry. *Proceedings of International Conference on Industrial Engineering and Operations Management*, Paris, France.

Ahadzie, D.K., Proverbs, D. D. & Olomolaiye, P.O. (2008) Critical success criteria for mass house building projects in developing countries. *International Journal of Project Management*, 26(6), 675-687.

Aineruhanga, M. (2004) Focus on the "Kenya ICT Week; *Chakula Newsletter*, (9).

Akinsola, A.O., Potts, K.F., Ndekugri, I. and Harris, F.C. (1997) Identification and evaluation of factors influencing variations on building projects. *International Journal in Project Management*, 15(4), 263-267.

Al- Haadiri, S. & Panuwatwanich. K. (2011) Critical Success Factors for Safety Program Implementation among Construction Companies in Saudi Arabia. *Procedia Engineering Volume*, 14, 148-155.

Ali, A. (2010) *Investigating Project Management Practices in Public Sector Organisations of a Less Developed Country*. PhD Thesis. RMIT University.

Alsolaiman, M.S. (2014) *An Empirical study of the factors impacting on the involvement of clients in Saudi Arabia*. PhD Thesis. Queensland University of Technology.

Altrichter, H., Feldman, A., Posch, P. & Somekh, B. (2008) *Teachers investigate their work; an introduction to action research across the professions*, 2nd ed. London: Routledge.

Alwaer, H. & Clements-Croome, D.J. (2010) Key Perforamnce Indicators (KPIs) and priority setting in using the multi attribute approach for assessing sustainable intelligent buildings. *Building and environment*, 45, 799-809.

Alwi, S., Hampson, K. & Mohamed, S. (2002) Waste in the Indonesian Construction Project: *Proceedings of the 1st International Conferences of CIB W107-Creating a Sustainable Construction Industry in Developing Countries, 11-13 November, South Africa*, ISBN: 0-7988-5544-4, pp 305-315

Amade, B., Ogbonna, A, C. and Kaduru, C.C. (2012) Determinants of Successful Project Implementation in Nigeria. *International Journal of Management Sciences and Business Research,* ISSN (2226-8235), Vol 1, Issue 6.

Ameh, O.J., Soyingbe, A.A. and Odusami, K.T. (2010) Significant factors causing cost overrun in telecommunication projects in Nigeria. *Journal of Construction in Developing Countries*, 15 (2), 49-67.

Anyanwu, L.U. (2003) *Project Management in Developing Nation*, Onitsha: Africana Feb Publishers.

Apolot, R., Alinaitwe.H. and Tindiwensi, D. (2016) *An Investigation into the Causes of Delay and Cost Overruns in Ugandan`s Public Sector Construction Projects*, Uganda: Makerere University Press

Arazi, I., Mahamound, S. and Mohamad, A.A. (2011) Decision Criteria for Selecting Main Contractors in Malaysia. *Research Journal of Applied Sciences, Engineering and Technology,* 3 (12), pp1360-1367.

Assaf, S.A. & Al-Hejji, S, S. (2006) Causes of delay in large construction projects. *International Journal of Project Management*, 24, pp. 349-361.

Auma, E. (2014) Factors Affecting Performance of Construction Projects in Kenya: A survey of low Rise Buildings in Nairobi, Central Business District. *The International Journal of Business and Management,* 2 (12), 115.

Azhar, N., Farooqui, R.U. & Ahmed, S.M., (2008) Cost Overrun factors in construction industry in Pakistan. Proceedings of *1st International Conference on Construction in Developing countries (ICCIDC-1), advancing and integrating construction education, research and practice*, Karachi, 4-5 August, pp 499-508.

Aziz, A.A. (2007) *Adoption of Industralised Building System in Malaysian Housing Industry*. Msc Thesis. University of Technology MARA (UiTM).

Bagaya, O and Song, J (2006) Empirical Study of Factors Influencing Schedule delays of Public Construction projects in Burkina Faso. *Journal of Management in Engineering*, 8(5), 57-87

Bailey, E.P. (1984) *Writing Clearly: A contemporary approach*, Columbus. OH: Charles Merrill

Baker, B.N., Murphy, D.C. and Fisher, D. (1988) Factors affecting Project Success: In Project Management Handbook.ed. D.I. Cleland and W.R. King, 2nd ed. 902-919. New York: Wiley: Cited In Morris, P. W. G. and Pinto, J. K. eds. *The Wiley Guide to Managing Projects,* New Jersey: John Wiley and Sons, Inc.

Banda, J. (2015) *An Investigation into the factors influencing the Performance of Contractors of Government-Funded Construction Projects in Muchinga Province of Zambia*. Unpublished MSC Thesis. Cavendish University- Zambia.

Banda, J., Mainga, W., & Banda, Z. I. (2019a) An Investigation into the factors affecting successful implementation of Public Sector Construction Projects in Zambia. *International Journal of Project Management* (Under final revision for publication)

Banda J., Mainga. W., & Banda, Z.I (2019b) Developing strategies for improvement of Public Sector Construction Projects implementation in Zambia. *International Journal of Project Management* (Under final revision for publication)

Barasa, W.H. (2014) Procurement practices affecting effective Public projects implementation in Kenya: A case study of Kenya Civil Aviation Authority. *European Journal of Business and Management*, (6)6, 2222-2839.

Baumann, L. (2013) *The Impact of National Culture on Project Management in the Middle East*. PhD Thesis. Loughborough University.

Berawi, M.A., Berawi, A.R.B. and Hadwart, K.A. (2012) Managing Construction Logistics Management: Findings from Contractors and Industralised Building System (IBS) Manufacturers. *African Journal of Business Management*, 6(5), 1932-1944.

Bertanlanffy, L.V. (2014) General System Theory, In: Sweis, R.J., Bisharat, S.M., Bisharat, L. and Sweis, G. eds. Factors Affecting Construction Performance in Public Construction Projects. *Life Science Journal*, 11(4s), 27-29.

Bertlett, J.E., Kotrlik, J.W. and Higgins, C.E (2001) Organisational Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning and Performance Journal*, 19(1), 43-50.

Bhatnagar, S (2003) *Last update, Enabling E-Government in Developing Countries: From vision to implementation* [online]. Available from :<http://www1.world bank'org/publicsector/egov/1week/Bhatnagar.pdf> [Accessed24th April, 2017]

Blake, D.W. (2006) *Scope for Improvement: A survey of Pressure Points in Australian Construction and Infrastructure Projects*, Australia: Australian Construction Association

Bland, J. and Altman, D. (1997) *Statistics Notes: Cronbach's Alpha*. BMJ, 314, 572.

Boars, W. (2006) *Project Management Handbook, Version 1.1.*, The Hague: Dans-Data Archiving and Networked Services

Boume, M., Neely, A., Mills, J and Platts, K (2003) Implementing Performance Measurement Systems: A literature Review. *International Journal of Business Performance Management*, 5(5), 1-24

Bryman, A. (2004) *Social Research Methods, 2nd ed*. Oxford: Oxford University Press.

Bryman, A. & Bell, E. (2003) *Business Research Methods.* Oxford: Oxford University Press.

Bubu, S.S. and Sudharkar, D. (2015) Critical Success factors influencing performance of Construction projects, *International Journal of Innovative Research in Science, Engineering and Technology (IJIRSCT)*, 4(5), 3285-329.

Burke, R. (2013) *Project Management Planning and Control Techniques*, 4th ed. Chichester: Wiley.

Burns, A.C. and Bush, R. F. (2002) *Marketing research: Online research applications, 4ed*, New Jersey: Prentice Hall

Burns, N. and Grove, S.K. (2003) *The practice of nursing research: conduct critique and utilization*, 4th ed, Philadelphia: Sage Publications.

Burns, R.B. (2000) *Introduction to Research Methods*, 4th ed., London: Sage Publications.

Burns, T. and Stalker, G.M. (1961) "The Management of Innovation" cited in Sysvester, D.C and Rain, A.S.N (2010)*Theoretical frameworks: factors for Project Success in Oil and Gas Companies and Contactors in Mini*, Sarawak, Malaysia.

Central Statistical Office (2010) *Prices Statistics*, Lusaka : Central Statistical Office

Central Statistical Office (2010) *National Accounts*, Lusaka: Central Statistical Office

Central Statistical Office (2016) *2015 Living Conditions Monitoring Survey Report*, Lusaka: Central Statistical Office

Chamwasunuth, P., Yabuki, N. and Tongthong, T. (2009) A Proposed Collaborative Framework for Prefabricated Housing Construction Using RFID Technology. In: Luo, Y .ed. *Cooperative Design, Visualisation, and Engineering*, Luxembourg: Springer Berlin Heidelberg, pp. 372-375

Chan, A.P.C. and Chan, P.C.A (2004) "Key performance indicators for measuring Construction Success, Benchmarking". *An International Journal*, 11(2), pp 203-221.

Chan.A.P.C., Scott. D. and Chan, A. P.L (2004) Factors Affecting the Success of a Construction Project. *Journal of Construction Engineering and Management ©ASCE, 0733-9364*, 130(1), 153.

Chen, Y., Okudan, G.E., & Riley, D.R., (2010) Sustainable performance criteria for construction method selection in concrete buildings, *Automation in Construction Article in Press*, Corrected Proof, doi: 10.1016/j.aautcon. 2009.10.004

Cherop, J.P. (2016) Procurement Practices influencing project implementation in Public Institutions in Kenya: A case of Kenya Electricity Generating Company.*10SR Sound of Business and Management (10SR-JBM),* 18 (5)Ver. III, pp. 47-71.

Chianca, T (2008) The OEC/DAC Criteria for International Development Evaluations: An Assessment and Ideas for improvement. *Journal of Multi-Displinary Evaluations*, 5 (9), 41-51.

Chilongo, S and Mbetwa, S (2017) An investigation into the factors affecting project performance among contractors affecting project performance among contractors in Lusaka District of Zambia. *The International Journal of Multi-Displinary Research*, 539, 3471-7102

Chua, D.K.H., Kogi, Y.C. and Loh, P.K. (1999) Critical Success factors for different project objectives. *Journal of Construction Engineering Management*, 125(3), 142-150.

Church, C.H (1983) *Practice and Perspectives in validation: Research into Higher Education Proceedings*. Gulldford: Society of Research into Higher Education.

Clason, D.L & Dormody, T. J. (1994) Analysing data measured by individual Likert-type items. *Journal of Agricultural Education*, 35 (4), pp 31-35.

Cohen, L., Manion, L. & Morrison, K. (2000) *Research methods in education, 5th ed.* London: Routledge Falmer.

Cooke-Davies, T. J. (2002) The "real" success factors in projects. *International Journal of Project Management*, 20(3): 85-190.

Cooke-Davies, T.J. (2004b) Project Success: In Morris, P. W. G. and Pinto, J. K. (Eds.) *The Wiley Guide to Managing Projects*, Leeds: John Wiley and Sons, Inc.

Cooper, D. R. and Schindler, P.S. (2006) *Marketing Research*, New York: McGraw-Hill/Irwin

Creswell, J. W. (2003) *Research design: qualitative, quantitative, and mixed methods approaches, 2nd ed*. London: SAGE Publication.

Creswell, J. W. (2013) *Qualitative inquiry and research design: Choosing among five approaches (3rd ed.)*. Thousand Oaks, CA: Sage Publications.

Creswell, W. J (2014) *Research Design, Qualitative, Quantitative and Mixed Methods Approaches, (4ed)*, Los Angeles: Sage Publications.

Crotty, M. (1998) *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: Sage Publications.

Dada, M.O. (2007) "Priorities in Nigerian public project implementation: Expectations from Consultants and Contractors". *Construction Journal*, 1(1), pp 10-14.

Dakhi, Z., Lafhaj. Z and Bos, A. (2016) "Experiencing lean Six Sigma in the French Residential Construction: Setting effective performance indicators to address Client Satisfaction". *Internal Journal of Lean Six Sigma*, 7(4), pp 346-368.

Dang, C.N. and Le-Hoai, L. (2016) "Critical Success factors for implementation of process of design-build projects in Vietnam". *Journal of Engineering Design and Technology*, 14(1), pp 17-32.

David, W. (2009) *Public –Sector Project Management*, New Jersey: John Wiley and Sons, Inc.

Diamantopoulos, A. & Schlegelmilch, B.B. (1997) *Taking the Fear out of Data Analysis*, London: The Dryden Press

Dikert, K., Paasivaara, M. and Lassenius, C. (2016) Challenges and Success factors for large scale agile transformations: A Systematic Literature review. *The Journal of Systems and Software*, 119, 87-108.

Easterby-Smith. M., Thorpe, R. and Lowe, A. (2006) *Management Research. An Introduction. 2nd ed*. London: SAGE Publishers

Enshassi, A., Mohamed, S. and Abushaban, S. (2009) Factors Affecting the Performance of Construction Projects in the Gaza Strip. *Journal of Civil Engineering and Management*, 15(3): 269-280.

Eriksson, P.E. & Westerberg, M. (2011) Effects of Cooperative Procurement Procedures on Construction Project Performance: A conceptual framework. *International Journal of Project Management*, 29(2), 197-208

Essam, K, Z. (2006) Construction claims in United Arab Emirates: Types, causes and frequency. *International Journal of Project Management*, 24(5), pp 453-459

Field, P.A. (2005) *Discovering Statistics using SPSS*, (2ed). London, Sage Publications

Forza, C. (2002) Survey research in operations management: a process-based perspective. *International Journal of operations and production management*, 22(2): 152-194.

Frimpong, Y., Oluwoye. J. and Crawford, L. (2003) "Causes of delay and cost overruns in construction of groundwater projects in developing countries: Ghana as a Case Study." *International Journal for Project Management*, 21 (5), 321-326.

Gakunu, P. (2004) *Last update, E-Government Strategy for Kenya [Online]*, Availablefrom<http://www.Apc.Org/apps/img_upload/69726166726963616461637 56d65e74/egov> [Accessed 10 May 2017]

Gale, A.W. & Fellows, R.F. (1990) Challenge and Innovation: the Challenge to the Construction Industry. *Construction Management and Economics*, 8,431-436.

Gangolells, M., Casals, M., Gasso, S., Foreada, N., Roco, X. and Fuerters, A. (2011) Assessing concerns of interested parties when predicting the significance of environmental impact related to construction process of residential buildings. *Building and Environment*, 46, 1023-1037.

Gillham, B. (2000a) *Developing a questionnaire.* London: Continuum

Gillham, B. (2000b) *The research interview*. London: Continuum

Goldstein, H. (1990) The knowledge base of Social Work Practice: Theory, Wisdom, analogue, or are? Families in Society. *The Journal of Contemporary Human Services*, 71 (1), 32-43.

Government of the Republic of Zambia (1979) *Third National Development Plan 1979-1983*, Lusaka: Ministry of Finance and National Development Planning.

Government of the Republic of Zambia (2001) *Procurement Guidelines*, Lusaka: Zambia National Tender Board.

Government of the Republic of Zambia (2002) *Report on the Auditor General on the Operations of the Presidential Housing Initiative for the period November 1998 to August, 2001*, Lusaka: Auditor General`s Report.

Government of the Republic of Zambia (2003) *The National Council for Construction Act of 2003*, Lusaka: Ministry of Justice.

Government of the Republic of Zambia (2004) *Development of Contractor Registration Scheme with a focus on Small Scale Civil Work Contractors, Technical Support of ILO*, Lusaka: National Council for Construction-Zambia

Government of the Republic of Zambia (2006) *Fifth National Development Plan*, Lusaka: Ministry of Finance and National Planning

Government of Republic of Zambia (2008) *The Public Procurement Act of 2008*, Lusaka: Zambia Public Procurement Authority (ZPPA).

Government of the Republic of Zambia (2011) *Auditor General`s Report*, Lusaka: Auditor General`s Office.

Government of Republic of Zambia (2011) *Public Procurement Amendment, No. 15 of 2011*, Lusaka: Zambia Public Procurement Authority.

Government of the Republic of Zambia (2011) *Sixth National Development Plan, 2011-2015, "Sustainable Economic Growth and Poverty Reduction",* Lusaka: Ministry of Finance and National planning.

Government of Republic of Zambia (2011) *Statutory Instrument No. 63 of 2011 on the Public Procurement Act No. 12 of 2008 and the Public Procurement Regulations, 2011*, Lusaka: Zambia Public Procurement Authority.

Government of the Republic of Zambia (2011) *2010 Annual Progress Review, fifth National Development Plan (FNDP)*, Lusaka: Ministry of finance and National Planning.

Government of the Republic of Zambia (2012) *2011 Auditor General`s Report*, Lusaka: Auditor General`s Office.

Government of the Republic of Zambia (2012) *Labour force survey*, Lusaka: Central Statistical Office

Government of the Republic of Zambia (2013) *2012 Annual Report*, Lusaka: National Council for Construction (NCC)

Government of the Republic of Zambia (2013) *2012 Auditor General`s Report*, Lusaka: Auditor General`s Office

Government of the Republic of Zambia (2013) 2013 *National Budget*, Lusaka: Ministry of Finance and National Planning.

Government of the Republic of Zambia (2014) *Report of the Committee of Communications, Transport, Works and Supply for the Fourth Session of the Eleventh National Assembly*, Lusaka: National Assembly of Zambia.

Government of the Republic of Zambia (2014) *2013 Auditor General`s Report*, Lusaka: Auditor General`s Office.

Government of the Republic of Zambia (2014) *Public-Private Partnerships in Infrastructure Development in Zambia*, Lusaka: Zambia Development Agency.

Government of the Republic of Zambia (2015) *President Edgar Lungus`s Parliamentary Speech on Public Sector Construction in full*, Lusaka: State House Media and Publicity.

Government of the Republic of Zambia (2015) *2014 Auditor General`s Report*, Lusaka: Auditor General`s Office.

Government of the Republic of Zambia (2016) *2015 Auditor General`s Report*, Lusaka: Auditor General`s Office.
Government of the Republic of Zambia (2017) *2016 Auditor General`s Report*, Lusaka: Auditor General`s Office.

Government of the Republic of Zambia (2016) *Ministerial Statement on Infrastructure development projects in Zambia*, Lusaka: Ministry of Works and Supply.

Government of the Republic of Zambia (2017) *Press statement by His Excellency the President on the State of Infrastructure at the Housing and Infrastructure Symposium at Mulungushi International Conference Centre*, Lusaka: State House Media and Publicity.

Government of the Republic of Zambia (2017) *Zambia`s 7TH National Development Plan 2017-2021*, Lusaka: Ministry of National Development Planning.

Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. (1998) *Multivariate Data Analysis*, 5th ed. New Jersey: Prentice Hall Inc.

Hair, J.F., Anderson, R.E., Tatham, R.L & Black, W.C (2006) Multivariate Data Analysis,6th ed. New Jersey: Prentice Hall.

Hair, J.F, Lamba, C.W and McDaniel, C.D (2006) *Marketing*, Cincinnati, Ohio: South-Western Publishing.

Halloway, I. and Wheeler, S. (2002) *Qualitative Research in nursing*, 2nd ed. Oxford: Blackwell Publishing.

Halpin, D.W., and Woodhead , R.W. (2006)Construction Management ,3ed. New York: Chichester

Heeks, R (2003a) *Last update. Building E-governance for Development: A framework for national and donor action* [Online], Institute for development policy and management. Available from: <http://.dpm.man.ac.uk/publiations/wp/,gov+wp12'pdf> [Accessed 18 February 2017]

Hendrickson, C.A. (2008) *Key factors for Successful Construction Project Management –Perceptions of Owners and Contractors*, Pittsburgh: The Project Management, HUT.

Hughes, W., Hillebrandt, P., Greenwood, D. and Kwanu, W. (2006) *Procurement in the Construction Industry: the impact and cost of alternative market and supply processes*. Oxford: Taylor and Francis.

Ibnu, A.M. (2006) *Causes and Effects of delays in ACEH Construction Industry*. Unpublished MSC Thesis .. University Technology Malaysia

Ibrahim, R.., Ayazi. E., Nasrmalek, S. and Nakhat, S. (2013) An Investigation of Critical Failure factors in Information Technology Projects. *10SR Journal of Business and Management*, 10 (3), 87-97.

Ishtiaq, F. and Jahanzaib, M. (2017) Impact of Project Complexity and Environmental Factors on Project Success: A case of Oil and Gas Sector of Pakistan. *Journal of Basic and Applied Sciences*, 13,351-358.

Ismail. F., Yasuwan. N.M. and Baharuddin, H.E. (2012) Management factors for Successful IBS Projects Implementation. *Social and Behavioral Sciences*, 68, 999-1070.

Iyer, K. C. and Jha, K. N. (2006) Critical Factors Affecting Schedule Performance: Evidence from Indian Construction Projects. *Journal of Construction Engineering and Management,* August 2006: 871-881.

Jahmane, A., Van Hoorebeke, D., and Louart, P. (2011) The Link between financial performance and the voluntary departure of personnel through a measurement scale. Business and Management Review, 1(6), 48-61.

Jha, K.N. and Iyer, K.C. (2006) Critical Factors Affecting Quality Performance in Construction Projects. *Total Quality Management*, 17 (9), 1155-1170.

Jha, K.N. and Iyer. C. (2006) What attributes should project coordinator posses? *Journal of Construction Management and Economics*, 24 (9), 977-988.

Johari. M. F. (2010) *Identifying Success factors in a Public Sector Project, An Empirical Study of the Malaysian School Computer Laboratory Project*. PhD thesis. University of Stirling

Joseph, O. and Muturi, W. (2015) Factors influencing effective implementation of Rural Electrification Programme in Uganda: A case of West Nile Region. *The Strategic journal of Business and Change Management*, 2(121), 1965-1987.

Kaliba, M., Muya, M. and Mumba, K. (2009) Cost Escalation and Schedule delays in road construction projects in Zambia. *International Journal of Project Management*, 27(1) 522-531.

Kaliba, J.C., Muya, M., and Sichombo, B. (2009) The Need to reduce Costs, Schedule Overruns and Quality Shortfalls in Construction. In: Association of Schools of Construction of Southern Africa, *Proceedings, The Fourth Built Environment Conference 17-19 May in Livingstone,* Zambia: Association of Schools of Construction of Africa.

Kaming, P.F., Olomolaiye, P.O., Holt, G.D. & Harris, F.C. (1997) Factors influencing construction time and cost overrun on high-rise projects in Indonesia. *Construction Management Economics*, 15(1), 83- 94.

Kamrul, A. &Indra, G. (2010) Analysis of cost and schedule performance of international development projects Original Research Article. *International Journal of Project Management*, 28(1), 68- 78.

Karamizadeh, S., Abdullah, S.M., Manaf, A.A., Zamani, M. and Hooman, A. (2013) An Overview of Principal Component Analysis. *Journal of Signal and Information Processing*, 4, 173-175

Kerzner, H. (2006) *Project Management a system Approach to Planning Scheduling and Controlling, (6ed),* Ohio: John Wiley &Sons.

Khaled, M. (2003) Last update. *Information technology in government: an action plan for Bangladesh.* Available from: <http://www.sictgov-org/IT%20Action%20Plan%20for %20BG.doc> [Accessed 25 May 2017]

Kiarie, W.A. and Wanyoike, D. (2016) Determinants of Successful implementation of Government funded projects in Kenya: A case study of Integrated Financial Management Information Systems. *International Journal of Innovative Research and Development*, 5(10).

Kogi, D.M. (2013) *Factors Influencing the Effectiveness of Implementation of the Economic Stimulus Programme (ESP), the Case of Construction Projects in Nairobi County, Kenya*. MA Thesis. University of Nairobi

Kombo, D. K. and Tromp, D.L.A. (2006) *Proposal and Thesis Writing, an Introduction,* Kenya: Pauline's Publication Africa

Kombo, D.K and Tromp, D.L.A. (2014) Proposal and Thesis Writing, An Introduction , Kenya: Pauline`s Publications Africa

Kothari, C.R. (2004) *Research Methodology, Methods and Techniques*, New Delhi: New Age International (P) Limited publishers

Koushki P.A., Al-Rashid, K. & Kartam, N. (2005) Delays and cost increases in construction of private residential projects in Kuwait. *Journal of Construction Management and Economics*, 23(3), 285-294.

Kululanga, G.K (1999) *A Framework to facilitate construction contractor`s learning*. Unpublished thesis. Loughborough University

Kulungu, M. (2009) Ethics and Modern Management, Los Angeles: Pauline`s Publications Africa

Leedy, P.D, and Omrod, J.E. (2012) *Practical Research: Planning and design, 8th ed.* Upper Saddle River, N.J: Prentice Hall

Le-Hoai, L., Lee, Y.D., & Lee, J.Y. (2008) Delay and cost overrun in Vietnam large construction projects: A comparison with other selected countries. *Journal of Civil Engineering*, 12(6), pp. 367-377.

Leslie, T. (2015) *5 Strategies of a Successful Construction Projects Manager*. Available from: <https://www. Smartsheet .com/blog/5strategies-of-construction-pm> [Accessed 13 May 2017].

Ling, Y., Low.S., Wang, S. and Lim. H. (2009) Key project management practices affecting Singaporean firms project performance in China. *International Journal of project management*, 27(1), 59-71.

Long, N.D., Ogunlana, S., Quang, T., Lam K.C. (2004) Large Construction projects in developing countries: a case study from Vietnam. *International Journal of Project Management*, 22(7), 553-561.

Luhmann, G. (2017) "Systems elements are rationally connected", In: Mele, C., Pels, J. and Polese, T. eds. A brief review of systems theories and their managerial applications. *Institute for operations research and management sciences (INFORMS) Service Science*, 2 (1-2); 126-135

Lysons, K. & Farrington, B. (2010) *Supply Management*, 7ed. London: Pearson Education Limited.

Macal, C.M. (2005) *Model Verification and Validation*, Chicago; University of Chicago

MANCOSA (2003) *Research Methods*, Durban: MANCOSA

Martinez-Moyano.I.J. (2006) Exploring the Dynamics of Collaboration in Interoganisational Settings. In Schuman, S.(eds.) *Creating a Culture of Collaboration: The International Association of facilitators Hand book*, pp. 68-85,San Francisco,CA: Jossey- Bass

Martini, C and Henaff, P (2010) Model Validation : theory, practice and perspectives. Journal of Risk Model Validation, 4(5), 3-5

Marosszeky, R.T.M., Karim, K., Davi, S. & McGeorge, D. (2002) T*he importance of project culture in achieving quality outcomes in construction.* Available from: <http://www.researchgate.net/publication/228796833_The_importance_of _project_culture_in_achieving_quality_outcomes_in_construction> [Accessed 12 January 2015].

Meredith, J.R. and Mantel, S.J. (2012) *Project Management: A managerial Approach*, Canada: John Wiley and Sons

Merewitz, L. (1973)Cost Overruns in Public Works. In W.A. Niskanen, A.C., Harberger, R.H., Haveman, R.,T. & R. Zeckhauser (eds), *Benefit- Cost and Policy Analysis,* pp.277-295, Chicago: Aldine

Mertens, D.M. (2010) *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods, 3rd ed.* Thousand Oaks, CA: Sage

Micheli, P(2011) *Strategy Implementation and Performance Measurement*, Uk: Warwick Business School

Miller, R. L. & Brewer, J. D. (2003) *The A-Z of Social Research.* London: Sage Publication

Mingers, J. (2001) Combining IS Research Methods: Towards a Pluralist Methodology. *Information Systems Research*, 12(3), 240-259

Mkuni, M (2016) *An assessment of the Planning Cycle in Zambia`s road construction projects.* Msc Thesis. The University of Zambia

Mohammed, M.A. (2011) *Examination of the Correlation of Critical Success and Delay Factors in Construction Projects in the Kingdom of Saudi Arabia*, [online]. Available from: http://www.google.com/search?client=firefox-b-d&channel=trow&q=Merewitz%2CL+(1973). [Accessed 4 April, 2019]

Molhotra, N.K & Dash, S (2011) *Marketing Research: An Applied Orientation*, 6ed. New Jersey: Prentice Hall

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological Implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1 (1), 48-76.

Mukape, W.N. (2017) *Cost Construction Sector, Transparency Initiative*, Lusaka: Cost Zambia

Mukuka, M.J., Aigbarboa.C. O. and Thwala, W.D. (2016) "*Construction Professionals Perception on the Causes and Effects of Project delay in Lusaka, Zambia*". University of Johannesburg.

Mukumbwa, B.B.M. (2008) *An Investigation into the selection process of Consultants and Contractors in the Public Construction Sector in Zambia.* MA Thesis. University of Zambia

Mukumbwa. B.B.M. (2013) *Ethics in the construction industry in Zambia, PhD Thesis.* University of Zambia

Muleya, F and Kamalondo, H (2017) An investigation of Waste Management Practices in the Zambian Construction Industry. *Journal of Building Construction and Planning Research*, 05(01), 1-13

Muleya, F. and Zulu, S. (2009) Delivering Infrastructure development using PPP/PFI: *A challenge for Zambia Proceedings; the 6th Built Environment Conference of the Association of Schools of Construction of Southern Africa (ASOCSA), Livingstone, Zambia, 5-7 March*

Murali, S., &Yau, W.S. (2007) Causes and effects of delays in Malaysia Construction industry. *International Journal of Project Management*, 25, 517-526.

Murphy, J.P. (1990). *Pragmatism: From Peirce to Davidson*, Boulder, CO: Westview

Muya, M. (1999) *A systematic approach for improving construction materials logistics*. MSC thesis. Louborough University

Mwiya, B. (2009) *The need for the technical auditing in the Zambian Construction Industry*, Lusaka: University of Zambia

Nawi, N., Abdu. Nifa, F.A., Abdullah and Yasin, FM., (2012) A Preliminary Survey of the Association of Industralised Building System (IBS) in Kedah and Perlis Malaysian Construction Industry. *Proceedings of the Conference on sustainable South-east-Asia,* Available from: <http://www.irbnet.deldaten/iconda/CIB11399.pdf> [Accessed 27March, 2017]

NCC and ZIPAR (2017) 'Baseline Survey of the Zambian Construction Industry: Final Report' Lusaka: National Council for Construction and Zambia for Policy Analysis and Research

Ndou, V. (2004) E-Government for developing Countries: Opportunities and Challenges. *Electronic Journal on Information Systems in Developing Countries*, 18, 1-24

Neumann, W.L. (2009) *Social research methods: Qualitative and Quantitative approaches.* 7ed. Boston: Allyn and Boston

Newton. P. (2015) *Principles of Project Management, Project Skills*. Available from: <http:// www.free-management-ebooks.com/aldebk-pdf/fme-project-principles.pdf>.[Accessed 27 April, 2019].

Ngacho, C. (2013) *An Assessment of performance of Public Sector Construction projects: An Empirical study of projects funded under Constituency Development Fund (CDF) in Western Province of Kenya.* PhD Thesis. University of Delhi.

Ngacho, C., & Das, D., (2013) A performance evaluation framework of public construction projects: An Empirical Study of Constituency Development Fun (CDF) Projects in Kenya, *International Journal of Project Management*, 45 (6), 67-87.

Ngoma, S., Muya, M. and Kaliba, C. (2014) Benefits, Constraints and Risks in infrastructure Development via Public –private Partnerships in Zambia, *Journal of Construction in Developing Countries*, 19 (1), 15-33.

Njunguna, H.B. (2008) *The Construction Industry in Kenya and Tanzania: Understanding the mechanisms that promote growth,* DBA assignment presentation. ESAMI.

Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill. (8).

Ochieng, E.G and Price, A.D. F., (2009) Managing Coss-cultural communication in multicultural construction project teams: The case of Kenya and UK. *International Journal of Project Management*, 28 (5), 449-460.

Odeh, A.M., & Battaineh, H.T., (2002) Causes of Construction Delay; Traditional Contracts. International Journal of Project Management, 20, 67-73.

O'Donoghue, T. & Punch K. (2003). Qualitative Educational Research in Action: Doing and Reflecting, London: Routledge.

Odoyo, C. (2013) Factors affecting implementation of community projects: case of Kimira, Oluch small holder farm improvement poject in Huma Bay County, Kenya, *Universal Journal of Management*, 1(2), 111-118.

Ofori, G (1990) *The Construction Industry: Aspects of its Economic and Management*, Singapore: Singapore University Press

Ofori, G. (2000) Challenges of Construction Industries in developing countries: Lessons from various countries. *Proceedings of the 2nd International Conference of the CIBTG29 on Construction in Developing Countries: Challenges facing the construction industry in developing countries, 15-17 November*, Gaborone, Botswana, pp.40-50

Ofori, G. (2017) Practice of Construction Industry development at the cross roads. *Construction and Architectural Management*, 3(4). 271-288.

Oka, T. & Shaw, I. (2003) Qualitative Research in Social Work. In; Hisada. H. ed., Shakai Fukushi no Kenkû Nyûmon, *Introduction to Social Work Research*, pp. 115-147.

Oladinrin, T.O, Olatunji, O.S. and Hamza, T.B. (2013) Effect of selected procurement systems on Building project performance in Nigeria. International *Journal of sustainable construction engineering and Technology*, l (1).

Omoregie, A. & Radford, D. (2006) *Infrastructure delays and cost escalation: causes and effects in Nigeria*. Available from: <http://www.irbnet.de/daten/icconda/CIB8964.pdf> [Accessed 1 May 2016].

Oppong, F. (2013) *A study on performance of Contractors selected using the lowest bid Evaluation Method as Major Criteria in Ghana*, Akumasi Study. Msc Thesis. Kwame Nkrumah University of Science and Technology.

O'Sullivan.E. Rassel, G.R and Berner, M (2010), *Research Methods for Public Administrators*, 5th ed. New York: Pearson-Longman

Owour, D.O. (2016) *Factors influencing completion of construction projects in Kenya: A case of Government Buildings Construction projects in Naiobi County*, Kenya: University of Nairobi

Oyewobi, L.O., Ibrahim, A.D. and Ganiyu, B.O. (2012) Evaluating the Impact of Risk on Contractor`s Tender Figure in Public Building Projects in Northern Nigeria, *Journal of Engineering, Project and Production Management*, 2 (1), 2-13.

Parahoo, K. (1997) *Nursing Research: Principles, process and issues*, London: MacMillan Press.

Patton, F. (2005) Does Six Sigma work in service industries? *Quality Progress*, 38(9), 55--60

Petersen. C. P.M.P. (2013) The Practical Guide to Project Management, 1st ed, bookboon.com

Phillips, D.C. and Burbules, N.C. (2000) *Postpositivism and educational research*. Lanham, MD: Rowman and Littlefield

Phiri, F. (2016) *An analysis of the Twenty Percent Subcontracting Policy in the Zambian Construction Sector: Is Efficacy in Developing capacities of local Contractors*, Msc Thesis: University of Zambia

Pinto, J.K. and Prescot, J.R. (1989) "Variations in Critical Success factors over the stages in the Project Life Cycle". *Journal of Management*, 14(1), pp 518.

Pinto, J.K and Slevin, D.P. (1987) "Critical factors in Successful Implementation" *IEEE Transactions on Engineering Management*, 34, 22-27.

Pinto, J. K. and Slevin, D. P. (1988) Critical Success factors across the project life cycle. *Project Management Journal*, 19, 67-75.

Polit, D.F. and Hungler, B.P. (2004) *Essentials of nursing research: Methods, appraisals and utilizations, 5th ed.* Philadelphia: Lippincott-Raven Publishers

Project Management Institute (2006) *Guide Project Management Body of Knowledge (PMBOK©,* Pennylvania: PMI

Project Management Institute (2008) A *Guide to the Project Management Body of Knowledge (PMBOK©), 4th ed.* New Square, PA: PMI

Project Management Institute Inc (2013) *A guide to the Project Management Body of Knowledge (PMBOK Guide), 5th ed,* USA: Project Management Institute Global Standard

Qureshi, S.M. and Kang, C. (2015) Analysing the Organizational factors of Project Complexity using structural equation modelling. *International Journal of Project Management*, 33 (1): 165-176.

Rahim, A. B.H. (2010) *Effective Project Delivery-Strategies for Successful Implementation of Projects under 10th Malaysia Plan*, Malaysia: Universiti Tecknologi Malaysia

Rawlinson, F. and Farrel, P. (2010) "UK Construction industry site Health and Safety Management. An examination of proportional web material as an Indicator of Current Direction". *Construction Innovation*, 10(4), pp. 435-446.

Russek, B. E. & Weinberg, S. L. (1993) Mixed methods in a study of implementation of technology-based materials in the elementary classroom. *Evaluation and Program Planning*, 16(2), 131-142.

Salleh, R (2009) *Critical success factors of Project Mangement for Brunel Construction Projects: Improving Project Performance*. Phd Thesis. Queensland University of Technology

Sarshar, M and Pitt, M (2009) "Adding value to clients: learning from four case studies: *Facilities*, 27(9/10), pp. 399-412

Saul, F and Zulu, C (1994) Africans Survival plan meeting the Challenges of Information technology in the 1990s and beyond. *Libri*, 44 (1) 73-94

Saultana. M., Rahman. A. and Chowdhury. A. (2012) Performance Based Maintenance of Road Infrastructure by Contracting-A challenge for Developing Countries, Journal of Service Science and Management, 5, 118-123.

Saunders, M., Lewis, P. and Thornhill, A. (1997) *Research Methods for Business Students*, London: Pearson Education Limited.

Saunders, M., Lewis, P. and Thornhill, A. (2003) *Research Methods for Business Students, 2nd ed.* London: Pearson Education Limited

Saunders, M., Lewis, P. and Thornhill, A. (2007) *Research Methods for Business Students, 4th ed.* London: Pearson Education Limited

Saunders, M., Lewis, P and Thornhill, A. (2010) *Research Methods for Business Students, 5th ed.* London: Pearson Education Limited

Scarbrough, H and Davison, M.R. (2014) *Critical failure factors in ERP Implementation* [Online]. Available from: <https:// www.researchgate.net/publication/221228770> [Accessed 14 March 2014]

Shaban, S.S. A. (2008) *"Factors affecting the performance of Construction Projects in Gaza strip"*. Msc Thesis. The Islamic University of Gaza

Shao, J. & Muller, R. (2011) The development of constructs of program context and program success: A qualitative study. *International Journal of Project Management*, 29(8), pp. 947-959.

Share, B. (2016) *Key factors of successful project implementation*, Washington: Office of Budget and Policy, federal Tansit Administration.

Sibanyama, G., Kaliba. C. and Muya, M (20114) An Overview of Construction Claims. A case study of the Zambian Construction Industry. *International Journal of Construction Management*, 12(1), 65-81

Sichombo, B, Muya. M and Kaliba. C. (2009) Promotion of Ethical Conduct in the Zambian Construction Industry through Technical Auditing. In association of schools of

construction of Southern Africa. *Proceedings of the fourth Built Environment Conference 17-19 May, 2009 in Livingstone*, Zambia

Sichombo, B., Muya, M., Shakantu, W and Kaliba, C (2009) The need for Technical Auditing in the Zambian Construction Industry. *International Journal of Project Management*, 27(8), 821-832.

Silva, M.D., Lee, L. and Ryan, G. (2015) Using Theory of Change in the development, Implementation and evaluation of complex, health interventions, A practical guide , The Centre for Global Mental Health and the Mental Health Innovation Network: Mental Health Innovation Network

Siporin, M. (1980) Ecological Systems theory in Social Work. *Journal of Sociology and social welfare*, 9(4)5-7, 32

Sitko, N.J. (2013) *Designing a Qualitative Research Project: Conceptual Framework and Research Questions*, Lusaka: Indaba Agricultural Policy Research Institute.

Slevin D.P. and Pinto, J.K. (1987) "Balancing Strategy and Tactics in Project in Project Implementation". *Sloan Management Review*, 29(6), pp. 33-41.

Sobotka, A., Czarnigowska, A., and Stefaniak, K. (2005) Logistics of construction projects. *Foundation of Civil and Environmental Engineering*,6

Songer, A.D., and Molenaar, K.R. (1997) Project Characteristics for successful public-sector design-build. *Journal of construction Engineering Management*, 123(1), 34-40.

Stewart, R.A., Mohamed, S and Daet, R. (2002) Strategic implementation of IT/IS projects in construction: A case study. *Automation in Construction*, 11(6), 681-694

Steyn, H, ed., (2012) *Project Management: a multi-displinary approach. 2nd ed*. Pretoria: FPM Pub

Sweis, R.J., Bisharat, S.M., Bisharat, L. and Sweis, G. (2014) Factors Affecting Contractor Performance on Public Construction Projects. *Life Science Journal*, 11(4s), 28-39

Sweis, G., Sweis, R., Abu Hammad, A., & Shboul, A., (2007) Delays in construction projects: The case of Jordan. *International Journal of Project Management*, 26, 665-674.

Syed, M.A., Salman, A., Pragnya, K. & Dharam, G. (2003) *Delays inConstruction: A Brief Study of the Florida Construction Industry*, Miami, FL: Florida International University

Tabish, S.Z.S., & Jha, K.N. (2011) Analysis of irregularities in public procurement in India. *Journal of Construction Management Economics*, 29(3): 261-274.

Thanasegaran, G. (2009) "Reliability and Validity issues in research", *Integration and Dissemination*, 4, 35-40.

Takim, R & Akintoye, A. (2002) Performance indicators for successful construction project performance. In: Greenwood, D (ed.), 18th Annual Arcom Conference, 2-4

September, and University of Northumbria. *Association of Researchers in Construction Management*, Vol. 2, 545-55.

Takim, R., Akintoye A. & Kelly, J, (2004) Analysis of measures of construction project success in Malaysia. *Association of Researchers in Construction Management*, 2(2), 1123-1133.

Tan, Y., Shen, L. & Yao, H. (2011) Sustainable Construction Practice and Contractors` competitiveness. A preliminary study. *HABITAT International*,35, 225-230.

Tashakkori, A. & Teddlie, C. (2003) *Handbook of mixed methods in social and behavioural sciences,* Thousand Oaks: Sage

Tashakkori, A. and Teddlie, C. eds. (2010) *SAGE handbook of mixed methods in social and behavioural research .2ed*. Thousanda Oaks, CA: Sage

Tawil, N.M., Khoiry, M.A., Arshad, I., Hamzah, N., Jasri, M.F., and Badaruzzaman, W.H.W. (2013) Factors Contribute to Delay Construction in Higher Learning Education, Case Study UKM. *Research Journal of Applied Sciences, Engineering and Technology*, 5 (11), 3112-3116.

Tembo, C.K., Chiponde, D., Mutale. L and Michelo, N (2015) Risk Reduction on Infrastructure Projects in the Zambian Construction Industry through Integrated Risk Management (IRM) Approach, *Modern Environmental Science and Engineering*, 1(3), 156-163

Tengan, C and Aigbavboa, C (2016) Evaluating Barriers to Effective Implementation of Project Monitoring and Evaluation in the Ghanaian Construction Industry. *Procedia Engineering*, 164, 389-394

Thomson, B. (1992a) Misuse of ANCOVA and related "Statistical Control procedures". *Reading Psychology*, 13(1), iii-xviii

Thomson, B. (1992b) Interpreting regression results: Beta weights and Structure coefficients are both important. Paper presented at the annual meeting of the American Educational Research Association, San Francisco

Transparency International (2007) *Anti- Corruption Training Manual (Infrastructure, Construction and Engineering Sectors) International Version* [Online], Available from: < online: http; // www.giacce-nthe.org/documents/giacc.training manual.int.pdf> [Accessed 15 October 2015]

Tsoulfas, G.T. & Pappis, C.P. (2008) A model for supply chains environmental performance analysis and decision making. *Journal of cleaner production*, 16, 1647-1657.

Ugwa, O.O. and Haupt, T.C. (2005) "Key Performance indicators for infrastructure sustainability-a comparative study between Hong Kong and South Africa*". Journal of Engineering, Design and Technology*, 3(1), pp 30-43.

United Nations (2014) *Good Working Conditions, Good Business? An Analysis of Zambian`s Building Construction Market System, The Zambian Green Jobs*

Programme, The Lab, Market Systems Development for Decent Work, Lusaka: United Nations

UNRWA (2006) *Projects completion reports*, Gaza: UNRWA

Walker, D.H, T. and Vines, M.W. (2000) "Australian multi-unit residential project construction time performance factors." *Eng. Constr.Archit.Mana*, 7(3), 278-284

Walker, P. And Greenwood, D. (2002) *Construction Companion to risk and value management*, London: RIBA Enterprises

Wallar, D. (2017) "Developing attributes for Evaluating Construction Project –based performance. *The TQM Journal*, 29(2), pp369-384.

Wambui, D.N., Ombui, K, and Kagiri, A. (2015) Factors Affecting Completion of Road Construction Projects in Nairobi City County: Case Study of Kenya Urban Roads Authority (KURA).*International Journal of Scientific and Research Publications*, 5(11), pp.2250-3153.

Wilson, K.L. (2009) *Project Management Hand Book*, New York: Van Nostrand Reinhold CO

Yung, P. &Yip, B. (2010) Construction quality in China during transition: A review of literature and empirical examination. *International Journal of Project Management*, 28 (1), 79-91

Ziglari. L. (2017) Interpreting Multivariate Regression Results: β weight and Structure coefficients, Texas, A &M University. General Linear Model Journal, 43(2).

Zientek, L. and Thomson, B. (2006) Applying bootstrap to the Multivariate Case: Bootstrap Component /factor analysis. *Beharviour Research Methods*, 39 (3), 318-325

Zikmund, W., Babin, B., Carr, J., and Griffin, M. (2010) *Business Research Methods, 8th ed.* South-Western: Cengage Learning

Zou, P.X.W. and Zhang, G. & Wang, J. (2007) Understanding the key risks in construction projects in China. *International Journal of Project Management*, 25(6), 601-614.

Zulu, S and Chileshe, N(2009) Using service Quality to Enhance competitive positioning of local contractors in Zambia, *In Associations of Schools of Construction of Southern Africa, Proceedings , The 4th Built Environment Conference, 17-19 May in Livinstone*, Zambia.

Zulu, S and Chileshe. N (2014) Service quality of building Maintenance Contractors in Zambia: A pilot study. *International Journal of Construction Management*, 10(3), 63-81

Appendix I: Semi-Structured Interview Guide

1.0 General Information: This section is designed to obtain general information

1.1 Indicate position in organization (tick): **Senior Manager** ☐ **Middle Manager** ☐ **Other** ☐

1.2 Indicate what role; your organization playing public sector construction projects, from among the given categories below

	Tick
Client (Project promoters/end users/Representatives)	
Consulting firm	
Contracting/Subcontracting firm	
Material Supplying firm	
Other(specify):	

2.0 Challenges: This section is designed to establish challenges experienced at implementation stage of public sector constructions projects

2.1 Do you think there are some challenges faced during implementation of public sector construction projects in Zambia?

Yes ☐

No ☐

If yes, which of the following do you think affect the implementation of public sector projects?

A) Project design related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Fault project design			
Non-involvement of project participants during design			
Unrealistic scope			
Unanticipated design changes			
Design complexity			
Fault project conceptualization			
Poor project scheduling			
Non-involvement of project beneficiaries during identification of project			
Other(please specify):			

B) Project Management related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Poor project management			
Incompetence of project managers			
Lack of technical skills			

Lack of appropriate coordinating skills			
Lack of motivation of staff			
Ineffective monitoring and feedback mechanisms			
Dishonest conduct by management			
Non-involvement of project stakeholders during identification of project			
Violation of health and safety rules by management			
Lack of authority by management			
Not working closely with the client			
Poor project planning			
Other (please specify)			

C) Procurement related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Poor selection methods(i.e. selection of bids based on least prices)			
Corruption			
Tender documents not specifying needed inputs(i.e. materials and services)			
Unrealistic and dishonesty variations (Excessive client change orders in terms of scope changes and contract modifications)			
Unavailability of specified materials and equipment			
Length approval procedure			
Competencies of suppliers			
Other(please specify):			

D) Projects participants related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Lack of team work among participants			
Excessive owner change orders			
Low level of commitment by participants			
Increased conflict among project participants			
Participants violation of health and safety rules			
Negligence of duty by participants			
Fraudulent certification of works in order to conceal errors			
Collusion to defraud the client by Contractors and Consultants and sometimes with client`s representatives			
Other(please specify):			

E) Financial related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Low client financing capacity			
Delay in clearance of stage completion certificates			
Delay and non-release of counterpart funding			
Deliberate delay in payments to induce corruption and bribes			

Insufficient working capital for Contractors			
Misallocation of funds by contractors			
Lack of accountability and transparency			
Inaccessibility to funds by contractors due to institutional lender`s rigidities			
Other(please specify):			

F) External Environment related challenges

	Agree	**Do Not Agree**	**Don`t Know**
Political interference in contracts determination			
Bureaucracy in public sector projects			
Weak monitoring and control systems in public sector			
Natural Calamities (e.g., droughts, hailstorms, landslides, etc.)			
Unanticipated policy changes			
Escalation of project costs due to inflationary pressures			
Adverse social aspects (e.g., poor working culture)			
Changes in government rules and regulations			
Lack of supporting infrastructures (e.g., markets)			
Frequent changes in government			
Other (please specify):			

3.0 Success Indicators: This section is designed to obtain ratings of success of implementation of public sector construction projects using various identified

3.1 What, in your view, are the ratings of success of implementation of public sector construction projects in Zambia using various success criteria? (1= Very low, 2=Low, 3=Good, 4= High and 5=Very high)

Success Indicators	**Ratings**				
	1	**2**	**3**	**4**	**5**
Projects executed within schedule (Time)					
Projects implemented within the planned budget (Cost)					
Project executed as specifications (Quality)					
Projects implemented to promoters satisfaction (Client Satisfaction)					
Projects implemented with minor health and safety incidences(Health and safety incidences)					
Projects implemented within manageable disputes(Site disputes)					
Projects implemented sustainably(Environmental impact)					
Other (please specify):					

4.0 Success factors: This section is designed to establish the Critical Success factors at implementation stage of public sector construction projects in Zambia

4.1 To what extent do the factors indicated below significantly affect the success of implementation of public sector construction project? (Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

A) Design related success factors

S/n		Ratings				
		1	2	3	4	5
1	Minimal changes in design and specifications					
2	Need for adequate schedule					
3	Need for quality designs					
4	Requirement for realistic cost estimates					
5	Team members involvement during design					
6	Need for realistic scope					
7	Clearly established success criteria					
8	Need for clearly defined goals					
9	Need for clearly specified materials					
	Other (please specify):					

B) Project Management related success factors

(Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

S/n		Ratings				
		1	2	3	4	5
1	Project Manager`s competence					
2	Need for an on-site Project Manager					
3	Need for Managers with necessary authority					
4	Requirement for managers `understanding of project mission					
5	Top down commitment					
6	Project team motivation and good orientation					
7	Monitoring , feedback and control mechanisms					
8	Effective project schedule application					
9	Management of supply chain and logistics					
10	Risk Management					
11	Effective Communication					
	Other, (please specify):					

C) Procurement related success factors

(Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

S/n		Ratings				
		1	2	3	4	5
1	Effective Procurement planning					

2	Contract monitoring and Control					
3	Choice of procurement procedure					
4	Need for competent procurement team					
5	Need for honest procurement team members					
6	Need for corrupt free procurement system					
7	Availability of specified materials					
8	Availability of suitable equipments					
9	Need for clearly specified materials					
10	Contracting philosophy on environment and health and safety considerations					
11	Competent suppliers					
	Other(please specify):					

D) Project participants related success factors

(Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

S/n		**Ratings**				
		1	**2**	**3**	**4**	**5**
1	Competence of project participants					
2	Size of available labour force					
3	Skills of available labour force					
4	Type of participants					
5	Size of participants` organizations					
6	Participants` emphasis on goal achievements					
7	Goal commitment of project team					
8	Effective communication channels between project participants					
9	Coordination between project participants					
	Other (please specify):					

E) Financial related success factors

(Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

S/n		**Ratings**				
		1	**2**	**3**	**4**	**5**
1	Financial capacity of client					
2	Adequacy of working capital of Contractors					
3	Need for timely clearance of stage completion certificates by clients					
4	Availability of resources as planned through project execution duration					
5	Cash flow of Contractor to enable steady payments to subcontractors and workers					
6	Financial accessibility to Contractors					
7	Need for Accountability and transparency					
8	Timely release of counterpart funding					
	Other (please specify):					

F) Environmental related success factors

(Where; 1=Not important, 2= A little important, 3 =Important, 4=More important and 5=Most important).

S/n		Ratings				
		1	2	3	4	5
1	Economic conditions prevailing at a time					
2	Social and cultural orientation of the community					
3	Political conditions prevailing at a time					
4	Bureaucracy					
5	Climatic conditions					
6	Ecological Environment					
7	Laws and regulations governing contracts industrial operations					
8	Technological standard					
9	**Other (please specify):**					

5.0 Strategies: This section is designed to establish the suitable strategies for enhancing success of implementation of public sector construction

5.1 What strategies can be employed to improve implementation of public sector construction projects in Zambia?

…….....**.....**

……
……
……
……
……

Thanks for your participation

Appendix II: Questionnaire for General Survey

INSTRUCTIONS: The questionnaire has six sections. Kindly respond to all questions. All information will be treated with utmost confidentiality. **Please tick in the appropriate box, where explanation is requested , please be concise** √

1.0 General information

1.1 Age bracket (years): 18-20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ above 50 ☐

1.2 Gender: Male ☐ Female ☐

1.3 Education level: Masters/PhD ☐ First degree ☐ Diploma/Technician ☐
Other:

1.4 Your position on the project: Client ☐ Consultant ☐ Contractor ☐ Other:

1.5 Profession: Architect ☐ Engineer ☐ Quantity Surveyor Other, ☐
specify……

1.6 Please indicate how long you have been involved with the Public sector construction projects?

Below 5 years ☐ 5-10years ☐ 11-15 years ☐ 16-20 year ☐ above 20 ☐

1.7 Indicate what type, your organization is, from among the given categories below (Please tick)

	Tick
Construction company: Buildings	
: Roads	
Consulting firm	
Donor Agency	
Public Sector organisation	
Quasi government organisation	
Private company/organisation	
Other(please specify)	

2.0 Challenging factors encountered during implementation stage of Public Sector Construction Projects

This section seeks to determine challenging factors faced during the implementation phase of Public Sector Construction projects. These factors have been categorized under six heads; Project design related, management related, procurement related, participants related, financial related, and External environmental related factors. On the basis of the projects you were involved in, you are kindly requested to indicate your level of agreement with each of the following project challenging or failure variables on 1to 5 point Likert scale **(1= strongly disagree , 2 =disagree, 3=Indifferent, 4= Agree and 5= strongly agree)**

	Project challenges/failure variables	**Level of Agreement**				
Design related factors (4)	**DCVI :** Fault project design	1	2	3	4	5
	DCV2: Non-involvement of project participants during design	1	2	3	4	5
	DCV3: Unexpected design changes	1	2	3	4	5
	DCV4: One design fits all	1	2	3	4	5
Management related factors(6)	**MCV1**: Poor project management	1	2	3	4	5
	MCV2: Incompetence of project Managers	1	2	3	4	5
	MCV3: Lack of appropriate coordination	1	2	3	4	5
	MCV4: Lack of motivation of staff	1	2	3	4	5
	MCV5: Ineffective monitoring and feedback mechanisms	1	2	3	4	5
	MCV6: Dishonest conduct by Management	1	2	3	4	5
Procurement related factors(4)	**PCV1**: Increased levels of Corruption	1	2	3	4	5
	PCV2: Length of approval procedure	1	2	3	4	5
	PCV3: Unavailability of specified materials	1	2	3	4	5
	PCV4: Tender documents not specifying needed inputs	1	2	3	4	5
Project Participants related factors (5)	**PPCV1**: Lack of team work among participants	1	2	3	4	5
	PPCV2: Excessive owner change orders	1	2	3	4	5
	PPCV3: Increased conflict among project participants	1	2	3	4	5
	PPCV4: Negligence of participants	1	2	3	4	5
	PPCV5: Fraudulent certification of works in order to conceal errors	1	2	3	4	5
Financial related factors(6)	**FCV1**: Reduced client financing capacity	1	2	3	4	5
	FCV2: Delay in clearance of stage completion certificates	1	2	3	4	5
	FCV3: Insufficient working capital for contractors	1	2	3	4	5
	FCV4: Misallocation of funds by contractors	1	2	3	4	5
	FCV5: Inaccessibility to funds by contractors	1	2	3	4	5
	FCV6: Inconsistent payments	1	2	3	4	5
External Environment related factors(8)	**ECV1**: Political interference in contracts determination	1	2	3	4	5
	ECV2: Bureaucracy in public sector projects	1	2	3	4	5
	ECV3: Weak monitoring and control systems in Public sector	1	2	3	4	5
	ECV4: Climate change effects (e.g., droughts, hailstorms, landslides, etc.)	1	2	3	4	5
	ECV5: Escalation of project costs due to inflationary pressures	1	2	3	4	5
	ECV6: Adverse Social aspects (e.g., poor working culture)	1	2	3	4	5
	ECV7: Changes in Government rules and regulations	1	2	3	4	5
	ECV8: Lack of needed supporting infrastructures (like roads)	1	2	3	4	5

3.0 Variables used to measure success during implementation of public sector construction projects

Based on your experience associated with the current as well as other construction projects in the past, you are kindly requested to indicate your level of agreement with each of the following project implementation performance measurement variables on 1 to 5 point Likert scale **(1= strongly disagree, 2 Disagree, 3 =Indifferent, 4= Agree and 5= strongly Agree)**

	Success Measurement Variables (SMV)	Level of Agreement				
Time Success Factors (5)	**TSV1**:Project execution is done within schedule	1	2	3	4	5
	TSV2:Timely delivery of resources	1	2	3	4	5
	TSV3: No delays in securing funds	1	2	3	4	5
	TSV4: No delays due to design changes	1	2	3	4	5
	TSV5: Clear plans are formulated	1	2	3	4	5
Cost Success Factors(6)	**CSV1**: Project execution are done within the stage approved cost	1	2	3	4	5
	CSV2: No increase in material costs	1	2	3	4	5
	CSV3: Minimum variation costs are incurred	1	2	3	4	5
	CSV4: Stable labour costs	1	2	3	4	5
	CSV5: No financial claims at end of implementation stage	1	2	3	4	5
	CSV6: Equipment at pre-budgeted costs	1	2	3	4	5
Site Dispute Success Factors (4)	**DSV1**: No serious dispute due to specifications	1	2	3	4	5
	DSV2: Minimised disputes due to the frequent changes	1	2	3	4	5
	DSV3: Harmonious relationship on site	1	2	3	4	5
	DSV4: No incidences of trade union agitation	1	2	3	4	5
	DSV5: Dispute resolution meetings	1	2	3	4	5
Environmental Impact Success factors (5)	**ESV1**:Reduced air pollution from project site	1	2	3	4	5
	ESV2: Reduced solid waste	1	2	3	4	5
	ESV3: Use of environmentally friendly technology	1	2	3	4	5
	ESV4: Reduced depletion of natural resources	1	2	3	4	5
	ESV5: No effect of weather and climate conditions	1	2	3	4	5
Quality Success Factors (5)	**QSV1**: Projects executed conform to specifications	1	2	3	4	5
	QSV2: Right material used for construction work	1	2	3	4	5
	QSV3: A sound Quality Management System adhered to	1	2	3	4	5
	QSV4: Workers trained on Quality Culture	1	2	3	4	5
	QSV5: No observed apparent defects at stage end	1	2	3	4	5
Safety and Health Success Factors (3)	**SSV1**: Accidents were reported	1	2	3	4	5
	SSV2: Minimal occurrence of fatalities	1	2	3	4	5
	SSV3: Minimal losses of resources due to thefts	1	2	3	4	5
Client Satisfaction Success Factors (3)	**CSV1**: Increased client support to projects	1	2	3	4	5
	CSV2: Increased level of client cooperation	1	2	3	4	5
	CSV3: Increased client appreciation	1	2	3	4	5

4.0 Critical Success factors affecting success of implementation of Public Sector Construction projects

This section seeks to determine the 'Critical Success factors' that influence the success of implementation of public sector construction projects. These factors have been categorized under seven heads; Project design related, procurement related, management related, participants related, project related, financial related and external environment related factors. On the basis of the public projects you were involved in, you are kindly requested to indicate your level of agreement with each of the following project success variables on 1 to 5 point Likert scale (1=strongly disagree, 2=Disagree, 3= Indifferent, 4= Agree and 5= strongly agree).

	Critical Success Variables (CSV)		**Level of Agreement**				
Design related factors (7)	**i**	Reduced design changes reduces the cost of implementation of project	1	2	3	4	5
	ii	Project Implementation schedule affects accuracy of the project	1	2	3	4	5
	iii	Project documentation (drawings and bills of quantities) is usually accurate and complete	1	2	3	4	5
	iv	The cost of material is dependent on their availability	1	2	3	4	5
	v	The types of materials specified determine the amount of time taken for their procurement and delivery	1	2	3	4	5
	vi	Site meetings are held monthly as stipulated	1	2	3	4	5
	vii	Project team site inspections are held bi-weekly	1	2	3	4	5
Management related factors (6)	**i**	Recruitment of Project Managers on the basis of education, training and experience increases success of projects	1	2	3	4	5
	ii	Top project managers are given weekly reports	1	2	3	4	5
	iii	Top project managers attends monthly site meetings	1	2	3	4	5
	iv	Relevant information is usually communicated within a reasonable time	1	2	3	4	5
	v	Relevant project control measures are usually in place	1	2	3	4	5
	vi	There is constant flow of needed materials to project sites	1	2	3	4	5
Procurement related factors (8)	**i**	Project delivery is done within estimated time	1	2	3	4	5
	ii	Specified materials are procured within expected time	1	2	3	4	5
	iii	There is increased levels of monitoring and evaluation mechanisms (of procurement) in place	1	2	3	4	5
	iv	There is no limit in the number of bidders for projects	1	2	3	4	5
	v	There is reduced compensation price level	1	2	3	4	5
	vi	There is reduced reliability on price on the awards of contracts	1	2	3	4	5
	vii	The tender board committee members are fairly motivated in order to deter corruption	1	2	3	4	5

	viii	The process of procurement is open to all eligible input suppliers	1	2	3	4	5
Project participants related factor (9)	**i**	Engagement of project participants on the basis of education, training and experience increases success of projects	1	2	3	4	5
	ii	Size and experience of client affect success of the project	1	2	3	4	5
	iii	Terms of employment (such as daily wages, piece work,) affect the work output of personnel	1	2	3	4	5
	iv	Ways used to motivate personnel (such as bonuses, time-off, training opportunities) affect productivity levels	1	2	3	4	5
	v	Assignments are allocated to personnel based on their specialized skills	1	2	3	4	5
	vi	Sometimes there is shortage of available appropriate workforce in a particular area at a particular time	1	2	3	4	5
	vii	Fluctuations in number of personnel required over different periods of time affect success of the project	1	2	3	4	5
	viii	Increased collaboration affect success of projects	1	2	3	4	5
	ix	Increased commitment affect success of projects	1	2	3	4	5
Financial related factor(8)	**i**	The contract sum is usually equivalent to the tender sum	1	2	3	4	5
	ii	Client's level of capital base affects progress of project	1	2	3	4	5
	iii	Loans are easily processed by banks and other financial institutions	1	2	3	4	5
	iv	Valuation and certification of work is completed within the stipulated two weeks period	1	2	3	4	5
	v	Minimised valuations for payments reduces disputes	1	2	3	4	5
	vi	Payment certificates are honoured within the stipulated two weeks period	1	2	3	4	5
	vii	Plans and records of income and expenditure are updated on a weekly basis	1	2	3	4	5
	viii	Counterpart/community contribution funds are honoured in time as pledged	1	2	3	4	5
Project related factors	**i**	Some types of construction projects are easy to execute	1	2	3	4	5
	ii	There are various laws and regulations which affect smooth execution of projects	1	2	3	4	5
	iii	The less complicated construction projects are the too easy to implement	1	2	3	4	5
	iv	The topography of a project site affect smooth implementation of projects	1	2	3	4	5
	vi	Some construction projects requires many operating units to succeed	1	2	3	4	5
	vii	The less the number of floors of the construction project the more easy it is to execute	1	2	3	4	5
	viii	The less the cost of the construction project the more easy it is to execute.	1	2	3	4	5
	ix	The smaller the number of focused beneficiaries of the project the more easy it is to execute	1	2	3	4	5

5.0 Intervening Critical Success factors affecting success of implementation of Public Sector Construction projects

This section seeks to determine the Intervening Critical Success factors that influence the success of implementation of public sector construction projects. These factors have been categorized under one head which is external environment related factors. On the basis of the public projects you were involved in, you are kindly requested to indicate your level of agreement with each of the following project success variables on 1 to 5 point Likert scale (1=strongly disagree, 2=Disagree, 3= Indifferent, 4= Agree and 5= strongly agree).

	Intervening Critical Success Variables		**Level of Agreement**				
External Environment related factors	i	Income levels in the country affect success of projects	1	2	3	4	5
	ii	Increases in prices of construction inputs affect success of project	1	2	3	4	5
	iii	Increased poverty levels in the country affect success of the project	1	2	3	4	5
	iv	Some prevailing culture affect the speed of doing work	1	2	3	4	5
	v	The number of social amenities in a project area has a positive effect on project success	1	2	3	4	5
	vi	Increased levels of social security has positive effect on project success through motivation of workforce	1	2	3	4	5
	vii	Stable political atmosphere in the country increases level of government commitment to projects	1	2	3	4	5
	viii	Amount of support to projects is enhanced by democracy in the nation	1	2	3	4	5
	ix	Reduced levels of bureaucracy positively affect success of project	1	2	3	4	5
	x	Reduced political interference positively affect success of project	1	2	3	4	5
	xi	Project sites richly endowed in required natural resources positively affect success of project	1	2	3	4	5
	xii	Reduced number of hazards during project implementation positively affect project success	1	2	3	4	5
	xiii	Increased levels of accessibility to required resources positively affect success of the project	1	2	3	4	5
	xiv	Increased levels adherence to laws and regulations surrounding project management positively affect success of projects	1	2	3	4	5
	xv	Reduced number of contradictory laws and regulations positively affect success of the project	1	2	3	4	5

6.0 Success Indicators for implementation of public sector construction projects

This section seeks to determine the Success indicators of implementation of public sector construction projects. These factors have been categorized under one head which is Successful implementation of public sector construction projects. On the basis of the public projects you were involved in, you are kindly requested to indicate your level of agreement with each of the following project success variables on 1 to 5 point Likert scale **(1=strongly disagree, 2=Disagree, 3= Indifferent, 4= Agree and 5= strongly agree).**

	Success variables for implementation of projects		**Level of Agreement**				
Successful implementation of public sector construction projects	i	Projects executed within the approved percentage contract sum for implementation	1	2	3	4	5
	ii	Projects implemented within the approved percentage contract period	1	2	3	4	5
	iii	Projects executed conform to specifications	1	2	3	4	5
	iv	Increased project support by client signifying client satisfaction during implementation of project	1	2	3	4	5
	v	Minor incidences of accidents and sicknesses during implementation	1	2	3	4	5
	vi	Project executed with less disputes	1	2	3	4	5
	vii	Project implemented with less destruction to the environment	1	2	3	4	5

7.0 Strategies for improvement of implementation of public sector construction projects

This section seeks to establish the vital strategies for improvement of implementation of public sector construction projects. Some proposed strategies gathered from literature review have been aligned. What do you recommend to be included as vital strategies for improvement of implementation of public sector construction projects? On the basis of the public projects you were involved in, you are kindly requested to indicate your level of agreement with each of the following project success variables on 1 to 5 point Likert scale **(1=strongly disagree, 2=Disagree, 3= Indifferent, 4= Agree and 5= strongly agree)**.

	Strategies for improvement of implementation of public sector construction projects	**Level of Agreement**				
i	Encouragement of private sector participation through Public-Private Partnerships (PPP)					
ii	Encouragement of private sector participation through Engineering financing initiatives (CFI) among other things					
iii	Encouragement of private sector participation through Contract financing initiatives among other things					
iv	Allow technocrats to make decision on the technical issues of the projects as opposed to political stakeholders					
v	Effective monitoring and feedback mechanisms should be put in place to avoid collusion between consultants and contractors guilty					
vi	Skills training and capacity building of stakeholders that are directly involved in projects implementation					

vii	Government should ensure appropriate planning and adequate finance of projects					
viii	Local financial institutions for Construction projects should be created to enable easy access of funds by local players					
ix	Establishment of data base of experienced and competent project managers					
x	Enforcement of output based budgeting and financing of projects rather than activity based model					
xi	Development of policies which encourages need for all stakeholders (Clients, Consultants, Contractors and manufacture/material suppliers) to adhere to the value for money principle					
xii	A deliberate policy should be put in place were foreign contractors should work hand in hand with local contractors so as to build capacity and share on the success on how to manage projects efficiently and effectively					

7.1 What are other strategies do you recommend for improvement of public sector construction projects in
Zambia……
……
……
……
……
……
……
……
……
……
……
……
……
……..

Thank you for participation

Appendix III: Questionnaire for Expert Validation of Framework

Questionnaire Survey for Validation of Model

This questionnaire is intended to validate the functionality, user friendliness and usefulness of the attached proposed model for measuring performance of implementation stage of Public sector construction projects. The model is aimed at improving performance of projects along the Project life cycles, to be specific implementation stage of Public sector construction projects. Kindly study the proposed model and answer the accompanying questions by ticking /writing in the spaces provided.

1. Name of Company/Organisation……..
2. Position of Respondent in Company/Organisation…….
3. Years of experience……
4. Have you previously come across a model for measuring performance of projects along the Project life cycle, to be specific along the implementation stage of Public sector Construction projects? Yes ☐ No ☐

   If "Yes", briefly explain? …….

5. Do you think the model is user-friendly? Yes ☐ No ☐

   If "No", State the reasons why.....

6. Can the model for measuring success of implementation of Public Sector Construction Projects be applied in Construction industry in Zambia?

   Yes ☐ No ☐

   If "No" State the reasons? ……

7. Do you think this model can be used to improve successful implementation of Public Sector Construction Projects?

   Yes ☐ No ☐

   If "No", State the reasons why? …….

8. Do you have any other comments with respect to the framework?
   ……

Appendix IV: Questionnaire for Industry-View Validation

Questionnaire Survey to Establish Industry-View of Model

1.0 General information (tick appropriate)

a) Profession : Architect ☐ Engineer ☐ Quantity Surveyor ☐

Others (indicate): ……..

b) Years of experience: 0-5 yrs ☐ 6-10 yrs ☐ Over 10 yrs ☐

c) State type of Organisation you work for (please tick):

Construction Company ☐

Public Sector Construction Client ☐

Consulting firm ☐

Quasi Government Construction Client ☐

Private Sector Construction Client ☐

Other (State)…… ☐

2.0 Kindly attempt to measure performance at implementation stages of Public Sector construction projects using the proposed model for measuring performance of projects that is attached. (by scoring the relationships from 1 to 5 in the intersection boxes)

Success Criteria	**Top Management Commitment**	**Supply Chain Management**	**Risk Management**	**Corruption free tender system**	**Procurement planning**	**Transparency in Procurement**	**Progress payment system**
Cost							
Time							
Quality							
Client Satisfaction							
Site Disputes							
Environmental impact							
Success Criteria	**Team members` involvement**	**Progressive Economic conditions**	**Prevailing culture**	**Stable climatic conditions**	**Stable Political conditions**	**Minimised Bureaucracy**	**Natural Endowments**
Cost							
Time							
Quality							
Client Satisfaction							
Site Disputes							
Environmental impact							

3.0 With respect to the attached model, please answer the following questions.

a) Is the model clear and unambiguous? Yes ☐ No ☐

b) Is the model useful? Yes ☐ No ☐

c) Can the model be used to measure performance of the implementation stage of Public sector construction projects? Yes ☐ No ☐

3.1 What challenges does your organization face in measuring performance of implementation of Public sector construction projects?

…….

3.2 What other views do you have regarding the model?

……

……

……