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An Investigation into the Applications of Total Quality Management on Government Funded Road Projects in Zambia A Case Study: The Kitwe-Ndola Dual carriageway

By **Jatto Siame**

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An Investigation into the Applications of Total Quality Management on Government Funded Road Projects in Zambia

A Case Study: The Kitwe-Ndola Dual carriageway

BY

Jatto Siame

13061582

A dissertation submitted to the Copperbelt University in fulfillment of the requirements for the Degree of Master of Science in Project Management

THE COPPERBELT UNIVERSITY

KITWE

2015

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DECLARATION

I hereby declare that all the work contained in this document is solely my own and has not been submitted by anyone to any institution of learning be it for a Diploma, Degree or any other qualification to the best of my knowledge.

……..……. ……...…… (Author)

Signature Date

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My special thanks go to my Parents, Mr. and Mrs. Siame for their unending love and guidance. Special thanks goes to my Project supervisor Mr.Jain for his total commitment and unfading guidance throughout the research, to you sir, I would not have made it thus this far if it wasn't for your strong guidance and undeserving support.

To my brothers and sisters, I implore you to never lose hope, better days are coming.

Jatto Siame

The Copperbelt University

May 2015

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LIST OF ACRONYMS

TQM	Total Quality Management
NRFA	National Road Fund Agency
CSM	Contractors site Management
DDF	Design and Documentation Factors
FIN	Financial and Management Factors
WRF	Human Resource Factors
PAC	Public Accounts Committee
RDA	Road Development Agency
CSF	Critical Success Factors
GRZ	Government of the Republic of Zambia
QCBS	Quality and Cost Based Selection
LCS	Least Cost Selection
FBS	Fixed Budget Selection method
QBS	Quality Based selection
NCB	National Competitive Bidding
ICB	International Competitive bidding
NCC	National Council for Construction
RFP	Request for Proposals
IPC	Interim Payment certificate
PDSA	Plan-Do-Study-Act Cycle
TQM	Total Quality Management
WTO	World Trade Organisation
ZIPAR	Zambia Institute for Policy Analysis and Research

ABSTRACT

The construction industry plays a vital role in the economic development of any country. The road sector in Zambia has been taken as the major drive in the effective transportation of goods and services from one area to another within the country and beyond. The general aim of the study was to establish the causes of poor quality road projects, quality shortfalls and schedule overruns in the Zambian road sector on government funded road projects. The research took a case study of the Ndola-Kitwe dual carriageway. This road directly serves a population of three towns and beyond, namely Ndola, Kitwe and Luanshya. The escalations on Costs, Schedule overruns and quality shortfalls have a negative effect on the performance of the road sector in enhancing economic growth of a country.

The research was conducted by use of closed ended type of questionnaires. These were delivered and collected by hand by the author himself to and from the respondents. The results from the Ndola-Kitwe dual carriageway confirmed that the project had cost escalations of 7.2% with a schedule overrun of 72.2%. Cost and schedule overruns were seen on other projects investigated. From the findings, the study identified lack of contractor experience, material shortages, project scope changes, poor project planning, high labour costs and insufficient tendering information and site conditions as the major causes of Cost overruns. Further the study identified changes in initial designs, low labour productivity, wrong material estimates, decision making delays and unforeseen ground conditions as the major causes of schedule overruns. On quality shortfalls, the study identified lack of material testing, late consultant engagements, wrong estimates and inadequate specifications as the major causes of quality shortfalls.

The study concluded that although there are levels on the usage of Total Quality Management principles on government funded road projects, however there are no formal systems that have been set up to implement the use of Total Quality Management. It was also established that the project team members lack training and education in the management of projects.

Appropriate training and education for project personnel should be enhanced couple with supplier involvement. The study also recommended the use of Quality groups in the implementation of Total Quality Management usage on Road construction projects.

Keywords: Total Quality Management, Cost, Quality, Schedule and implementation

CHAPTER ONE

PROBLEM SPECIFICATION

1.1 Introduction

This chapter provides the background, problem statement, research questions, project objectives and the significance of the study. It also sets out the objectives of the study that were used as well as the research questions pertaining to the road construction industry whose funding comes from the Government. It has also set out the main three problems that the projects face in terms of Quality shortfalls, Cost escalations and Schedule overruns.

1.2 Background

This study focused on an investigation into the applications of Total Quality Management in the road construction industry, specifically on Government funded road projects in Zambia.

Total Quality Management (TQM) implementation has been slow in the construction industry probably due to the age of the industry and the reluctance to change old management techniques; on the other hand projects are getting bigger and more complex while clients are demanding higher standards of quality of the end product (Dam, 2010).

This study looked at Total Quality Management (TQM) and its applications on Government funded road projects in Zambia, to be specific, the Kitwe-Ndola dual carriageway was the project of consideration in this research.

In Zambia most projects have experienced Quality problems, Time overruns, Cost escalations, and the public has always bemoaned the lack of quality on the finished road product (Chabota, 2010) despite the huge sums of money that the Government seems to be allocating towards road projects. This research established the causes of poor quality road projects and how applications of Total Quality Management (TQM) on Government Funded road projects would be able to help alleviate the vice.

Kojo (2014) outlined that Total Quality Management has been used to reduce on waste, poor quality works and re-works to reduce on costs and increase on efficiency in the problems of road projects with other associated costs. Kojo (2014) further noted that the success on projects where TQM has been used lie in its proper coordination of work processes which encourages continuous improvement in all parts of the business with the major mandate of meeting or exceeding customer satisfaction. Quality attainment should therefore not be dependent on organisation or project size but should perform towards customer satisfaction and organizational performance improvement.

In relation to other industries, the construction industry has been cited as the major culprit in the execution of projects in terms of customer satisfaction (Hoonakkera et al.2010). Wong and Kanji (1998) cited by (Hoonakkera et al.2010) noted that most construction industry's management principles are being challenged and hence there is a shift in the way projects are being managed towards to those being used in the manufacturing industry. Wong and Kanji (1998) revealed that Quality Management concepts have been increasing in usage in recent years in the construction industry in solving quality problems and meeting customer demands. It was however noted by (Hoonakkera et al.2010) that the implementation of TQM has been difficult in the construction industry due to the

lack of industry standardization and that too many parties are involved in the execution of projects. The construction industry has been facing challenges of Project costs, safety due to the lack of a defined system process and Total Quality Management can be a solution to the problems faced in the construction industry (Hoonakkera et al.2010) citing (Burati et al, 1993). As noted by Chase (1998) the use of Total Quality Management has been proven to speed up works, save costs whilest increasing profitability. (Hoonakkera et al.2010) noted that the use of Total Quality Management coupled with ISO implementation has resulted in project satisfaction. Although there is a limit to the information of the many benefits of Total Quality Management usage, its benefits have been known not only for the customer, but the contractors as well. Furthermore, if Costs and Quality problems coupled with project schedule overruns are not controlled or monitored, the value for investments become minimal or see no benefits at all.

1.3 Problem Statement

The construction industry is one of the major contributors to a nation's GDP especially in developing countries (Muya et al, 2006).In Zambia, major road projects are undertaken with huge sums of money being spent i.e. the Link Zambia 8000 kilometer and Pave Zambia 2000 Kilometer campaigns. This has seen a rapid growth in the birth of construction companies both local indigenous as well as foreign owned. However, the Zambian Road projects are marred with low quality works that have become a drain on national treasury as works have to be re-done or those that are accepted do not meet the acceptable quality standards to repay investments or have an equivalent value for money spent(Raballand and Whitworth,2012) . Shoddy works have been of great concern both to the Government as well as to the public as stakeholders (Chabota, 2010).

In 2008 the Zambian Government blacklisted 42 contractors for shoddy works as a control measure. However, contractors claimed compensation for what they cited as wrongful termination of contracts (Chabota, 2010).

In 2014, the Road Development Agency instructed the contractor working on the Kitwe-Ndola dual carriageway to re-do the works on sections that had developed potholes even before handover of the whole road project was completed, this was to be at the contractors own cost.

An integration of analyses by different researchers revealed that the problems in road construction arise due to improper planning, design and enforcement of construction programmes, contracting methods, contract types, specifications, constructions estimates, construction operations, quality control and historical records (Ubani and Ononuju, 2013).

Chabota (2010) contends that the resultant poor performance in quality terms can have far reaching effects on the economy which if it goes unchecked has the ability to retard national development. Consultancy or Government supervising agencies as well as contractors do not seem to understand or pay attention to the root causes of poor quality road projects, this issue has dragged on for a number of years. Despite the huge sums and public outcries that have characterized the projects, no modalities seem to have been put in place to counter the re-currency of the same quality problems on most of the projects. This research therefore aimed at establishing how Total Quality Management (TQM) principles can be applied at every stage of a project in improving road construction performance in the Zambian road sector as regards to Quality, Time management and Cost saving.

1.4 Research Questions

In order to help fulfill the purpose of this research, the following questions were formulated:

(i) Are there any Total Quality Management principles in use on Government funded road projects in Zambia?

(ii) To what extents are these TQM principles identified in (i) above used if any and at what project stages are they used on Government funded road projects in Zambia?

(iii) Are there any benefits of using Total Quality Management on road projects?

(iv) What factors hinder the implementation of a TQM process on road projects?

1.5 Project Objectives

1.5.1 Main Objective

The main objective of this research was to investigate the use of TQM and establish how its principles can be used to improve road performance and quality in the Zambian road sector.

1.5.2 Specific Objectives

In order to achieve the main objective, the following specific objectives were devised:

(i) To identify which TQM principles are in use on road construction projects

(ii) To establish the extents to which TQM principles are applied on Zambian Government funded road projects and evaluate the possible principles of TQM that can be used on road projects and at what stages of the project they should be enforced.

(iii) To establish the benefits of using TQM on road construction projects

(iv) To establish an implementation framework for Total Quality Management usage and implementation on road projects in Zambia.

1.6 Research Significance

The main purpose of this study was to establish how TQM principles can be applied in improving road quality performance in the Zambian road sector and how it can help in ensuring that the end product gives value for investment and decrease on wastage and enhance productivity, thereby promoting the utilization of the scarce resources to full capacity in the Zambian road sector.

1.7 Project Scope

The research was restricted to Government Funded Road projects on the Copperbelt although stakeholders from Lusaka who were identified as participants to Government funded road projects were as well included. The research was limited to the applications of Total Quality Management in road construction in terms of Cost, Quality and Project schedules or Time.

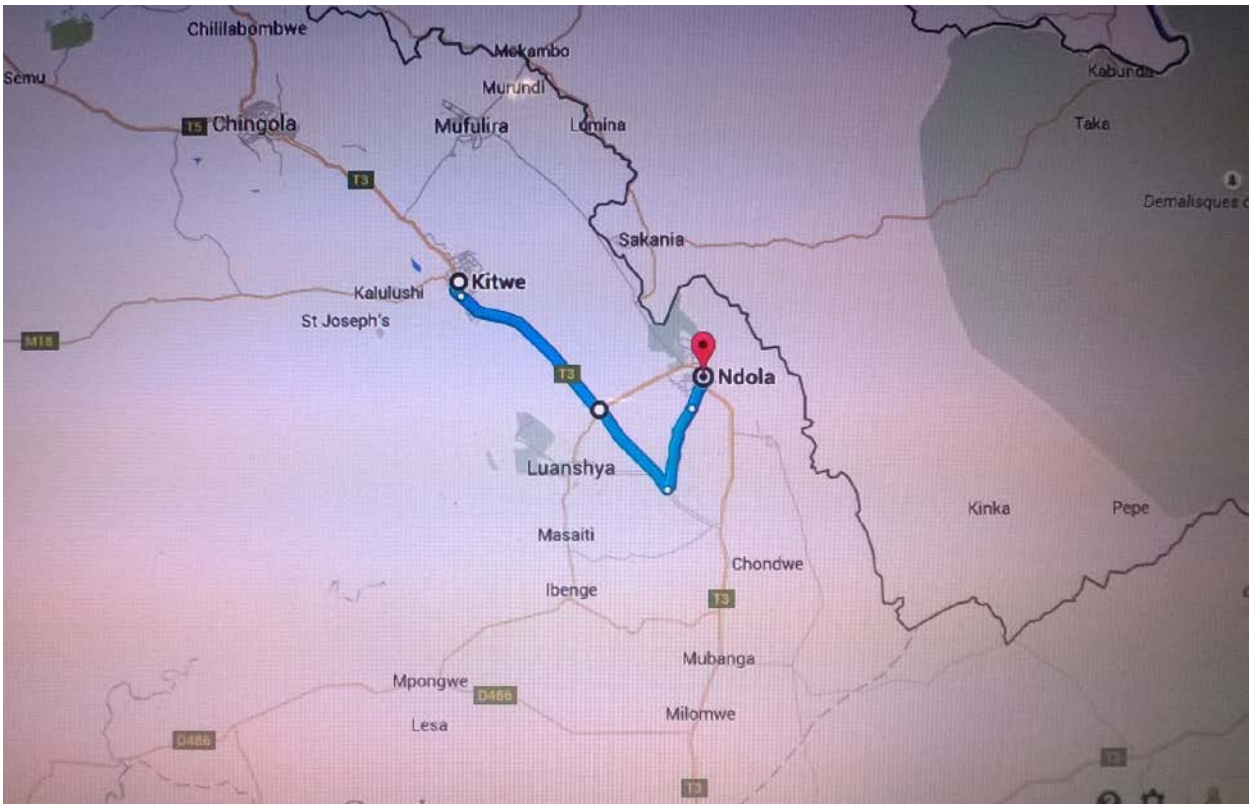
1.8 Report Layout

The research report was divided into six (6) main chapters. Chapter one laid the foundation to the research in terms of the background, problem statement, established the research questions, established the research objectives, significance and established the scope of the study. Chapter two instituted a detailed review of literature from different researchers; Literature on the causes of Quality shortfalls, schedule overruns and cost escalations was given enough research to find solutions to the research questions. Chapter two also outlined the different management approaches in Road Construction as well as the different stages on Road construction projects. Chapter three developed the Conceptual and Theoretical framework and gave an overview of Total Quality Management. It also established the industries that have used Total Quality Management in the running of their projects. Chapter four set out the Methodology in which the research approach was defined, the methods used and the samples sizes. Data presentation and analysis was done in chapter five whilest the Conclusions and Recommendations were done in Chapter six. At the end of references, a list of appendices was also included.

1.9 Case study Location and General Information

The Ndola-Kitwe dual carriageway is located on the Copperbelt province of Zambia and is an inter link between the Copperbelt's two major towns namely Ndola and Kitwe, Luanshya a third town directly connects to the dual carriageway. Apart from connecting these towns, this dual carriageway is one of the country's major roads that eventually connect the country to the Democratic Republic of Congo. Kitwe is the second largest city in Zambia both in terms of size and population. As of 2010 census, the city was home to 504,194 people. The city is one of the major three industrialized cities in the country and is home to a good number of mines. On the other hand, Ndola the other city connected to the dual carriageway is home to 455,194 people as of 2010 population census and is the third largest city in the country. Ndola is considered as the industrial and commercial centre of the Copperbelt province. The population of the three towns mainly depends on the mining sector which is the major economic contributor to the industrial base of the region. The Ndola-Kitwe dual carriageway runs over a stretch of 64km between Kitwe and Ndola and is part of the T3 of the country's core road network (Roads 2014, RDA Edition No.12). The road underwent a Periodic Maintenance from November 2012 to August 2014 as its initial project duration at a cost of 290,287,688.31 ZMW although the duration was later exceeded and the contract sum changed. The Location of the project is given in Figure 1.0 below:

Figure 1.0: Location of the project under study



Source: Google Maps 2015

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Chapter two looked at the available researches/literature concerning the use of Total Quality Management in road construction projects as well as the construction industry in general. It also looked at the issues that have a bearing on the failures and success factors of road construction projects as given by different researchers. Usually success in construction is synonymous with Cost, Time and Quality. The chapter has also identified some case studies in the construction industry and the applications of Total Quality Management by a number of researchers.

2.2 Definition of Terms

The following terms were of paramount importance to this research:

(i) Total Quality Management-is a philosophy with a system science whose nature is that of focusing on continuous improvement within and outside the organisation so as to give superior value of a product or service to the customer, (Saeed and Hasan, 2012).

(ii) Escalate-increase rapidly from the initially planned time or cost. Any effect on time has an effect on cost and vice versa (Choudhry et al,2012)

(iii) Resource-simply put comprises of people, facilities and equipment (UC Davis,2013)

(iv) Organisation-a business entity whose purpose is to make profits thereby generating return on investment (Mullins,2010)

(v) Total- implies a whole companywide commitment to quality including its suppliers, customers and employees.

(vi) Quality- attainment of acceptable standard. Quality on projects is defined by specifications and project designs (Chimene, 2013).

(vii) Cost-amount or value being paid to excute or perform a project. Project costs are derived from the scope and extents of project demand (PMBOK, 1996).

(viii) Time-period exhausted to excute a project, usually taken from the start to the end of project execution. Usually a number of projects fail to complete within the project allowable period (PMBOK, 1996).

2.3 The project Management Scope /Triangle of constraints

According to Kerzner (2011), the success of any project revolves around three constraints that is Time, Cost and Performance or Quality. This definition of project success has been applied by many from the birth of project management. The identified factors are believed to have a bearing on each other, where any change in one will have an implication or effect on the other. These three constraints i.e. Time, Cost and Scope or performance are believed to have a bearing on the final quality of the project. One side is taken as Cost, the other as Time and the final one as the Scope. Others have actually called this as a triangle of triple project constraints. This is represented as given in figure 2.1 below:

Figure 2.1: The project Management Triple constraints triangle.

Source: Kerzner (2011).

In this case, it can be seen that any change in any of the three sides of the triangle will have an effect on the quality of the project and ultimately on the success of that project. Each project will come with its own problems which will attract changes in the way the project was initially planned. For example an increase in scope will result in an increase in completion times, which will equally have a bearing on the initial project cost and might eventually lead to changes or compromise in the desired project quality. According to Larson et al (2011), the triple constraints are competitive in nature to each other and require control measures by project managers for project success.

2.4 Literature on Total Quality Management in the Construction industry and its relationship to cost, quality and schedule overruns

Asim et al (2013) defined Total Quality Management as a management approach that tries to ensure that the benefits of the project go to the customer. In this case he (Asim et al, 2013) considers the benefits of Cost, Quality and the Time taken to get the facility. It is however rare that a project will be done within the planned Cost, Time and Quality and hence research has been done by different researchers to identify the causes and how these can be overcome.

2.4.1 Cost Escalations

Choudhry et al (2012) defined cost escalation as final costs exceeding original estimates. On the other hand, cost escalations are defined as an increase in the amount of money required for project execution going beyond the original budgeted cost. Some causes of cost overruns are as a result of poor contract management, delays in mobilization, low standard technical performance and low raw material supply performances, unforeseen problems with changes in raw material acquisitions, internal project stakeholder wrangles, project size, engineering uncertainties' and administrative structure complexities.

Choudhry et al (2012) contends that the construction sector has problems with timely payments of monthly certificates, variations, schedule slippages, and lack of project knowledge by cardinal stakeholders. Other factors include changes in design and scope coupled with insufficient information from site investigations.

When projects are delayed, there are usually extra costs that are incurred i.e. labour wages, services, rentals, material price escalations and inflation.

The Public Accounts Committee (PAC) report on the Road Development Agency (RDA, 2010) cited some of the causes of project cost overruns as delays in paying contractors resulting in interest charges and standing time, other reasons identified by the report included stoppage of works by contractors due to non availability of funds from the National Road Fund Agency (NRFA) for works done.

Ubani and Ononuju (2013) cited the following as the factors that lead to cost escalations on road projects:

(i) Inadequate project planning
Insufficient project information, wrong cost estimates, inadequate experienced personnel, poor field investigations, and insufficient project analysis.

(ii) Poor implementation planning
Insufficient time for planning, insufficient resources, low level of equipment supply and inadequate cost planning.

(iii) Inefficient contract planning and management
Inappropriate pre-contract actions, poor post award contract management.

(iv) Inefficient project management during execution
Inefficient and ineffective work schedules, delays and changes in scope of work.

More literature identified cost overrun factors in the construction industry as Poor Management of sites, late site mobilizations, inflexible mind-sets by project supervisors, and valuation of variations without approvals and the attitude of making design changes during construction stages without involving the input of the contractors by the client's representative. The root causes of the factors have more to do with wrong documentation of projects data at tender stage, massive changes in the requirements of the client after project commencement and unworkable tender rates.

Sengar et al (2014) noted that cost effectiveness is improved as a result of the application of Total Quality Management as it tries to bring out the potential of each of the workforce and that in this case it has a direct bearing on the cost of quality i.e. the effort taken to achieve an acceptable product by the client. Chileshe and Berko (2010) identified failure by contractors to identify risks as one of the causes of problems to do with cost control. Other identified risks suffered by contractors which lead to cost escalations are risks to do with project initiation in that any delays will attract some cost to it, risks of financing in time in line with the budget, risk of not getting skilled labour and hence training costs will be incurred, issues to do with material procurement and re-work due to errors in technical supervision. Underestimating and schedule slippages were other factors identified as contributors to

project cost overruns. Design errors and omissions were also cited as the contributors of project cost overruns (Chileshe and Berko, 2010).

According to Kojo (2014), since the early 1960's, cost control on road projects have been difficult because quality management has not been on the centre of most organisations, its applications can also increase efficiency and reduce on poor quality works. To have an efficient reduction on production costs, Total Quality Management and its application can enhance process and production control (Kojo, 2014). Kojo (2014) citing (Rao et al, 2004) indicates that organisations that have used Total Quality Management enjoy cost efficiency and simplicity in the way they run their projects and manage their costs. Farooqui et al (2008) attributes cost overruns to underestimation of project costs and as a result of schedule delays, poor quantity estimation and lack of cost control during project execution. Other factors identified by Farooqui et al (2008) included:

(i) Incompetent project design team
(ii) Issues of inflation and poor currency performance
(iii) Untimely approval of works done for payments and
(iv) Force Majeure

Farooqui et al (2008) concludes that cost overruns can be avoided by providing and incorporating the entire workforce in the project objectives by offering training.

Beckwith (1992) cited lack of training and poor production rates by machinery as some of the Cost escalation enhancers. Aiyetan (2011) cited lack of client commitment to fulfilling their mandate to pay as a major constraint on contractor's cash flow performance.

Rahman et al, (2013) reported various construction projects on which cost escalations occurred as given in Table 2.1 below:

Table 2.1: Cost overruns on various construction projects from different countries

Country	Nigeria	Portugal	Pakistan
Percentage increase	14	12	10

Source: Rahman et al, (2013)

Rahman et al, (2013) identified a number of the causes of Cost escalations such as contractor experience, stability of the economy, high interest lending rates charged by banks on bonds and loans, poor site management, inaccurate quantities at project takeoff, fraudulent practices and demand for kickbacks. Various researchers cited by Rahman et al (2013) have found more factors and further categorized them as given below:

(i) Contractors site Management Related factors (CSM)

Rahman et al, (2013) cites Poor site management and supervision, incompetent subcontractors, schedule delays, poor planning and schedule controls, lack of experience, inadequate monitoring and control,

Construction execution mistakes as the contributors of cost escalations under Contractors site Management Related factors.

(ii) Design and Documentation related Factors (DDF)

Usually on public road projects, the consultant or engineer is engaged to assist with the design of the project aspects. Frequent changes in design, erroneous designs, incomplete designs at tender stage, drawing approval delays and design changes after project execution has commenced were cited as part of the Design and Documentation related Factors that contribute to cost escalations.

(iii) Financial and Management Related Factors (FIN)

If Interim payments are delayed, the contractor cannot pay the suppliers and may attract interest charges on time elapses. Difficulties with cash flow and financial difficulties faced by contractors, Poor financial control on site as well as financial difficulties of the project sponsor may as well lead to interest charges by the lending agencies which will attract unbudgeted for costs (Rahman et al, 2013).

(iv) Information and Communication Related Factors

Rahman et al (2013) indicates that Lack of coordination between parties, lagging of information flow between parties, lack of or inadequate communication between parties contributes to cash flow delays which may lead to late procurement of materials and services.

(v) Human Resource Workforce related Factors (WRF)

These according to Rahman et al (2013) have to do with low Labour productivity, shortage of skilled site workers, high cost of labour wages and unreliable experienced personnel who leave companies at will.

(vi) Non-Human resource related Factors

These are resources that do not have a human bearing on project outcome and include Fluctuation of material prices, Material shortages, late material and machinery delivery, Equipment availability and failure of its delivery.

(vii) Project Management and Contract administration related Factors

These factors include Poor project Management, Change in the scope of the project, Delays in decision making by project parties, inaccurate quantity take-off.

In the case of road construction projects in Sri Lanka, Wijekoon and Attanayake (2012) looks at costs as one of the major a consideration throughout a project's life cycle. They (Wijekoon and Attanayake, 2012) however noted that road projects rarely get completed successfully without encountering cost overruns. Wijekoon and Attanayake (2012) cites a number of critical factors responsible for cost escalations as unpredictable weather, wrong material estimates, size and nature of the project, contractor's lack of project experience and the absence of project geography at design stage. Other cited reasons are that of wrong rate estimates and tendering a project with omissions of cardinal information and outdated rates (Wijekoon and Attanayake, 2012). Abadie et al (2013) looked at cost overruns as a core of many wrong decisions and mismanagement of project principles. He came up with the concept of the causes of Project Cost overruns as shown in Figure 2.2:

Figure 2.2: Causes of Project Cost overruns

Source: Abadie et al (2013)

Bordat (2004) noted that cost overruns are affected by the size of the project, construction type, how competitive the project is and the difference in time between condition survey and project award. He (Bordat, 2004) further noted that there are other factors which he (Bordat, 2004) termed as non quantifiable and include the quality of contract documents, how the project parties interact with each other and their organizational policies. Vidalis and Najafi (2002) attributes causes of project cost overruns to project complexities which attract changes of the initial project cost. Kojo (2014) cites poor quality finished road projects as one of the reasons of cost overruns. Love et al (2014) revealed that project scope changes and unforeseen ground conditions contribute to project cost overruns. More literature revealed that cost overruns on projects are a result of accidents on site, unreliable material sources, inadequate tools and plant, insufficient supervisory skills, poor site communications and unwarranted reworks and shortage of skilled labour from within construction sites.

Literature revealed the following as the major causes of Project cost overruns on road projects;

(i) Poor monitoring and control

(ii) Underqualified personnel running projects

(iii) Wrong material estimates and unpredictable weather patterns

(iv) Errors in designs and scope changes

2.4.2 Schedule overruns

Shanmugapriya and Subramanian (2013) defined schedule overruns as the lapse in time between the estimated and the actual completion time. Choudhry et al (2012) defines schedule overruns as a condition where a construction project fails to meet the targeted time or extension of time beyond what was planned. However, Ramanathan et al, (2012) simply puts it as an exceeding in time on the targeted date of completion. Shanmugapriya and Subramanian (2013) noted that schedule overruns vary with project types, project location, project size and scope and identified the five causes including changes in actual designs, poor labour productivity, inadequate planning, material shortages, wrong material estimates, poor site management and supervision, unforeseen ground conditions, decision making delays and variations initiated by clients.

Choudhry et al (2012) identifies Poor contract management, interim monthly payment difficulties from agencies, and difficulties in material procurement, poor technical performance, poor contractor management skills and material price escalations as some of the causes of schedule overruns. Other identified issues include inclemental weather, and unexpected natural events as causes of schedule escalation on construction projects. Lack of timely approval of test results, labour and plant costs were also identified as some of the causes of project completion delays (Choudhry et al, 2012).

In most African developing countries (Ogunlana and Promkungtong, 1996) identify shortages or inadequacies in infrastructure such as resource supply, problems caused by clients and consultants coupled with incompetent contractors as the main causes of project schedule escalations.

Choudhry et al, (2012) further compounded delays in material acquisitions, land issues and resettlement, environmental issues, natural catastrophes, slow or weak financial processes, political instabilities and changes in scope as the leading or major factors that contribute to schedule overruns.

Farooqui et al (2008) noted that schedule overruns on most projects are experienced due to the habit by the contractors to claim for scope changes during the project execution especially in the conclusion stages of project execution. Underestimation of quantities is another issue cited by Farooqui et al (2008) which are in most cases only realized way after execution has commenced and time schedules have been set. Bowen et al (2002) recommends that a consented effort from the project team is cardinal for the execution of a project on time and within the cost. Bowen et al (2002) noted that since road projects are considered as engineering projects in many ways, the use of schedule of rates and or their likeliness to attract variation orders to the main contracts were also a cause of schedule overruns.

Due to the fact that most designs are marred with errors, cardinal time is spent on re-designs at the expense of production which in turn results in cumulative loss of time coupled with intermittent supply of funds (Chileshe and

Berko, 2010). Mahamid (2013) looks at the following issues as contributors of schedule overruns in the road construction sector such as; Poor management of resources by contractors, the lapse in time between award and commencement, lack of project supervisors, shortage of project materials on the market, poor currency performance and constant breakdown of plant which can either be too old or underqualified personnel to maintain or repair it. Problems with subcontractor performance and quality coupled with late payment for works done were cited by Mahamid (2013) as the other factors that have a bearing on timely completion of projects as well as issues to do with lack of knowledge on machinery and designs. Mahamid (2013) attributed the vice of time overruns to clients or initiators lack of experience. Apolot et al (2011) citing El-Razek et al (2008) noted that lack of or absence of coordination amongst stakeholder's, communication and untimely payments are some of the reasons for time escalations. Lack of skilled contractor supervisors, untimely payments by clients, low material supply, shortage of project equipment and massive re-works were cited as the issues contributing to schedule delays (Apolot et al, 2011). Bordat et al (2004) discussed issues of wrong method statements which attracts re-works as improper construction methods may be rejected later on, slow mobilization due to nonpayment of advance payments and unreliable suppliers as some of the causes of schedule overruns. A research conducted by Ellis and Thomas (2002) cited by Bordat et al (2004) revealed that 31 to 55% of road construction projects experience on average a time lapse of 44% or more of the programmed project schedule. Most of these projects with time lapses occurred in urban project areas. Bordat et al (2004) further identified some of the root causes of time delays on projects in urban areas such as maintenance of traffic zones, design errors and omissions of important features, re-locating of services and utilities, utility disputes and unforeseen population disturbances, habits by contractors to excute activities on the schedule that have high rates despite them not being on the critical line.

Mahamid (2013) looked at a number of factors that most contractors in Palestine defined as the causes of project time overruns and categorized them into 8 groups as given below:

(i) Project Group

The factors in this group include awarding projects to the lowest bidders without looking at their technical ability to deliver, confined working spaces, lack of good project materials and relocation of public routes and activities.

(ii) Owner's Group

By project owner Mahamid (2013) alluded to the project promoters who give unreasonable time frames, delays in approving sample materials, late delivery of information and lack of constructive communication to the project parties.

(iii) Materials and Equipment Group

This group has to do with lack of adequate and good material to meet the specifications, effective and able to produce machinery and non availability of equipment at the right time.

(iv) Labour Groups

Labour Groups include lack of qualified personnel, worker management conflict and conflicts amongst personnel in objective attainment.

(v) External Groups

External project influences include factors to do with cost escalations, weather conditions and monopolistic behaviour of material suppliers.

(vi) Design Groups

Design group factors include wrong drawings, insufficient design information, late delivery of project drawings and errors in dimensions.

(vii) Contractor Group

Contractor groups have to do with all issues to do with conflicts amongst contractor's team, failure to manage resources, Non adherence to construction methods, less qualified personnel on the contractor's team, and poor contractor project scheduling and re-work due to poor quality workmanship.

(viii) Consultant's Group

Factors that come from the consultants group include rigidity of the consultant, lack of a communication framework by the contractor to project parties, incapable inspectors on the consultant's team and delays by consultants to perform.

Schedules have been known to escalate in the Jordan public construction projects due to changes in project use, late material deliveries, issues to do with economic performances and increases in scope of the project (Sweis, 2013). Abadie et al (2013) analysed issues with false progress reports, design delays and breakdowns in communication as the issues affecting capital projects scheduling.

Literature revealed the following are the major causes of Project schedule overruns on road construction projects:

(i) Untimely payments of interim Payment certificates
(ii) Scope changes during project executions
(iii) Late project mobilizations
(iv) Low labour productions
(v) Lack of control and monitoring
(vi) Inclemental weather conditions
(vii) Material shortages coupled with wrong material quantity estimates
(viii) Poor contracts administration

It was also seen that most of these were attributed to the contractor rather than other project stakeholders.

2.4.3 Quality shortfalls

There is no one definition of quality and different researchers have defined it with regard to how it is applied and ability to meet desired satisfaction, implying that there is no standard definition of quality. Chimene (2013) defined Quality as the intensity of worthiness of a product or service in fulfilling accepted project requirements i.e. its suitability for use and its ability to enhance satisfaction. However, Crosby (1979) defined quality as "conformance to requirements". Usually, project specifications define the required quality for the agreed works. Other identified reasons from literature reveals that more lagging time between investigation/assessment, procurement, award and implementation, Lack of consistent release of funds by clients, and in most cases funds are released in smaller

quantities. Financial management problems by contractors, inexperienced consultants awarded supervisory roles, low capacity by contractors to excute the works, and demand for kick backs by consultants prior to certification of works as some of the reasons for quality shortfalls on road projects (Choudhry et al, 2012).

Mukumbwa (2013) attributed the prevalence of quality shortfalls on projects to the following reasons;

(i) Poor contract documents, poor contract administration

(ii) Late engagements of consultants ,where execution starts with the contractor before the designs are done

(iii) Wrong estimates used to bid for the project

(iv) Lack of initial condition surveys

(v) Contractors lack of interest in reading project specifications

Time, cost and quality are all interlinked and a variation in one leads to an effect on the other. More research and records prove that the issue of low quality road works is more prevalent in the public than private sector, which although is at a higher scale, no significant investigations have been carried out to realise the causes of the vice in the Zambian Public road sector (Chabota, 2010).

Inadequate and lack of material testing on site as well as the inability by the project supervisors (Government appointed consultants) to scrutinize laboratory results were found to be part of the causes of quality shortfalls on public projects (PAC Report on RDA, 2010).

Farooqui et al (2008) noted in his research for the construction industry in Pakistan that the problem with most construction projects is that organisations tend to centre their energies more on corrective measures rather than getting the root cause and doing improvement process. Most organisations try to impose cost constraints thereby inducing a compromise on project quality (Farooqui et al, 2008). Farooqui et al (2008) further noted that most projects are awarded on the principle of the lowest bidder by the project owners without a consideration for prevailing market value of materials and services. Poor project supervision, Low site coordination, wrong design decisions and late material procurement were cited as the contributing factors for quality shortfalls in the Pakistan construction industry (Farooqui et al, 2008). Jafari and Setak (2010) noted that poor quality is a cost as it attracts a cost in form of re-work or penalties. Smith (2000) looked at different types of problems namely conformance quality problems, unstructured performance problems, problems to do with efficiency as well as product and process design quality problems. Kumar (2008) identified the following as the major factors leading to project quality problems: Problems with equipment or defective materials, problems with work procedures, personnel errors, incomplete designs, lack of training for personnel and management style. Keng (2011) cited lack of interest and difficulties in measuring results, difficulties in understanding concepts, and lack of interest by subcontractors and suppliers in meeting project quality demands. Keng (2011) citing (Moatazed-Keivani et al, 1999) noted that issues of bureaucracy, costs, time consumption and interpretation of ISO standards as part of the factors responsible for

quality shortfalls. However Muir (2005) revealed that quality problems are caused by design methods, inspection periods, lack of or absence of skilled workforce, financial issues coupled with availability of materials. According to a report for the Republic of Tanzania for National Audit office (2010), it alluded quality shortfalls in the Tanzanian road sector to a lack of monitoring and inspection practice, with an absence of a documentation model and lack of coordination in task allocation to the different consultants engaged by the Government's agency, on availability of Quality Assurance system in place. Asim et al (2013) demonstrated that as Quality is accomplished by involving the members of a project in undertaking the aspects of design, testing and innovation in process improvements, costs tend to go down which in turn improves levels of productivity.

2.5 Management Approaches in Road Construction

There are various management approaches that have been used on road projects as well as on many other construction projects. Each of the approaches has its own advantages over the other depending on the nature of such a project. Some of these methods or approaches are given as;

(i) Business Process Re-Engineering (BPR)

(ii) Just In Time (JIT)

(iii) Material Requirement Planning (MRP)

(iv) Total Productive Maintenance (TPM)

(v) Concurrent Engineering (CE)

(vi) Total Quality Management (TQM)

While most approaches focus on improvement of a product by an organisation, Total Quality Management tries to incorporate the stakeholders from outside the organisation in attaining or achieving the cost, quality and time frame of the product delivery to the customer. Total quality Management brings in Top leadership involvement from the initiation stage to completion of a project (Mullins, 2010). He (Mullins, 2010) further defined Total Quality Management as a way of managing in which the organisation has everyone's involvement through dedicated responsibility for delivering a quality product or project to the end user or the customer.

The implementation of an approach on a project however depends to some extent on the size of the project and the organisation at large. Total Quality management has of all the identified approaches been identified as the most effective by a number of writers (Mullins, 2010).

2.6 Case Studies

2.6.1 Effects of Total Quality Management on Construction Project Performance (Construction Firms in Yemen, Nashwan and Awad Sad)

Saeed and Hassan (Vol.17 No.2, 2012) contends that firms have arrived at the conclusion that effective implementation of TQM can improve competitive abilities and provide strategic advantages in the market place. They (Saeed and Hassan, 2012) further argued that effective TQM implementation leads to improvements in productivity, quality and competitiveness. Their research also concluded that contrary to the initial perceptions, the concept of TQM was actually missing in Yemen's construction industry. Their further analysis proved that TQM application has positive effects on teamwork satisfaction, reduces time and cost and increases the quality of project implementation.

2.6.1.1 Lessons learnt from the use of TQM in Yemen

In Yemen, the use of TQM enhanced productivity and put the organisations that were using the philosophy on a competitive advantage compared to others that were not. Teamwork satisfaction was equally enhanced which increased the savings on time and costs at the same time preserved the quality of the project outcomes.

2.6.2 An exploration of the effect of employee engagement on performance in the petrochemical industry (Boikanyo, 2012)

In his research, Dinko claims that many industries that are using TQM have seen an increase in competitive abilities and provide strategic advantages in the market place (Anderson and Sedatole, 1998).TQM implementation also helps organisations compete on a broader market. In its effective implementation, Boikanyo (2012) argued that TQM would require the involvement of all organizational employees starting from top management down to the last worker. For TQM process to be successful there is a need to have a continuous improvement coupled or supported by customer involvement (Morhman et al, 1995).

Employee engagement has been defined by different researchers. Boikanyo (2012) has given different perspectives on employee engagement. The various definitions given are: employee satisfaction with their work and being proud of their employer or bosses. This definition encompasses the extent to which people get motivated and enjoy what they do. The motivation is yielded through training, involvement and how the employer appreciates the employees input. Boikanyo (2012) citing Stockley (2007) looked at employee engagement as the extent to which a worker or employee believes in the organizational mission, purpose and value through his commitment by way of actions towards work and attitude towards the employer and customers. Other definitions given include "the attachment of the organisations members full selves to their job demands, in engagement in terms of physical, cognitively and emotional strength during their performances.

In shot employee engagement refers to the attention and absorption of the employee to his role in the organisation.

2.6.2.1 Lessons learnt from effect of employee engagement on performance

In order to motivate employees in the attainment of TQM success, (Boikanyo, 2012) encourages Top management participation in the running of TQM implementation and offering training and education to the employees. Motivation has been cited as one important factor in effective TQM implementation.

2.6.3 Quality Management as a Key Requirement for Stakeholders' Satisfaction In Nigerian Construction Projects (Chinyio et al, 2013).

Chinyio et al (2013) brought out a number of factors that assist in the effective implementation of Total Quality Management in the construction industry in Nigeria. He termed them as technical attributes of Quality Management as given below;

(i) Ensuring that suitable training is given to the required stakeholders and their responsibilities are in line with the training
(ii) Ensuring that best practices are followed in the execution of works by leaders
(iii) Both long and short term monitoring evaluation strategies are formulated
(iv) Quality control measures should be put in place from inception to completion of the project
(v) Specialists should be involved in the construction of complicated works
(vi) Accountability of every personnel who is involvement in the project

Chinyio et al (2013) identified other factors as contributors to the successful implementation of Total Quality Management as measurement of results, design of process procedure to reduce conflict in working strategies by employees, client to customer relationship improvement, the creations of an enabling environment to allow employee participation in planning and decision making. All these to effectively work require a patch up of an organizations' cultural change.

2.6.3.1 Lessons learnt from the case of the Nigerian Construction Projects

Chinyio et al, (2013) noted that for TQM implementation to be successful, the organisation should encourage stakeholder responsibility, teamwork and process improvements with the encouragements of long term thinking.

2.6.4 ISO 9001: A Stepping Stone to Total Quality Management for Construction Companies (Ahmed et al 2009)

According to Ahmed et al (2009), effective implementation of Total Quality Management is mainly dependent on the following factors; focusing on customers to increase revenue, involving the people, workforce understanding of the process, choosing an effective procedure, promotion of good working environment, encouraging the promotion of suppliers and subcontractors, Putting in place effective control systems that can easily be monitored. Once the system is effectively done, there is a chance that time, costs and quality issues will be sorted and there will be less time spent on supervising subcontractors.

2.6.4.1 Lessons Learnt from ISO 9001

The major drive in the effective implementation of TQM from ISO 9001 perspective is built on the principle of customer focus using control systems set up within the organisation in the attainment of the desired quality.

2.6.5 The Quality Journey: A TQM Roadmap for Public Transportation (MacDorman et al, 1995)

MacDorman et al (1995) recommended that for an effective Total Quality Management implementation, there should be an interaction with the project stakeholders from inception such as involving the customer in the quality focus i.e. by the creation of focus groups, reward and recognize contributions made by team members, formation of leadership teams to spearhead and formulate Total Quality Management action plans, encourage team participation and reward eagerness to employees initiating change, persist in the monitoring with total encouragement to the project team. The implementation and benefits of Total Quality Management should be shared to all stakeholders with defined objectives and goals of the project and organisation. He (MacDorman et al, 1995) further highlighted that Management and their workforce both become participants and their bond attracts a big success of the implementation.

2.6.5.1 Lessons learnt from The Quality Journey

Formation of Quality groups, stakeholder involvement and reward or motivation to employees allows effective TQM implementation. The employees should be able to feel that they are part of the organisation and their efforts are appreciated.

2.7 Road Construction Projects in Zambia

Road Construction projects are massive investment projects whose funding attracts a number of different stakeholders. In Zambia, all Public road projects are funded by the government. Roads in Zambia are basically classified according to the purpose they serve. The Core Road Network (CRN) infrastructure in Zambia consists of a sparsely interconnected network of Trunk (T), Main (M), District (D), Primary Feeder (PF) and Urban (U) roads. The Core Road Network is identified as the bare minimum road network that Zambia requires to be maintained continuously and on sustainable basis in order to realise social-economic success. Each of these road categories depending on the nature and need maybe subjected to any of the following maintenance categories;

(i) Routine Maintenance -is one which is expected to be performed on a regular basis and is usually seasonal or perennial (for example, ditch clearing, de-silting of drainage structures and grass cutting) and may even be one that is performed more often than once a year (such as road marking).

(ii) Periodic Maintenance -activity, on the other hand, is one that is necessitated by a problem induced by the impact of traffic, such as rutting and cracking, is subject to analysis, and is therefore reasonably and objectively predictable, though not necessarily cyclic. Periodic maintenance activities would include patching and overlaying.

(iii) Emergency Spot Problem -though more difficult to predict, might nevertheless have more disastrous consequences. Problems such as bridge washouts and landslides on a vital roadway must be attended to promptly, and the necessary resources must therefore be readily available. Maintenance activities in these cases usually take on the character of major rehabilitation or even full re-construction.

2.8 Legislative and Policy Framework in the Procurement of projects in Zambia

The public projects in Zambia are controlled by a number of legislative bodies that mostly came into existence by acts of parliament. The following are some of the major bodies entrusted with the overseeing of public projects in Zambia, some directly and others indirectly:

2.8.1 The National Council for Construction (NCC)

The National Council for Construction (NCC) was enacted in 2003 with the mandate to Register, Regulate and promote contractors in Zambia and was based on Act No.13 of 2003. The legal framework on which the Act of 2003 No.13 was based was on the principle of fulfilling the functions with only a few recommendations made as regards to regulations and inquiries.

Despite the potential of growth in the construction sector in Zambia, the absence of a fair and transparent registration scheme has been set apart as a major barrier that inhibits the effective participation and growth of contractors in the country's construction industry, hence this saw the need for a body such as the National Council for Construction (NCC).The National Council for Construction (NCC) 's registration framework has consolidated on best practice and need to address the registration barriers that had existed earlier. The registration criteria that the National Council for Construction (NCC) had taken into cognizance were to:

(i) provide a fair and transparent slot for participation of contractors to access work opportunities
(ii) facilitate growth for all spectrum of contractors
(iii) promote small to medium contractors
(iv) provide flexibility for emerging contractors
(v) safeguard the public against bogus contractors
(vi) provide for a regulated environment
(vii) Provide a framework for developing contractors.

2.8.2 The Zambia Public Procurement Authority (ZPPA)

The procurement in Zambia is governed by the Public procurement ACT No.12 of 2008 and public Procurement of 2011. Initially Public procurement was governed by the Zambia National Tender Board Act No.30 of 1982. The Public Procurement Act of 2008 was done in order to achieve the following objectives:

(i) to ensure that there is transparency and accountability in public procurement
(ii) To regulate and control practices in public procurement in order to promote integrity, fairness and assure restoration of public confidence.

This Act (ACT No.12 of 2008) also provides for the total decentralization in the procuring of works by entities without having to report to other bodies for authority.

2.8.3 Institutional Framework of the Zambia Public Procurement Authority

The basic framework provides for an effective and efficient implementation for provisions in the separation of functions, transparency and accountability. The Act through the Zambia Public Procurement Authority (ZPPA) regulates policy, standards and standard setting, performance and compliance and monitoring, development of professionals, and information management (Ketelhodt, 2013).

2.8.4 The Road Development Agency (RDA)

The Road Development Agency (RDA) was established through an Act of Parliament of the Public Roads Act No.12 of 2002. It was premised on the mandate of responsibility for the care, maintenance and construction of Public roads in Zambia. This was aimed at removing the fragmentation and duplication in the planning and implementation of road projects. In order to help facilitate the implementation or achievement of the core objectives of the Agency, annual work plans are done to act as a roadmap towards the goals. As of 2013 Road Development Agency (RDA) Annual work Plan, the country had a total of 67,67l km with a Core Road Network (CRN) of 40,454km (The Zambian Economist, August 2014). The Core Road Network, as defined by Road Sector Investment Programme of 2003 (RoadSlP II), is the minimum network required to spur economic development in Zambia. The Core Road Network (CRN) infrastructure in Zambia consists of a sparsely interconnected network of Trunk (T), Main (M), District (D), Primary Feeder (PF) and Urban (U) roads. The share of the road network is as given in Table 2.2 below:

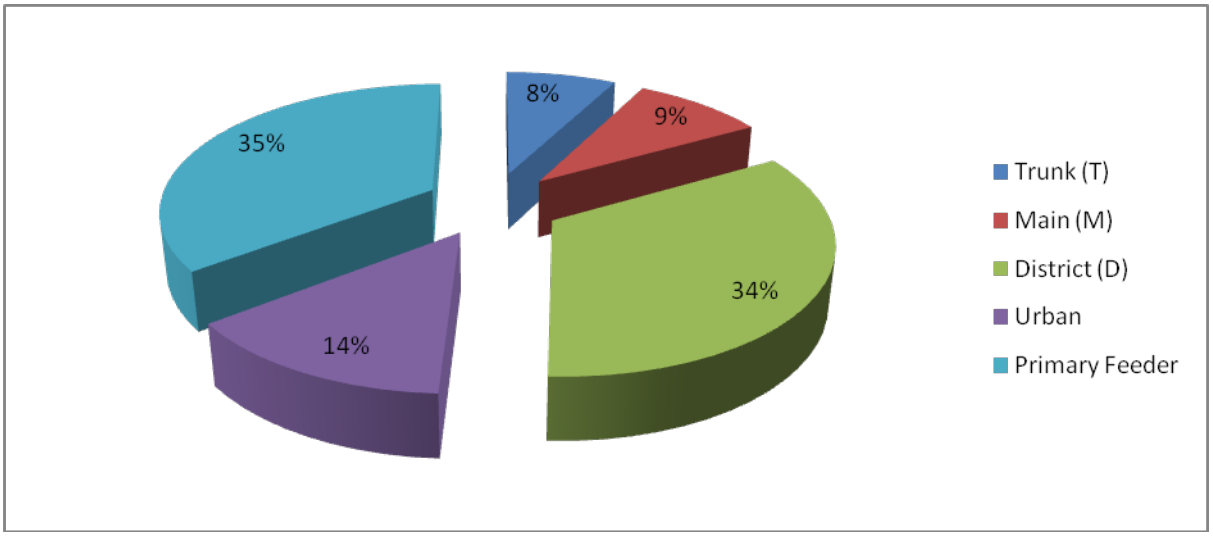
Table 2.2: Zambia's Core Road network

Road Type	**CRN (in Kilometers)**
Trunk (T)	3,116
Main (M)	3,701
District (D)	13,707
Urban	5,597
Primary Feeder	14,333
Total	**40,454**

Source: Mushota, 2013.

The Road network is as presented in Figure 2.3 below:

Figure 2.3: Percentage division of Core Road network in Zambia



Source: Mushota, 2013.

2.8.5 Benefits of a Good Road network on Trade and Commerce

Mushota (2013) suggests that a good road network has the following advantages:

(i) Reduces vehicle operation costs

Reduction on operating costs on vehicles include tyres, spare parts, Lubricants, which all increase as a result of bad road network such as potholes.

(ii) Travel time costs

This includes time value of vehicle occupants, time value of goods in transit and the value of the vehicles in transit.

(iii) Accident costs

These costs rank amongst the highest on road network costs and include costs of fatality, costs of injuries and costs of damage to property.

CHAPTER THREE

THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

Chapter three looks at the interrelationship between Total Quality Management and the three tenets of Quality control as well as project success namely Time, Cost and Quality. It addresses the research problem and undertakes to provide the answers to the research questions.

Oluwatoyin and Oluseun (2008) defined a Theoretical and conceptual frameworks as a model of logical sense of the relationship that exists among the several different factors that have been identified as of valuable importance to the existence of the problem.

3.1.1 Overview of Total Quality Management

A successful project is one which meets the triple constraints of Time, Cost and performance. The triple constraints are done or considered before, during and after the project. These three constraints are all imbedded in the concept of quality (Kerzner, 2009). However, this research tries to look at 'quality' with a link to two other concepts i.e. 'Total and Management", from which the concept or process of Total Quality Management (TQM) was born. Dale (1999) defined TQM as "A management approach of an organisation, centered on quality, based on the participation of all its members, and aiming at long term success through customer satisfaction and benefits to all members of the organisation and society (Erickson,2002).

3.1.2 Quality

Total Quality Management can however be traced back to its inventors or Gurus who had a major interest in it. These included Deming, Juran, Crosby, Ishikawa and Feigenbaum who all defined the concept in varying ways although their direction of thought was the same. Deming defined quality as a continuous improvement process towards predictable degree of uniformity and dependability; He went on further and identified what he termed as the 14 principles of quality management to improve productivity and performance of an organisation. Juran looked at quality as "fitness for use." He attributed this to the idea that every person in the organisation must be involved in the effort to ensure products and services they provide are fit for use. Crosby looked at quality as conformance to requirements, with emphasis on zero defects and doing things right the very first time. Ishikawa looked at quality as an important control measure to improve organizational performance, including the behaviour of a product or service during its time in the hands of the customer or user. Feigenbaum defined quality as a continuous work process, starting with customer requirements and ending with customer satisfaction (Jha and Joshi, 2007).

3.1.3 Management

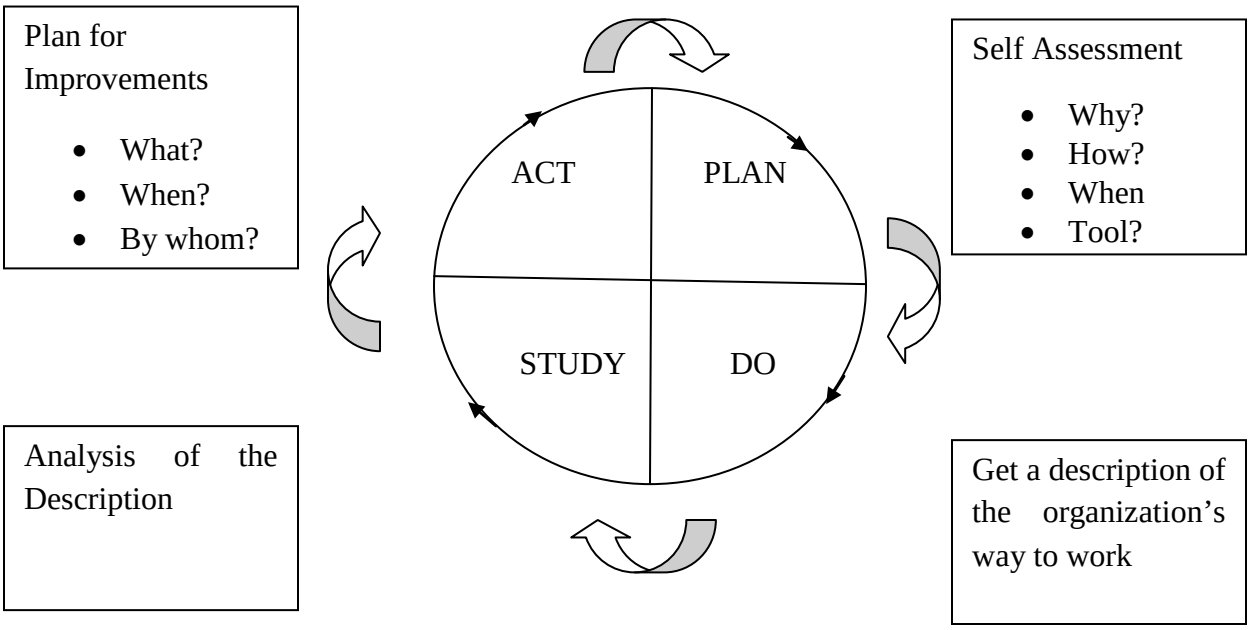
Like Quality, management can also be traced back to the old ages where its definition emanates. Drucker (1993) defined management as "Supplying knowledge to find out how existing knowledge can be applied to produce results."

3.1.4 Total Quality Management

Total quality management is all about organisation integration of resources, processes and activities in meeting or exceeding customer requirements.

Shiba et al (1993) defined TQM as "an evolving system of practices, tools and training methods for managing companies to provide customer satisfaction in a rapidly changing world ", Eriksson (2002),says TQM is a continuous process and requires monitoring coupled with improvement. Schewhart (1924) developed what he termed the Deming cycle which he introduced to his quality mentor Dr.Deming and later became known as the PDCA cycle. The PDSA cycle is a systematic series of steps that are taken for gaining valuable learning and build up of knowledge for a continuous improvement of a process or product. It tries to make perfections to a product or service before it can be given to the customer. Figure 3.1 below illustrates the concept of the Deming cycle.

Figure 3.1: The Deming cycle concept



Source: Eriksson (2002)

The Plan, Do, Study and Act cycle (PDSA) starts with identifying the goal or the purpose that the project wants to achieve, it formulates the theory, definition of success and putting the plan into action. The components of the plan are later implemented in the 'DO' stage i.e. testing or modeling a service or product, the 'STUDY' stage follows afterwards in which the validation of the plan is made i.e. in terms of progress and problems or success is identified and improved upon. In the last stage which is the 'ACT', there is an integration of what is learnt in the whole process and adjustments or changes are then made. The entire process is then repeated depending on the need.

Erickson, (2002) alludes to Svensson and Klefsjo (2000) on their analysis based on Figure 3.1 that the direct application of the PDSA cycle can be applied in organisations to improve their product or service. Evans and Lindsay (1996) looked at the concept in the manner given below:

(i) Self assessment where the organisation should ask when the work should be carried out, who should be involved, how shall the product or service be defined.
(ii) Description of the organisation and what products or services it should or does offer
(iii) An analysis of the description so as to define or find strength or weaknesses in the product or service
(iv) A plan for improvement based on issues identified and devising programs on what should be done, what resources are needed, who should do it and who should be responsible.

Lau and Anderson (1997) also quoted by Boikanyo (2012) explained that each abbreviated letter in TQM stands for the following:

(i) T-Component of TQM: implies a total or whole companywide commitment to quality including its suppliers, customers and employees.
(ii) Q-Component of TQM: which is quality and whose major goal is to meet and exceed customer expectations. Continuous improvement becomes very important and helps to keep the customer satisfied.
(iii) M-Component of TQM: deals with commitment from Top management in the formulation, implementation, integration and support of policies into shaping of the organizational culture towards quality.

Karia and Asaari (2006) contends that TQM can also be defined as a set of practical measures that are put in place to assist with continuous improvement, meeting customer requirements, reducing re-work, long range thinking, process re-design, team involvement and continuous monitoring of results (Boikanyo,2012). The key thing about TQM is quality and continuous improvements. Some Researchers have analysed TQM and its positive impacts on organizational performance (Mohammed et al, 2012).

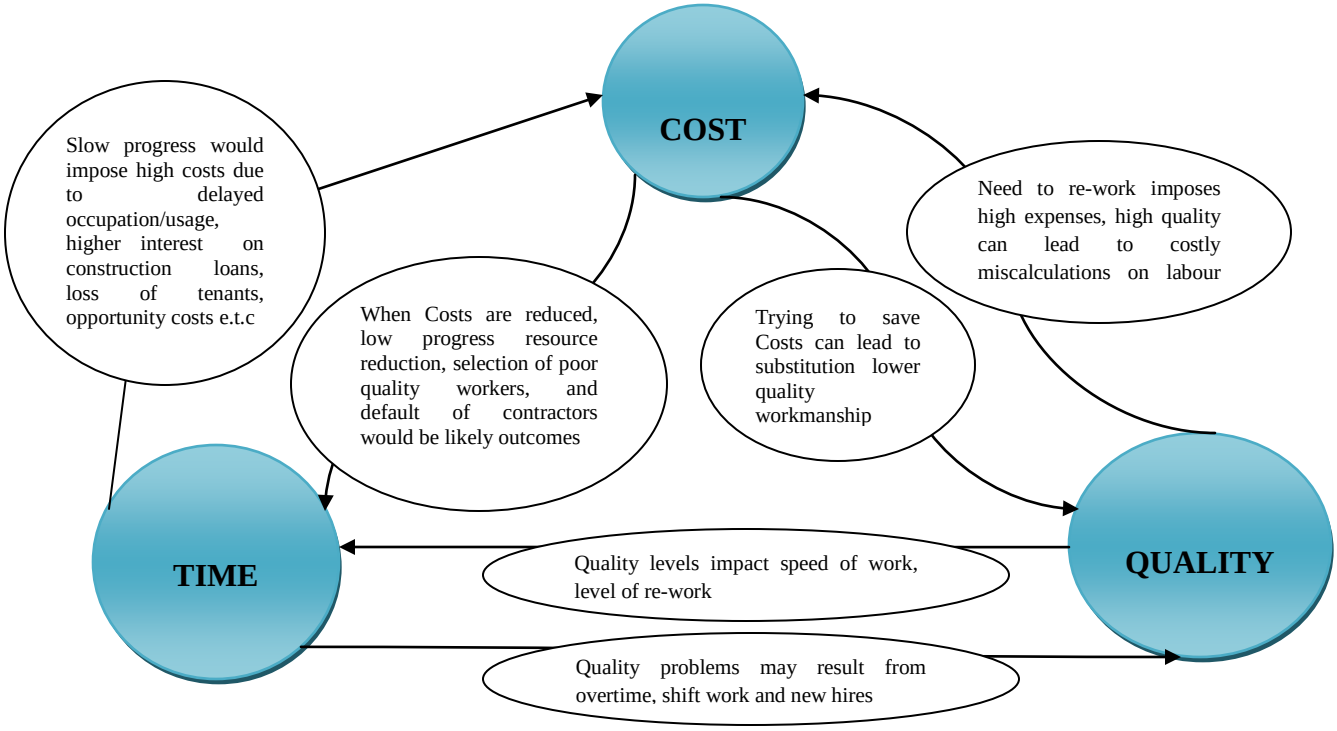
3.1.5 Total Quality Management Applications

Different organisations started applying Total Quality Management as one of the ways of improving productivity after its successes in the early 1980's in Japan where it was used to achieve a competitive edge over other organisations.

Al-Ababneh and Lockwood (2010) argues that creativity as a result of the application of TQM in various industries has resulted in outcomes that provide new levels of quality, cost, customer satisfaction and either changing or improvising new methods and enhancing job satisfaction, motivation, teamwork, strategic thinking, efficiency and customer satisfaction.

It would be wrong therefore to talk about Total Quality Management without linking it to the three tenets of project success.i.e Cost, Quality and Time. To effectively link these tenets, Chabota (2010) contends that there are a number of factors that help ensure that the three are effectively implemented on a project. See Figure 3.2 below:

Figure 3.2: Cost, Quality and Time Relationship



Source: Chabota (2010)

Usually the most important factors that determine project direction reside in the conception stages. At this stage, decisions should be based on full knowledge of project objectives. Having a full knowledge of the risks involved in the project helps resolve the problems before they occur. This should be a team effort or involvement. Toor and Ogunlana (2006) argued that such preparations help face challenges way before they occur.

Chinyio and Suresh (2013) further highlighted that there are equally technical attributes that have to do with successful implementation of Total Quality Management. They highlighted the following as the Technical attributes of Total Quality Management on Construction projects. Table 3.1 is an illustration of the technical attributes to successful TQM implementation.

Table 3.1: Technical attributes to successful TQM implementation**.**

Quality Attribute		Brief Description	Reference
No			
1	Quality Training	This has to do with giving the appropriate training to all responsible stakeholders	(Akao,2004)

2	Benchmarking	This processing entails the identification and emulation of the best practices from the leaders	Love et al (2004)
3	Continuous Improvements	There should be a focus on improving the construction process in use over time or as need may be depending on process duration	(Akao,2004)
4	Long Range Thinking	Strategic thinking and focus on long term goals into the future construction processes as well as its nature	Ahmed (1995)
5	Quality Control	Throughout the project life cycle, it should be ensured that an acceptable level of quality on the project as well as supplier involvement is enhanced.	(Akao,2004)
6	Health and Safety issues	Health and safety issues should always be attached to the working environment.	BSI ,(2008)
7	Technical Expertise	Specialists usage should be promoted for key aspects of construction coupled with the procedures of benchmarking.	Leung et al (2008)
8	Quality Standard Implementation	Quality standards implementation is cardinal. Such standards would include ISO 9001,ISO 14000 to the construction project inclusive of the suppliers to the project	BSI ,(2008)
9	Auditing	This ensures accountability of personnel and materials throughout the project life cycle	BSI ,(2008)

Source: Chinyio and Suresh (2013)

The technical attributes have to do with skills development in the race to Total Quality Management Implementation in the Construction industry. Chinyio and Suresh (2013), argues that these skills are not only limited to stakeholder development but also to the attainment of international standards and requirements in the construction sector.

It is a well known fact that attributes of Quality are well appreciated by the end user as a stakeholder in the construction of roads. Therefore different scholars have come up with attributes that lead to stakeholder satisfaction where construction is concerned.

Chinyio and Suresh (2013) cited other researchers regarding stakeholder satisfaction as given in Table 3.2:

Table 3.2: TQM attributes that lead to stakeholder satisfaction

Quality Attribute		Brief Description	Reference
No			
1	Process Improvements	Strategy in the evaluation of existing construction processes to meet agreed targets and set goals	Hoonaker et al (2010)
2	Open Culture	Ease of access to management and information	Leung et al (2008)
3	Meeting Customer requirements	Clear and defined or good understanding of the needs of the customer's requirements and setting criteria for understanding such needs	Hai et al (2012)
4	Reducing Rework	Early identification coupled with detection of mistakes in the construction process with low reliance on final inspection and encouraging monitoring	Ballard (2008)
5	Process Design	Ensuring that the continuity of an effective design process is in place and eliminate any misunderstandings that may arise as a result of changes in design personnel changes	Barret,(2000)
6	Result Measurement	Setting and monitoring critical activities to measure project progress and results of quality levels to set goals and schedules	Phillips et al (2008)
7	Quality Assurance	The designed quality being the benchmark and activities should be ensured that planning, design and development to keep specifications and standards to stakeholder satisfaction	Phillips et al (2008)
8	Post Project Review	Management knowledge acquired at the completion of any project critically based on the activities carried out	BSI,(2008)
9	Post implementation evaluation	Evaluation in business form to measure the expense against the need for the project.	BSI,(2008)

Source: Chinyio and Suresh (2013)

Stakeholders are usually more satisfied with the quality of the end product. It should be of cardinal importance to note that end product satisfaction can only be attained if planned process is monitored and evaluated (Chimene and Suresh, 2013). Chinyio and Suresh (2013) further noted that quality appreciation can also be enhanced by ensuring stakeholder involvement from conception to the use of the project facility.

Table 3.3: Motivational Attributes of Quality Management (Employee)

Quality Attribute		Brief Description	Reference
No			
1	Employee empowerment	Building confidence or reducing employee dependence on external influence and ensuring conformance to design standards and specifications	Leung et al (2008)
2	Executive commitment	All management involvement and offering support to employees. Management motivation is cardinal	Hoonaker et al (2010)
3	Employee involvement	Building confidence in employee quality responsibility and decision making	Zwick (2004),Phillips et al (2008)
4	Teamwork	The use of teams through in goal focusing in process management and job performance coupled with satisfaction	Leung et al (2008)
5	Team based problem solving	No man is an island, each member's contribution should be acknowledged to problem solving. Team members should be accorded an opportunity to find solutions to project problems	Phillips et al (2008), Hoonaker et al (2010)
6	Increased supplier relationship	Suppliers should be involved in setting quality criteria	Bemelmans,(2012)
7	Motivation	Reward employees for their contribution towards quality attainment	Phillips et al (2008),

Source: Chinyio and Suresh (2013)

Chinyio and Suresh (2013) identified a number of factors that are barriers to the Total Quality Management implementation in the Nigerian construction projects. The issues identified include: nature of construction, Construction participants, Traditional contractual agreements, organizational characteristics and construction management approach.

Oluwatoyin and Oluseun (2008) developed a conceptual framework where they argued that successful TQM implementation is benchmarked or seen from three aspects namely employee satisfaction, Customer satisfaction and effective organizational operation. Oluwatoyin and Oluseun (2008) argued that if employees are not happy with their work, their relationship to production and the organisation affects customers. The satisfaction of the customer is the pride of the company as they are the main reason for the organization's existence (Oluwatoyin and Oluseun, 2008).

3.4 The Conceptual Framework

Figure 3.3 is a representation of the conceptual framework for the Applications of Total Quality Management in road construction based on literature and theories of past researchers. The problem at hand is in inferior quality or shoddy works that is being experienced on projects, the second one is the issue to do with budget constraints or cost overruns and lastly schedule escalations or time delays. All the three are present on road projects as a result of poor management and administration in the execution of projects. The three are all related such that if cost is not administered well, there will be a compromise on quality, and if quality is not well managed it will affect time as re-works are likely to increase.

Due to the fact that the three should be eliminated (Cost overruns, Time delays and inferior quality) there is a need to shift to a more effective Management philosophy. This new and effective philosophy is what is called Total Quality Management.

According to the conceptual framework, there is no relationship between Total Quality Management and poor administration and management of projects hence the reason for not having the link between the two. The success of Total Quality Management lie in its ability to use certain principles and variables that work as the driving factors or forces in its success. The first line highlights the major principles that need to be in place to have an effective TQM usage. These principles are analysed further as given below;

(i) Leadership and Top Management Commitment

When leadership is committed, which is what TQM is about; there is room that the organisation will have a well defined vision and plan for the organisation. This will help the organisation to set work benchmarks, implement quality standards and long range thinking goals. When long range thinking goals are in place, the organisation can easily have an executive that is fully committed to the organisation. This will make it easy to satisfy the principles of TQM.

(ii) System Process

A system process will enhance quality improvement. Once there is a system to be followed when or before any works can be done such as permits to excavate, inspection of sections to be surfaced, re-works will be reduced, quality control enhanced, coupled with quality assurance and an open culture will be promoted amongst work personnel and stakeholders.

(iii) Supplier Quality

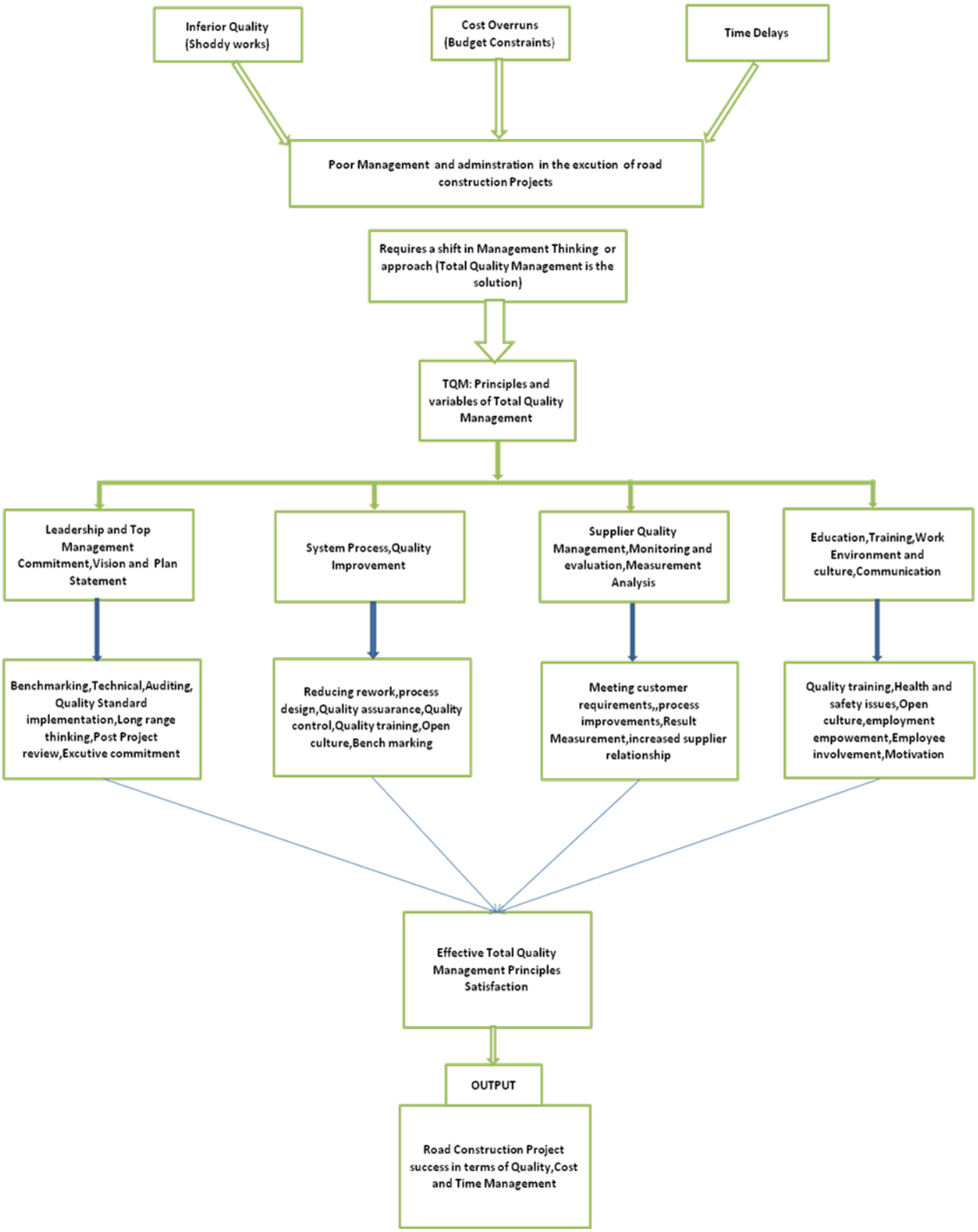
The involving of suppliers in the management of projects enhances monitoring and measurement analysis to be done easily. This also promotes the process improvements, result measurements and development of a strong relationship with the supplier. When the relationship with the supplier is well developed, it becomes easy to provide feedback on the performance of his products.

(iv) Education and Training

When Education and training on quality issues is offered to the project personnel, there is a change in culture in the way employee's value and view the importance of quality. It will also give motivation and empowerment to the employees as well as promotion of an open culture amongst them.

When there is a combination of the principles identified in (i) to (iv) above, the result is an effective satisfaction of Total Quality Management principles and once that is done there will be an effective output in terms of savings on Costs, Quality and time schedules.

Figure 3.3: Conceptual framework



Source: Author (2015)

Understanding of the project objectives by the concerned stakeholders enhances a successful project output. The level of project success is largely dependent on the extents to which Total Quality Management is applied.

Wideman (2001) recommends that it is essential for any project manager and his project team to be comfortable with their cultural, social and organizational ethics. He further highlighted that provided the stakeholders are involved in the initial stages, the possibilities of influencing the project in a positive way become eminent. Identification of some of the issues and risks at a tender stage significantly reduces the vice. This comes about when stakeholder participation is enhanced.

3.4.1 Conclusions from the conceptual framework

It was seen from the conceptual framework that for any organisation to be successful, in terms of Total Quality Management (TQM) implementation, it should have a system in place that encourages tools that bring about problem solving techniques that help in inducing continuous improvement opportunities. Jha and Joshi (2007) suggested that result oriented organisations try to integrate the following in their Total Quality Management implementation:

(i) visionary leadership,
(ii) customer-driven excellence,
(iii) organizational and personal learning,
(iv) valuing employees and partners, agility, focus on the future, managing for innovation,
(v) management by fact,
(vi) social responsibility, focus on results and creating value,
(vii) systems perspective

This should be coupled with how an organisation does its selection, its gathering, analysis, manages and improves its data and its information and how well it empowers its people towards information and its technology as an integral part on the achievement of Total Quality Management Implementation.

3.5 The Queuing Theory

The theory has been used by engineers in solving traffic engineering challenges, operations research and theories of reliability (Sztrik, 2012). Anokye et al (2013) analysed the principle of queuing and concluded that it can help prove the principle of traffic prediction passing a point at certain times. This theory has been used in chapter four to determine the sample population for road users.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

Chapter four brought highlights the research design, the sample population, sampling design and size, data collection and data analysis.

4.1.1 Research Objectives

The project research laid down the following as the objectives of this research:

(i) To identify which TQM principles are in use on road construction projects

(ii) To establish the extents to which TQM principles are applied on Zambian Government funded road projects

(iii) To establish the benefits of using TQM on road construction projects

(iv) To establish an implementation framework for Total Quality Management usage and implementation on road projects.

4.2 Research Approach used

Quantitative method of approach was used in this research due to fact that specific questions were asked to respondents which were narrow in nature and at the end the answers were analysed by simple statistical methods. The other reason being that information was analysed more in form of numbers. The approach used is further given in detail below:

4.2.1 Quantitative Approach

Fischler (2011) defined Quantitative approach as a kind of data gathering method that uses numbers in getting responses to the query and analyse them using statistics. The approach stresses on the importance of using scores on analyzing of the issue at hand. Creswell (2010) ascertains that this approach is used when the topic is relatively new or has not been tried before on that particular group.

4.3 Research Methods used

The methods adopted for this research included:

(i) Primary

(ii) Secondary sources

4.3.1 Primary Sources

Oluwatoyin and Oluseun (2008) defines Primary source of data as the information which is gathered directly by the researcher and is usually done on cases where secondary data is not available or is inadequate to meet the research

objectives. They (Oluwatoyin and Oluseun, 2008) further allude that the collection of primary data involves the use of strategies such as questionnaires and interviews. Primary data Technique involves such methods as observations, interviews and use of questionnaires. However, reliability of Primary Techniques depends on the consistency of the results obtained from the instrument used in the research (Oluwatoyin and Oluseun, 2008). In this research, questionnaires were used as a way of gathering data from the sources.

Oluwatoyin and Oluseun (2008) defined a questionnaire as a research instrument which consists of a series of questions and other timely purposed ways of gathering information from the respondents. Mostly, questionnaires are used for statistical analysis of the responses. Questionnaires can be of two types namely; self propelled or administered questionnaires which are posted to the respondent and returned and sent back after completion and an administered questionnaire is one in which delivery is by the interviewer him/herself. This research adopted the administered questionnaire approach.

4.3.2 Secondary Sources

This Technique involves the use of already processed information from another source. Literature review is a good depiction of the Secondary source or technique of data gathering.

4.4 Research Design

Mukumbwa (2013) defined research designs as plans that are used to provide guidance on, when and how data should be collected, how to collect it, from who and how the collected data would be analysed. The main purpose of the research design is to assist mould the approach to be taken in the research (Mukumbwa, 2013).

The purpose of this chapter was to find solutions to the objectives outlined in chapter one and how the aspects identified could be incorporated into an effective Total Quality Management implementation system through the identified data gathering methods namely the Questionnaires.

4.4.1 Questionnaire Surveys

A questionnaire is a set of questions prepared by the researcher to the respondent to help him get the answers. It can either be closed or open-ended or a combination of both (Oluwatoyin and Oluseun, 2008). This research was of Close-ended type. The questionnaires were designed in such a manner that they allowed the respondents to respond to the objectives of this research. The questionnaires were based on a weight from 1 to 5 with each of the weights defined. The questionnaires were designed in such a way that it allowed respondents to simply tick the appropriate number representing the required scale or weight. They were thirty five (35) questionnaires which were divided into eight (8) sections with each section designed in way that it compelled the respondent to give the information on Total Quality Management such as factors and implementation. The questionnaire questions were phrased in such as way that it compelled the respondents to give outright answers to the questions. The distribution and collection of the questionnaires was done by the author himself and were delivered by hand to the respondents. Piloting of the questionnaire was only done on RDA by the author as it was the most accessible stakeholder. Fine tuning of the questions was then done to ensure the questions were amended to suit the study.

4.5 Sampling Method

Two sampling methods were adopted for this research namely judgmental sampling and probability sampling. Whilest probability sampling gives an opportunity to have each sample selected, not all samples can be selected using this method. Each unit or sample in probability sampling has an equal chance of being selected and hence it gives a representative of the precise parameters in the population (Mukumbwa, 2013). Judgmental sampling was used on the other hand because of the restrictiveness of some of the information.

Judgmental sampling was used due to the following reasons:

(i) the sources of information were well known
(ii) the project area was singular and defined

In Judgmental Sampling, the researcher uses his judgment to select the population from which he can get accurate information (Dawson et al, 2008).

There are a number of Probability sampling methods and some of them include systematic probability sampling, stratified probability sampling and cluster sampling.

According to (Mukumbwa, 2013), Systematic sampling requires a list of some population under consideration. In systematic sampling, the population is divided into a number of units by the number desired for the sample.

Stratified sampling tries to ensure that a selected sample takes into consideration the groups in the population under consideration; this is done on the basis of common characteristics.

On the other hand, cluster sampling is used when large geographical areas are under consideration.

Stratified sampling was used in this research in the administering of questionnaires. Stratified sampling applied to the following groups:

(i) Contractors
(ii) Suppliers

The Sampling for road users was subjected to the Queueing Theory. The major purpose of Queueing theory is to get the main performance measures of a system that is probabilistic in nature (Sztrik et al, 2012).

4.5.1 Sample Sizes

The questionnaire distribution and sample size was divided in the following manner due to the nature of the adopted method of sampling and for the contractor it was restricted to the Copperbelt:

4.5.1.1 Road Development Agency (RDA-The Client)

The questionnaires for the Road Development Agency were distributed as follows:

(i) Planning/Design Department

The planning department comprised of two questionnaires .i.e. one to regional offices and the other one to headquarters. This was done to help in understanding how the designs were undertaken and what parties were involved.

(ii) Contracts Department

This department received two questionnaires, one was given to the regional office in Ndola and another to head office in Lusaka, making total of two for this department. This was to help understand how the contract was administered.

(iii) Procurement Department

The headquarters received one questionnaire to assist on how the awarding of the project was done in terms of duration and how the contractor was selected.

The summary of questionnaire distribution to the Road Development Agency is given in Table 4.1 below:

Table 4.1: Questionnaire sample size for RDA

Department	Net Number
Planning /Design -Ndola	1
Planning /Design- Lusaka	1
Contracts -Ndola	1
Contracts -Lusaka	1
Procurement -Lusaka	1
Total Questionnaires for RDA	**5**

Source: Author (2015)

4.5.1.2 Local Authority (Kitwe and Ndola City Councils)

The questionnaire for the Local Authority was directed at the Directors of Engineering services as they are the key personnel that are linked to road projects from the Local Authorities and these were the only Local Authorities that participated in the project. The distribution was as given in Table 4.2 below:

Table 4.2: Questionnaire sample size for the Local Authorities (Kitwe and Ndola City Councils)

Department	Net Number
Director of Engineering Services-Kitwe	1
Director of Engineering Services-Ndola	1
Total Questionnaires for Local Authorities	**2**

Source: Author (2015)

4.5.1.3 National Council for Construction (NCC)

The mandate as defined in the NCC Act No.13 of 2003 is to monitor the growth and performance of contractors in the country. The questionnaires to the National Council for Construction (NCC) were to help provide information as to what extents the body was involved in this project. The questionnaire survey was distributed as given in Table 4.3 below:

Table 4.3: Questionnaire sample size for the National Council for Construction (NCC)

Department	Net Number
National Council for Construction (NCC)-Copperbelt	1
National Council for Construction (NCC)-Lusaka HQ	1
Total Questionnaires National Council for Construction	**2**

Source: Author (2015)

4.5.1.4 Zambia Public Procurement Authority (ZPPA)

Public procurement is done by this entity and their questionnaire was to help understand how the awarding of the project was done. One questionnaire was delivered to ZPPA. The distribution was as given in Table 4.4 below:

Table 4.4: Questionnaire sample size for the Zambia Public Procurement Authority (ZPPA)

Department	Net Number
Zambia Public Procurement Authority -Lusaka HQ	1
Total Questionnaires National Council for Construction	**1**

Source: Author (2015)

4.5.1.5 The Contractors and Consultants (Copperbelt based)

They were a total number of five (5) Road contractors and four (4) consultants on the Copperbelt doing public projects through the Road Development Agency (RDA Contracts, Ndola, 2015). All the contractors and consultants were included in the samples as there was no significance of doing the sampling space due to the small number of respondents.

Table 4.5: Contractor and Consultant sample

Organisation	**Net Number**
Consultants	4
Contractors	5
Total Questionnaires	**9**

Source: Author (2015)

4.5.1.6 Suppliers of Various products (Copperbelt based)

Suppliers in this category related to all suppliers dealing in materials and services on roads registered with the National Council for Construction and were directly related to the execution of the works. The suppliers sampled were those given by the contractor to have participated on the project. The total number of suppliers given was eight (8) and all of them were sampled.

4.5.1.7 Ndola-Kitwe Dual carriageway Road Users

The Queueing Theory was used to come up with the sample size for road users. The points for analysis for this research were taken at Hillcrest check point and Zam-Turn police check points on the Ndola –Kitwe dual carriageway. The assumption here was that the traffic volume during and after construction of the carriageway had not changed much as the interlink of the activities the highway serves had remained constant before and after

construction. This principle (Queueing Theory) is based on Poisson's distribution along with a Queueing discipline of first come first serve basis (Anokye et al (2013). The parameters in use for this analysis are as given in the equations below and are known as the Mean Performance Parameters of the Queque M/M/1/∞:

$$p = \frac{\lambda}{\mu}$$ equation (ii) where the factors are as given in table 4.6 below:

Table 4.6: Mean Performance Parameters of Queueing Theory

Parameter	**Definition of Parameter**
p	Traffic intensity or occupancy
λ	Average arrival interval
μ	Average service rate

Source: Anokye (2013).

To determine the number of users or vehicles passing a point on the road, the mean number of traffic in the system, equation (iii) was used.

For equation (ii) to work, the average rate of service or simply put service rate should be higher than the rate of arrival. Equation (iii) gives the Mean number of traffic in the system passing a certain point (Anokye, 2013).

$$N = \frac{p(1-p) = p}{(1-p)^2} \quad or \; N = \frac{p}{1-p} = \frac{\lambda}{\mu-\lambda}$$ equation (iii)

The traffic data was taken and recorded at the two check points as given in table 4.7 and table 4.8 below:

Table 4.7: Traffic counts at Hillcrest and Zam-Turn check points

No	LOCATION	SESSION	ARRIVAL		SERVICE	
			Average		Average	
			Cars (No)	Time (min)	Cars (No)	Time(min)
1	Hillcrest	Morning	65	5	88	5
2	Zam-Turn	Morning	71	5	83	5
3	Hillcrest	Afternoon	32	5	44	5
4	Zam-Turn	Afternoon	43	5	55	5
5	Hillcrest	Evening	74	5	86	5
6	Zam-Turn	Evening	81	5	99	5

Source: Author (2015)

Table 4.8: Traffic count results at Hillcrest and Zam-Turn check points results

Parameter / Value	λ = arr no.car / arrival time	μ= ser n.o car / service time	$p = \frac{\lambda}{\mu}$	$N = \frac{p}{1-p}$
No. 1	13	18	0.7222	3
2	14	17	0.8235	5

3	7	9	0.7778	4
4	9	11	0.8182	5
5	15	17	0.8824	8
6	16	20	0.8000	4

Source: Author (2015)

The highest mean number of cars in the system is 8 road users at a time passing a certain point; therefore the highest number used was 8 questionnaires for road users. The questionnaires were distributed to road users that had used the road before, during and after its construction.

The total number of questionnaires distributed for the entire research was as given in Table 4.9 below:

Table 4.9: Table Questionnaire distribution summary

Target Stakeholder	**Net Number**
Road Development Agency (RDA)	5
The Contractors	5
The Project Consultants	4
Local Authorities (Kitwe and Ndola City Councils)	2
National Council for Construction (NCC)	2
Zambia Public Procurement Authority (ZPPA)	1
Road Users	8
Suppliers	8
Total Number of Questionnaires to distribute	**35**

Source: Author (2015)

4.5.2 Data collected

The data collected from various project participants directly and indirectly was highlighted in the various questionnaires given. However summary of the data tried to establish if Total Quality Management was used on the project either by any of the parties and the project as a whole as well as establish a system that might have been used if any. It also tried to establish a system that can be used in the implementation of Total Quality Management and the extents to which the principles of TQM are being applied on road projects.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

5.1 Introduction

Chapter five provides data collected from the questionnaires and analysed it. This research was an investigative one as it identified the factors that are responsible for the escalations on cost, time and quality shortfalls and proved the correlation between Cost, Time and Quality. The descriptive statistics were used in line with the total scores and frequencies which permitted the ranking of the factors as given by the respondents.

The average work experience for the respondents was 8.3 years and it was assumed that they had enough experience to understand and respond to the questions.

Out of a total number of thirty five (35) administered questionnaires by the author, Twenty six (26) respondents gave feedback, eight (8) were unreached (combined with non response) and one (1) was rejected representing an accepted response rate of 74 percent.

The constants used to weigh the respondents views were weighed from 1 to 5 and were defined as given below;

(i) 1-Strongly disagree

(ii) 2- Disagree

(iii) 3- Neutral

(iv) 4- Agree and

(v) 5-Strongly agree

5.2 Data Presentation

The analysis was based on data collected from the projects on the Copperbelt Province of Zambia. The respondents were from the Consultants, Contractors, Client's Agencies, Material suppliers, Road users, Local Authorities, Regulatory bodies and the distribution of questionnaires replied to was as given in Table 5.0 below to a round figure:

Table 5.0: Questionnaire distribution summary

No.	Respondent	Administered	Successful/Returned	Response Rate
1	RDA	5	4	**80%**
2	Contractors	5	4	**80%**
3	Consultants	4	3	**75%**
4	Local Authorities	2	2	**100%**
5	NCC	2	1	**50%**
6	ZPPA	1	0	**0%**

7	Road Users	8	8	**100%**
8	Suppliers	8	4	**50%**
Total Average		**35**	**26**	

Source: Author (2015)

5.2.1 Ndola-Kitwe Dual Carriageway Road Project Synopsis

The Ndola-Kitwe Dual Carriageway Road Project initially commenced on the 28th of November 2012 and was initially estimated to end on the 28th of August 2014 (Roads 2014, RDA Edition 10).The project contractor was China Jianxi and the project consultant was Nga'ndu Consulting Limited. The other project parties included the Road Development Agency as the Client (on behalf of the Government) and NCC as auditors. The road is a strategic link conveying very important goods and services within and across the country's borders. The scope of works included bush clearing, pothole patching, edge repairs, shoulder reinstatement, reconstruction of selected sections, asphalt leveling on wearing course, asphalt wearing course on reconstructed sections, drainage works, and provision of road furniture .The works had an additional scope of upgrading of 7.02km to bituminous standards from the main carriageway to Ndola Girls Technical School. The project had a total number of 455 employees of which 43 were women (Roads 2014, RDA Edition 12).The cost and schedule of the project were as given in Table 5.1 below:

Table 5.1: Cost and Schedule Project escalations for the project under review (Ndola-Kitwe dual Carriageway)

Item Name	Initial Estimate	Final Achieved	Percentage escalation
Cost	290,287,688.31 ZMW	311,206,169.37 ZMW	7.2%
Duration	18 Months	31 months	72.2%

Source: RDA (2015)

Some of the other projects sampled are given in Tables 5.2 and 5.3 below:

Table 5.2: Cost and Schedule Project escalations for Kalulushi-Lufwanyama Road

Item Name	Initial Estimate	Final Achieved	Percentage escalation
Cost	123,122,864.49 ZMW	137,987,876.97 ZMW	12.07%
Duration	24Months	33months	37.5%

Source: RDA (2015)

Table 5.3: Cost and Schedule Project escalations for Luanshya, Ndola urban Roads

Item Name	Initial Estimate	Final Achieved	Percentage escalation
Cost	53,000,000 ZMW	139,000,000 ZMW	162.3%
Duration	12Months	18months	50%

Source: Gomes (2015)

5.3 Data Analysis

Data analysis was presented in a summarized format and in tabular form as per response from each respondent group. However analysis for the study was categorized in groups so that it could allow for the project objectives to be analysed critically.

5.3.1 TQM use on Government Funded Road Projects in Zambia

5.3.1.1 Data gathered from the Contractors

Results from the contractors revealed the following as given in the tables taken from a scale of 1 to 5 as the respondent's weights.

Table 5.4: Principles in use on road construction projects

Descriptive statistics	Mean Response	Percentage	Rank
Total quality Management was applied on the project	2.25	45%	4
Total commitment from the project team in attaining the quality to the desired specifications on the project	3.25	65%	2
Control and measuring methods	3.00	60%	3
Good Communication	3.75	75%	1
Stakeholder participation	3.25	65%	2
Supplier involvement	1.25	25%	5
Teamwork	3.25	65%	2
Process improvements	2.25	45%	4
System process for decision making	3.75	75%	1
Grand Mean	**2.89**	**57.80%**	

Source: Author (2015)

Table 5.4 indicates that a system process and good communications were ranked as the highest TQM principles in use on road projects followed by project team commitment, stakeholder participation and teamwork. Control and measuring methods was ranked third with process improvements and TQM use in fourth whilest supplier involvement was ranked fifth and last. The overall average TQM principle usage stood at 57.8% with a grand mean response of 2.89 out of a total score of 5.

Table 5.5: Extents to which TQM Principles are being applied

Descriptive statistics	Mean Response	Percentage	Rank
To what extents do you practice or apply the principles of TQM in your organisation and your projects?	4	80%	3
How would you rate client's satisfaction in your organisation?	3.75	75%	4
Do you set quality levels in your organisation?	4.25	85%	2
How does your organisation rate customer satisfaction?	3.5	70%	5
To what level does your organisation value quality?	4.5	90%	1
How often do you survey your client's satisfaction?	2.5	50%	7
Do you have a system for gathering employee suggestions?	3.25	65%	6
Do you have a system that empowers employees to make changes to the operation?	4.25	85%	2
The Surrounding communities were involved in the project in any way	2	40%	8
Grand Mean	**3.56**	**71.11%**	

Source: Author (2015)

Table 5.5 represents data on the extents to which TQM principles are being applied and overall ranks the extent percentage at 71.11% application. Organization's valuing of quality was ranked the first at mean response of 4.5 at 90%, setting quality levels and having system that empowers employees to make suggestions was ranked number 2 with a mean response of 4.25,the other principles ranked 3rd was extents of TQM usage with rating clients satisfaction in the fourth place. The last ranked had a mean response of 2 at 40%. The average percentage extents to which TQM principles are in use stood at 71.11%.

Table 5.6: Benefits of using TQM on road projects

Descriptive statistics	Mean Response	Percentage	Rank
The use of Total Quality Management could save on costs, Time overrun and quality challenges on the project	4.25	85%	2
Total Quality Management usage has resulted in successful project execution on similar projects	4.25	85%	2
Total Quality Management can be a solution to Poor Management and administration in project execution of roads	4.75	95%	1
Total quality management can be a solution to losses in project objectives	4.25	85%	2
Total Quality Management can be a solution to Time escalations	4.25	85%	2
Grand Mean	**4.35**	**87%**	

Source: Author (2015)

Table 5.6 represents the benefits of using TQM on road projects with its highest ranked one being its ability to solve administration and management loopholes. The other 2nd ranked factors or benefits include savings on costs, quality challenges and schedule overruns, project objective attainment and time control or monitoring.

Table 5.7: Possible TQM principles that can be used on road construction projects

Descriptive statistics	Mean Response	Percentage	Rank
Technical expertise in project personnel	5	100%	1
Standards such as ISO 9001,ISO 14000	4.5	90%	3
Training in Quality of project personnel	4.5	90%	3
Leadership and Top management commitment	4.5	90%	3
Workers need training and education	4.75	95%	2
Supplier involvement as stakeholders	4.5	90%	3
Total commitment from the project team	3.75	75%	4
Grand Mean	**4.5**	**`90%**	

Source: Author (2015)

The principles of TQM that can be used on road construction projects had technical expertise ranked number 1 with a mean response of 5 at 100% support from respondents, training and education was ranked 2nd with a response rate of 4.75 whilest those ranked 3rd included supplier involvement, Top leadership and management commitment, training in quality of project personnel and use of standards such as ISO 9001,ISO 14000 with a mean response of 4.5 and lastly total team commitment at 3.75 as mean response. The grand mean for the principles capable of being used on road construction was 4.5 representing 90% usage.

Table 5.8: Implementation framework for TQM Implementation

Descriptive statistics	Mean Response	Percentage	Rank
Quality control should be encouraged throughout the project life cycle	4.5	90%	3
Continuous improvement should be encouraged in Total Quality Management implementation	5	100%	1
A system process necessitates quality improvement	4.25	85%	4
Top Leadership should spearhead the implementation and benchmarking of quality standards in an organisation by creating an executive interactive environment	4	80%	5
Formulation of a legal framework	4.25	85%	4
Auditing and monitoring of project performance	4	80%	5
Overhaul of a current management system	3.75	75%	6
Formation of Quality groups	4.75	95%	2
Grand Mean	**4.31**	**86.25%**	

Source: Author (2015)

Table 5.8 presents data regarding the implementation framework for TQM on road projects. The analysis ranked continuous improvement at number 1 with a mean response of 5; formation of quality groups was second with a 4.75 mean response. The respondents were of the view that quality control should be done throughout the project life cycle which had a mean response of 4.5,formation of a legal framework with a system processes were ranked 4th with a mean response of 4.25 and overhaul of the current system was ranked last at 6 with a mean response of 3.75. The average support for the legal framework implementation was at 86.25%.

5.3.1.2 Data gathered from the Road Development Agency (RDA)

The survey on the Road Development Agency was done to supplement information provided by the contractors. The average work experience for the respondents from RDA was 7 years and 4 months and it was assumed that there was enough experience from the respondents in understanding the topic. The project objectives were well understood by the RDA project personnel. There was an agreement from the RDA respondents that the use of TQM could have saved on the Cost escalations, Quality shortfalls and schedule overruns on the project. The respondents also felt that the contractor's execution team did not fully understand the project objectives. In as much as the RDA respondents showed an appreciation for the use of TQM principles in the managing and running of the organisation, there are no formal guidelines on its use, hence showing that TQM is not in use by RDA. Although the RDA agreed that the current system was not fully sufficient to overcome the lapses in the triple constrains of Cost, Quality and Time, their recommendation is not to fully overhaul the current system but fix what is not working and retain what is doing well. Auditing of projects was also seen as one of the cardinal factors that would help assist project success. The response from RDA highlighted the causes of Cost overruns as lack of education and training on project personnel, Lack of timely funding by clients, wrong conceptual designs and scope changes. On schedules overruns, issues of the absence of a monitoring system, scope changes and untimely funding were cited. Quality shortfalls were identified to be happening due to cheating by contractors in submitting wrong test results, wrong personnel documents during tender and unethical conduct in works execution.

5.3.1.3 Data gathered from Project Consultants

The consultants cited poor management in the execution of road projects due to the absence of TQM as a major cause of the challenges to do with Quality, Cost and schedule overruns. If TQM implementation was to be fulfilled, the consultants cited use of standards such as ISO 9001, ISO 14000 as cardinal in TQM implementation. This also calls for continuous improvements and accountability from all project stakeholders. The causes of Cost overruns, Quality shortfalls and project schedule overruns cited by the RDA were equally echoed as the causes by the consultants.

5.3.1.4 Data gathered from The Local Authorities

As stakeholders in project execution and planning, the local authorities revealed that they were only involved in the project by 50%. The respondents also revealed that if TQM has to succeed, it should be used throughout the project cycle than to be selective on stages on which to use it. In a quest to implement TQM, the Local Authorities cited training and education, continuous improvement and accountability from project stakeholders as cardinal in project success. Although The Local Authorities echoed the same reasons as RDA on the causes of Cost overruns, Cost

escalations and Quality shortfalls, they were neutral on Total overhaul on the current system in use in the execution of projects.

5.3.1.5 Data gathered from Material Suppliers

According to the material suppliers, the involvement of their organisations in the planning of the project execution from the start to the end would have saved on Costs, Project schedule overruns and quality problems. Feedback was considered as a very important factor in the execution of projects as it helps in supplier quality management.

5.3.1.6 Data Gathered from Road users

Road user's consideration during project execution can save on unnecessary conflicts that arise between the road users and project team if communication is enhanced as well as proper signage and an environment that takes care of health and safety of all other project stakeholders. The information on road sections to be worked on at particular times was seen as important/cardinal to the road users.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Chapter six gives the conclusions on the findings and makes recommendations on the use of Total Quality Management as well as an evaluation to the principles that can be used on project execution on Government funded road projects and provides limitations to the research.

6.2 Findings from Literature review

Findings from literature review in line with the study's project objectives revealed that TQM principles on road projects are not different from those in other industries. Such principles include; workforce procedure education, promotion of suppliers and subcontractors, system controls and focuses groups. The extents to which these principles are applied by organisations practicing TQM in project management is high and is usually done with an improvement process.

Literature review has highlighted a number of benefits of using TQM in the management of road projects and some of them include; enhancement of business quality, increases in customer satisfaction, reductions of project unplanned costs, savings on time as it will reduces on re-works and enhances customer contractor relationship as it reduces conflicts. From Literature, the study identified the following as the factors that hinder the implementation of TQM on projects; lack of a monitoring system, low education levels, absence of supplier customer relationship and absence of communication. To have an effective TQM management system (Jafari and Setak, 2010) recommended the use of quality circles.

6.3 Findings from Data Analysis

The findings from analysed data revealed that Zambia government funded road projects are marred with quality shortfalls, Cost and schedule overruns and their causes were identified as given below;

6.3.1 Causes of Cost overruns on Road construction projects in Zambia

The prominent causes of cost overruns identified in the research on Government funded road projects in Zambia included Lack of supplier involvement in delivery schedules, Re-works due to non specification understanding, Lack of cost monitoring systems, poor project administration, Untimely payments by the clients for works done, Lack of education and training on project personnel, Wrong designs at conception stage and delays in responding to queries by consultants, Lack of timely funding by the client to the project for completed works which attracts interest, Project scope changes during project execution and at handover.

6.3.2 Causes of Quality shortfalls on Road construction projects in Zambia

The research established the following factors as the prominent causes of quality shortfalls; Lack of technical expertees, Selective quality control on project stages, Solving problems without identifying the root causes, Lack of

training in quality of project personnel, Lack of a system process to necessitate quality improvement, Wrong designs at project inception, Lack of defined objectives at conception stage by the client, Lack of technical inputs at design stage by the client's consultants, Late engagement of consultants by the client, Lack of a system process and a measuring process to achieve project objectives, Lack of a team based problem solving of project issues from the project participants, Insufficient consultant's personnel to supervise the project, Lack of training and education on project personnel, Cheating by contractors in submitting test results, Project scope changes during project execution by the client.

6.3.3 Causes of schedule overruns on Road construction projects in Zambia

Research has established the following as major causes of schedule overruns on Government funded road projects in Zambia; Lack of stakeholder accountability on the project team, Lack of vision from Top leadership in management of projects, Lack of Quality Assurance, Quality control and Quality training to reduce on rework, Lack of Supplier involvement in delivery times of materials and services, Time lapses to get feedback for the required information on which to make decisions, Wrong designs at conception stage and delays in responding to queries by consultants, Lack of timely funding by the client to the project for completed works, Project scope changes during project execution and at handover, Late engagement of consultants by the client, Lack of technical inputs at execution stage by the contractors, Large lapse time between condition surveys and project award, Lack of a system that takes care of health and safety issues, Poor Management and administration in execution of road projects, Non consideration of Road signage and traffic control, Non involvement of the Local authorities in the design process and supervision of the projects and Non team based problem solving of project issues from the project participants.

It was seen from 6.3.1,6.3.2 and 6.3.3 that some of the reasons for the causes in Cost overruns, Schedule escalations and Quality shortfalls are intertwined, proving the relationship in the three tenets that they are interrelated i.e. Cost, Quality and Time.

6.4 Conclusion and Recommendations

6.4.1 Conclusion 1

There are a good number of TQM principles in use on Government funded road projects in Zambia. For example the following were seen as the TQM principles in use by the road project stakeholders; good communication, system process for decision making, teamwork, stakeholder participation, control and measuring tools and team commitment to achieving goals. The application of these principles varied from one stakeholder to another but was seen to be more prevalent with the contractors.

6.4.1 Recommendation 1

For the TQM principles to be used effectively there should be training and education to the project personnel on the importance of upholding these principles. For example the operatives should know that if they can't communicate, they cannot get feedback and hence may not get the required materials for work execution in time. Organisations i.e. contractors should devise methods or procedures of doing their work, i.e. who should be informed, when, by who and for what. Project stakeholders should also encourage innovation in line with the demands of the job specifications, for example, method statements on how work will be done and any risk identification by team members.

6.4.2 Conclusion 2

Results show that there are some levels of TQM principles being applied by project contractors on road projects. About 71% of surveyed TQM principles seem to be in use by 4 of the surveyed contractors.

It was also evident from the surveyed projects that there are Cost escalation, Quality shortfalls and schedule overruns on Zambian funded road projects. Results showed the following as the cost escalations and Schedule overruns incurred.

Ndola-Kitwe Cost escalation was 7.2% with a schedule overrun of 72.2%, Kalulushi-Lufwanyama Road Cost escalation was 12.07% with a schedule overrun of 37.5% while Luanshya, Ndola urban Roads suffered Cost escalations of 162.3% and schedule overruns of 50%.These results indicate that there are escalations on Cost, schedule overruns and Quality shortfalls which need a solution.

6.4.2 Recommendation 2

The escalations in terms of cost and Schedule plus quality shortfalls are quiet high on the Zambian Government funded road projects. To counter these escalations on schedules and cost as well as quality shortfalls, the following principles should be promoted; Leadership and Top management commitment. Top management should ensure that they spearhead quality programs, training of personnel and ensuring that plans are adhered to by the project team members. Training and education of project personnel should be promoted. The organisations should set up deliberate policies where they ensure that their personnel have basic skills in construction such as material testing, reading of drawings, costing and quality control. These trainings can be accessed from the National Council for Construction school. Motivation of team members will promote continuous improvements and helpful suggestions may get promoted. Awarding of deserving employees should be enhanced as well as an open culture. The involvement of suppliers in material and service schedule deliveries should be promoted. This can be done by promoting the use of supplier feedback on how they feel about customer advice and related issues, feedback on the performance of their products as well as promotion of training were the supplier of machinery gives basic skills to the mechanics of the client (in this case the user) of their equipment. Basic skills or expertees in the team leaders should be promoted. These should be able to share knowledge to their members by offering workshops, classes and

information manuals. The principles identified, which may vary from one project to another should be applied throughout the project life from inception to completion and handover.

6.4.3 Conclusion 3

In as much as there are advantages of using other management philosophies in project management, there are more benefits of using TQM as a management philosophy than any other. Not only do these benefits go to the customer, but to the organisation engaged in project execution as well. The direct benefits include saving on costs, quality and time losses, promotes effective management, keeps the organisation focused on project objectives and promotes unity. The major drive in using TQM lies in its ability to promote customer-relationship which encourages the use and improvement of the best materials and services. Apart from giving a competitive edge to an organisation over others, it helps give employees skills that other management philosophies won't promote and TQM has focus of improving employee knowledge and skills in their project execution fields and beyond.

6.4.3 Recommendation 3

To fully reap the benefits of TQM, the following recommendations were made; Contractors and other project stakeholders should invest in training of personnel, the vision of the organisation should suit the business i.e. construction. Employees should be given responsibilities which will encourage their total participation (unappreciated employees are underproductive). Identification of employees to award or train can be done by use of performance appraisals. To encourage employees to stay longer in the same organisation i.e. contractor, long term goals such as department rotation of personnel should be promoted. This will allow employees to be more conversant with organizational performance in terms of policies and procedures.

6.4.4 Conclusion 4

The research identified a number of factors that are responsible for the hindrance in TQM implementation on road projects in Zambia. Data from the respondents revealed the following as the main hindrances to the implementation of Total Quality Management on road projects; Lack of training and education, Lack of monitoring and measurement, Lack of defined project objectives, Rigidity in changing organizational culture, Lack of vision and Top Management support, Low supplier involvement, Low stakeholder involvement, Lack of system process and Lack of a system procedure.

6.4.4 Recommendation 4

First and foremost, the implementation framework should be carried out bearing in mind that there should be cultural change in the way the organisation operates. The author recommends the following framework for Total Quality Management implementation;

6.4.4.1 Step 1: Commitment from Top Management to change organizational culture

The first step would be to change how the organisation operates by aligning what needs to be changed to what the organisation requires. At this point management should define the improvements to be made. The most critical issue

at this point is to ensure that Top management becomes fully committed to the set goals in changing the process on how the organisation used to be run.

6.4.4.2 Step 2: Develop the Mission and the Vision

At this stage, share of responsibilities, alignment of departments to suit the goals with the involvement of all concerned should be done. Formulation of the Mission and vision should involve the employees and it should be ensured they understand what the organization's long and short term goals are. Depending on the goals set i.e. long or short term, the organisation should be able to decide on what type of training to offer to its employees.

6.4.4.3 Step 3: Set the objectives that the organisation wants to achieve

These objectives should be measurable in that the organisation should be able to quantify if its achieving its goals or not. The purpose of setting measurable objectives is to help monitor if the organisation is moving towards its mission and helps mould management decisions.

6.4.4.4 Step 4: Formulate the Critical Success Factors

The critical success factors will help an organisation understand what they need to do in order to monitor or check if they are gaining or losing in terms of achieving goals. The selected critical success factors should be able to give direction as to how the attainment of goals will be achieved. Some of these critical success factors would include; Leadership and Top Management Commitment, Defined Vision and Policy Statement, Quality Management by Supplier, System for Quality process improvement, Total involvement of employees, Training coupled with education, Performance appraisals, Recognition, customer oriented satisfaction, Work environment and culture, Continuous Monitoring and evaluation, Communication and Motivation.

6.4.4.5 Step 5: Break down the Critical Success Factors into Sub Factors

Identification of who the selected Critical success factors will be instituted or used is interpreted at this level. The assigning and monitoring or measurement of the factor performance should also be cleared at this stage.

6.4.4.6 Step 6: Measurement and monitoring of the Critical success Factors

Measurement to ensure what the organisation planned as a new system is being implemented becomes important. Comparisons to what is required and what is being achieved should be ensured so that the organisation can know what to improve, what to re-align, when to make changes and the implications if changes are not made is enhanced. Continuous improvements should go with recommendations where opportunities for changes can be made. To do step 6 effectively, the formation of quality groups would be cardinal.

Although the research was more inclined to the use of Total Quality management by the contractors, other project stakeholders were sampled in order to check their view on the use of TQM in managing road construction projects and if they use any of the TQM principles in managing their projects.

6.5 Research Limitations

The research faced a number of limitations as follows;

(i) Accessing of critical information such as project costs from respondents was treated as confidential by most respondents.

(ii) Respondents from Government agencies did not want to participate in the questionnaires, these included ZPPA

(iii) Time was not enough to do further research on challenges faced by construction companies in implementing Total Quality Management

(iv) Top management from the surveyed respondents did not want to respond to questionnaires but instead delegated on a good number of administered questionnaires.

(v) The study failed to explore what specific management styles are in use on road construction projects due to an overrun in Time.

6.6 Recommendations for further research

Further research is recommended to explore specific models that can be used in the implementation of TQM in management of projects either in execution, supervision, selection and project identification. The author also recommends further research in involving a legal procedure or framework on the use of TQM on Government funded road projects.

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