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Analysis of the Causes Cost of Poor Quality in the South African Construction Small and Medium Enterprises

A thesis submitted in partial fulfilment of the requirements of the degree

MASTERS TECHNOLOGIAE
In

OPERATIONS MANAGEMENT
In the

FACULTY OF ENGINEERING AND BUILT ENVIRONMENT
at the

UNIVERSITY OF JOHANNESBURG

By

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February 2019

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PREFACE

The work presented in this master’s thesis was conducted at the Department of Quality and Operations Management within the Faculty of Engineering and the Built Environment of the University of Johannesburg under the supervision of Mr Ndala Yves Mulongo and Prof Pule Kholopane. One peer-reviewed conference proceeding was generated out of the content of this master’s thesis

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I would also like to thank all the respondents for making this work a reality.

And to everyone who in one way or another contributed to the completion of this work, you are appreciated.
DECLARATION

I, DORCAS NIATI, do hereby declare that this dissertation is the result of my own investigation and research, except to the extent indicated in the references and by comments included in the body of the report and that it has not been presented elsewhere for a similar purpose. It was submitted to the University of Johannesburg (Department of Quality and Operations Management), as a requirement to obtain a MAGISTER TECHNOLOGIAE degree in Operations Management.

________________________  12/02/2019

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ABSTRACT

With the current ever-growing competition within the worldwide market, business organisations are aiming to design and generate goods or service of high quality in order to have competitive market advantage. Over the last decades, many business organisations begun to be concerned with the issue related to enhancing quality and measuring quality-related problems. Nowadays, firms especially small to medium enterprises have developed the fear that generating product of high quality or offering service of high-quality mean that high cost will be involved. This is not true, since poor quality products or service equals high costs. Hence, the concept of Cost of Poor Quality has become a buzzword among industrial practitioners as well as scholars, during the past decades. To this end, this study aimed at analysing the causes behind the Cost of Poor Quality within the small to medium enterprises, using the South African Construction sector as case study.

To achieve this goal, the present study adopted a two-fold approach, first this study conducted a critical appraisal of a set of previous studies with the aim of identifying existing gaps in the current literature. Secondly, the study refined the existing gaps by means of a quantitative research methodology. Based on the two-fold approach, the results related to the critical analysis of existing studies demonstrated that many studies have used large companies especially multi-national manufacturing companies to measure and determine the reason behind the Cost of Poor Quality. Whilst, very few attempted to measure the cost of poor quality in the small to medium manufacturing enterprises. Hence, this study is among the first example in the context South African small to medium construction enterprises. Secondly, the results obtained through a quantitative research survey demonstrated that the factors associated with poor performance of South African construction sector were cost, time, quality, productivity, client satisfaction, regulatory, human resource, health and safety, Innovation and learning and environmental factors. Additionally, the results revealed that the implementation of the concept of cost of quality was not easy. Furthermore, respondents argued that they did not have enough knowledge concerning the concept of cost of quality; the implementation of cost of quality was seen to be expensive; the collection cost of poor quality data revealed itself to be difficult; there is a lack of information sharing; there is no commitment from the senior management; an organisation’s culture can be a barrier to the implementation of a cost of quality program; experts perceive the benefits of cost of quality to be insufficient and lastly; and there is no sense of accountability when it comes to cost of poor quality. Considering these, the present study recommended that due to the benefits that can be generated through the implementation of the concept of Cost of Poor Quality, decision makers in the construction sector should develop a culture of knowledge sharing, especially in the small to medium enterprises in order to successfully adopt and implement the Cost of Poor Quality.
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LIST OF ACRONYMS

AIC: Advanced Industrial Country
ANN: Artificial Neural Networks
ASEAN: Association of Southeast Asian Nations
B-BBEE: Broad-Based Black Economic Empowerment
BEE: Black Economic Empowerment
BNA: Banco Nacional de Angola
BOT: Build-Operate-Transfer
CIDB: Construction Industry Development Board
COPQ: Cost of poor quality
COQ: Cost of Quality
D&B: Design and Build
DBR: Dowel Bar Retrofit
EPCM: Engineering, Procurement, Construction and Management
ERL: Express Rail Link
EU: European Union
FDPSO: Fuzzy Discrete Particle Swarm Optimisation
FGA: Fuzzy Genetic Algorithm
FIEC: European Construction Industry Federation
FIFA: Fédération Internationale de Football Association (French: International Federation of Association Football)
GDFI: Gross Domestic Fixed Investment
GDP: Gross Domestic Product
GFCF: Gross Fixed Capital Formation
H&S: Health and Safety
IBS: Industrialised Building Systems
IMF: International Monetary Fund
ISO: Internal Organisation for Standardisation
JCP: Jointed Concrete Pavement
JIT: Just-in-Time
JSE: Johannesburg Stock Exchange
LRT: Light Rail Transit
MMC: Modern Methods of Construction
MSS: Maximum Sensitivity Selections
MYR: Malaysian Ringgit
PAF: Prevention, Appraisal and Failure
PEV: Plug-in Electric Vehicle
PMC: Project Monitoring and Control
PRC: People’s Republic of China
QES: Quality, Environmental and Safety
QIP: Quality Improvement Project
R: Rank
SD: Standard Deviation
SME: Small and Medium Enterprise
SMME: Small, Medium and Micro Enterprise
SPC: Statistical Process Control
SRO: System Reliability Optimisation
TANU: Tanganyika African National Union
TPS: Toyota Production System
TQM: Total Quality Management
UK: United Kingdom
UN: United Nations
UNCHS: United Nations Commission on Human Settlements
USD: United States Dollar
V: Variance
WCED: Western Cape Education Department
ZAR: Zuidafrikaanse Rand (South African Rand)
ZI: Zero Inventories
CHAPTER 1 INTRODUCTION

Quality is frequently comprehended as a basic achievement factor for accomplishing competitive advantage in organisations. Relatively every organisation is by one means or another, advancing and putting a considerable measure of endeavours towards their excellent offerings, at least when promoting their offerings to clients. In the competitive market today, most organisations are tested to furnish their clients with items and administrations requiring as little expenses as possible without influencing the quality of the item (Miller, 1996). In the past, organisations have had to deal with the fact that great quality equals high expenses, while it is in reality, the absence of quality that causes high costs (Flynn et al., 1994). Miller (1996) insist on the utilisation of the expression Cost of Poor Quality (CoPQ), to accentuate that low quality is what causes costs. Anderson et al. (1994) characterises CoPQ as "the expenses which would be disposed of if an organization's items and the procedures in its business were great". In recent writing on CoPQ, various writers have built up various frameworks, accentuating diverse classes of CoPQ (Wicks and Roethlein, 2009). The purpose behind it is that organisations have different issues and needs and thus need to concentrate on various prioritised zones. Further, the diverse arrangements are because of various understandings and core interests (Anderson et al., 1994).

Due to stiff competition and evolving client needs in the present world, firms can barely compete in the marketplace without incurring higher costs. Low quality implies that companies stand to lose their competitiveness. Quality expenses, in this particular situation, refer to the hidden part of the cost iceberg, which will constitute an awesome advantage to the organisations, as long as they are identified and managed. In this manner, the estimation of the costs of quality deserves to be thought about at firm level, for the good of the business and economy in general. Most of the time, quality costs are split into two important classes: the cost associated with accomplishing great quality, otherwise called the cost of conformance; and the cost related to low quality items otherwise known as the cost of non-conformance (Reeves and Bednar, 1994). A few models are found in written works about costs of quality, which talk about the connection found between costs of conformance and non-conformance, which are otherwise called ‘the traditional quality cost model’, ‘quality-based learning model’ and ‘the new model of quality costs’.

This master’s thesis aims at studying the cost of poor quality in the small and medium construction sector, using South Africa as a case study. This first chapter is merely a collection of basic background information concerning the research. It begins with a research regarding the contextual background and further brief supporting aspects within the literature.
1.1. Background

As one of the greatest businesses around the world, the construction industry assumes a critical part in the pursuit for social and contributes to economic growth and development of a specific country. On a social basis, it provides people with places for lodging, instruction, culture, pharmaceutical, business, recreation, entertainment and in addition urban foundation. Railways, ports, roads, power and water supply, drainage, sewerage and telecommunications (Yang, 2008). On an economical level, Mthalane et al. (2008) think that the construction sector adds to the economy of a nation by giving the greater part of the nation's fixed capital resources and framework that help different ventures, making openings for work, and expanding national Gross Domestic Product (GDP).

The construction sector encourages customers to achieve better value for money, for work done by building companies by bettering local construction businesses (Sambasivan and Soon, 2007). It represents a pillar of the local economy of a nation (Ortiz et al., 2009) as well as a controlling arm in government service to ease or slow down the activities pertaining to economy (Aibinu and Jagboro, 2002). It is also known as an industry that offers benefits that result in construction products, including initiation, outline, development, task or operation and annihilation stages. It is a sector that is highly risky, that generates small profit and has a reputation for disappointing clients (Dubois and Gadde, 2002). Same opinions are expressed by Dubois and Gadde (2002) about the fact that the construction sector is prone to risk because of financial, legal, political and cultural difficulties.

Spence and Mulligan (1995) refer to the construction sector as an organisation of build and design. Spence and Mulligan (1995) definition also underlines construction action rather than design. A more extensive meaning of the construction sector gives a comprehensive view as one which manages new structures and adjusting, expanding, renovating, keeping up, repairing and demolishing of existing constructions or structures. Those structures, according to Shen and Tam (2002), are said to be housing constructions, commercial or public buildings, civil works, roads and manufacturing facilities. It is evident from every one of the definitions, that the construction sector influences numerous aspects of human life and adds to them (Dubois and Gadde, 2002).

This shows that the construction sector is a vital role player in the economy and has different backward and forward links to different other sectors. The construction sector conceivably contributes significantly to socio-economic improvement and work (Lyons and Skitmore, 2004; Shen and Tam, 2002). It represents a critical pointer of financial activities and government frequently utilise it to cause progress or aid with financial recuperation from recession. Besides, it gives a stage to rivalry for freelancers (Sambasivan and Soon, 2007).
1.2. Research Problem

With the current ever-growing competition within the worldwide market, business organisations are aiming to design and generate goods or service of high quality in order to have competitive market advantage. Over the last decades, many business organisations begun to be concerned with the issue related to enhancing quality and measuring quality-related problems. Nowadays, firms especially small to medium enterprises have developed the fear that generating product of high quality or offering service of high-quality mean that high cost will be involved. This is not true, since poor quality products or service equals high costs. Hence, the concept of Cost of Poor Quality has become a buzzword among industrial practitioners as well as scholars, during the past decades. The research problem originated from the fact that, despite this, literature presented in this study clearly revealed that many studies have focused on large companies especially multi-national manufacturing companies to measure and determine the reason behind the Cost of Poor Quality. Whilst, very few attempted to measure the cost of poor quality in the small to medium manufacturing enterprises. Hence, this study is aimed at addressing this gap.

1.3. Research Goal

To address the research problem identified in this study, the main goal of this study was to analyse the causes of the Cost of Poor Quality in the small to medium enterprises, using South African Construction sector as a case study. The outcome of this study should help decision-makers regarding the steps that should be followed to improve the performance of the small to medium construction enterprises in the long run.

1.4. Research Objectives

To achieve the goal of this study the following objectives were developed:

- Determine to what extent the concept of cost of poor quality has been approached from a holistic point of view in the construction sector
- Identify the factors associated with poor performance of South African construction sector.
- Determine the issues that professionals in the construction industry face while applying a cost of quality program.
- Identify the benefits linked to the implementation of the concept of cost of quality.

1.5. Research Questions
In order to achieve the research objectives of this study, the following research questions were formulated:

- To what extent has the concept of cost of poor quality been approached from a holistic perspective?
- What are the factors or elements that contribute to the poor performance of the construction industry of South Africa?
- What are the issues faced by experts in the construction sector in the implementation of a cost of quality program?
- Which types of advantages can be generated through the implementation of the cost of quality concept

1.6. Significance of the Study

The significance of this study is that the study should be to contribute to the body knowledge through an assessment of the cause of cost of poor quality within South African small to medium construction sector. The latter will assist the decision makers within the construction sector in South Africa to tackle issues associated with the poor performance and productivity in within industry.

1.7. Research Methodology

As mentioned earlier, the present study adopted a two-fold approach, first this study conducted a critical appraisal of a set of previous studies with the aim of identifying existing gaps in the current literature. Secondly, the study refined the existing gaps by means of a quantitative research methodology.

1.8. Overview of Chapters

Chapter 1 is the *Introduction*. Chapter 1 provides an initial perception of the background of the study, the research problem, objectives, research question and justification, the goal of the investigation and the research design.

Chapter 2 is *Theoretical Framework*. Chapter 2 consists of the critical assessment of studies on the cost of poor quality in various sectors and industries in order to identify the gaps in the current literature about the concept.

Chapter 3 is the *Overview of Cost of Quality*. In Chapter 3 the study explores the concept of cost of quality from a general perspective to obtain a vast array of information about quality management and after that expanded into cost of poor quality (CoPQ)
Chapter 4 is *Construction Industry from International Case*. Chapter 4 delves into analysis of the construction sector from an international point of view, by studying the construction industries of two countries outside the African continent.

Chapter 5 is *Construction Industry from African Case*. Chapter 5 looks at the study of the construction sector within African countries. Two African countries were selected and their construction industries will be studied.

Chapter 6 is *Construction Industry South African Case*. This chapter will examine the South African construction industry, its structure and its impact on the national economy.

Chapter 7 is *Methodology*. This chapter will present the technique used to collect and study data as well as the reliability and validity of the research tool utilised.

Chapter 8 is *Data Analysis*. In Chapter 8 the results of the data collection will be broken down and analysed using various types of analysis including, descriptive analysis, reliability analysis and normality test.

Chapter 9 is *Conclusion and Recommendations*. Chapter is a summary that explains the results and arrives at conclusions about the research objectives. Recommendations are outlined in Chapter 9.
CHAPTER 2 THEORETICAL FRAMEWORK

2.1. Introduction

To position this work within the body of knowledge on the Cost of Poor Quality, the overall goal of this chapter was to critically review previous studies that were conducted on the Cost of Poor Quality within the construction sector over the last two decades. This helps in identifying gaps that exist in the current literature. Various steps were undertaken to select the best studies that were thoroughly appraised.

To determine the methodology and points of focus of this study, a critical assessment of 30 studies was conducted on the Cost of Poor Quality in various industries in order to highlight the gaps and accurately identify the point of interest of this research.

The studies assessed were generated by the ISI Web of Science database provided by the University of Johannesburg Library. The search for key words Cost of Poor Quality, after focusing the research based on language (English), countries (USA, Australia, England, China, India, Nigeria, South Africa), time frame (1997-2017), peer review articles and research area yielded in over 271 documents from which the top 30 studies were chosen and thoroughly assessed by means of title and background with the purpose of developing additional boundaries and eliminating incorrect entries. Throughout this phase, groups of inclusion and segregation standards were established and against which every journal article was evaluated. Articles that were assessed are those which focused on the Cost of Poor Quality. It should be pointed out that studies that did not meet these requirements were not taken into account. This stage generated 152 studies focused on the cost of poor quality in construction, food processing, steel and automobile industries. The papers were labelled based on a set of standards. In this paper the studies were selected based on citations. To this end, the following table displays the 30 best studies that were critically analysed.

Table 2.1. Theoretical Framework Table
<table>
<thead>
<tr>
<th>Authors and years</th>
<th>Type of Industry</th>
<th>Company Size</th>
<th>Research Methodology</th>
<th>Country</th>
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<td></td>
<td>Construction</td>
<td>Food</td>
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<td>Tam et al. (2016)</td>
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<td>Tran et al. (2014)</td>
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<td>Attalla and Hegazy (2003)</td>
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<td>Koehn and Datta (2003)</td>
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<td>Love and Smith (2003)</td>
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<td>Mehri (2006)</td>
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<td>China</td>
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<td>Tao and Tam (2012)</td>
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<td>Tewari et al. (2017)</td>
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<td>USA</td>
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<td>El-Gohary and Aziz (2013)</td>
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<td>Dai et al. (2012)</td>
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<td>Sha and Jiang (2003)</td>
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<td>Hajforoosh et al. (2015)</td>
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<td>McCarthy (2012)</td>
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<td>Japan/UK/USA</td>
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<td>Pan et al. (2008)</td>
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<td>Gibb and Isack (2003)</td>
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<td>Mills et al. (2009)</td>
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<td>Australia</td>
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2.2. Critical Assessment

Vivian W. Y. Tam et al. (2017) talked about the Maintenance Priority Setting for Private Residential Buildings in Hong Kong. They argued that buildings are being built at a disturbing speed because of unlimited demands all over the world. Nevertheless, they stated that the dearth of initiatives on the part of building owners in take on methodical and scheduled preventive maintenance for residential buildings privately owned has become a causative factor to premature aging and decay. According to the authors, the majority of building owners depend on building professionals to assume the responsibilities of maintenance related works. Building maintenance develops into a main concern for most building professionals in Hong Kong.

The paper explored the approach toward setting maintenance priority from building owners and professionals by examining the thoughts on expert knowledge and experience that have a direct effect on maintenance decision making; the general standards of private residential constructions; the responsibilities for correct preservation of the buildings; and reasons behind building decays. The authors conducted a questionnaire survey among building owners and professionals.

According to the results, the building owners and building professionals mostly agreed on the buildings being of poor quality, even though they disagreed on the owners being responsible for the proper preservation of the constructions. The owners' lack of mindfulness, dearth of intentional initiatives, and reluctance to bear the cost of maintenance are the three usual reasons for building decays found from the survey results. The paper advises improving mindfulness of building care by offering seminars to owners as well as the public and increasing the maintenance budget for residential buildings. The authors focused on a quantitative approach and therefore failed to elaborate on the results that could have been obtained using a qualitative methodology.

Dai Q. Tran et al. (2014) based their study on the Construction Management Challenges and Best Practices for Rural Transit Projects. Rural Transit Projects usually have a small scope but are abundant and dispersed geographically. The authors stated that the managing of those jobs could be puzzling due to extremely restricted capitals, particular risk factors and a dearth of knowledge in the management of construction. They also expressed that without proper approaches to construction management, it would be improbable for rural transportation developments to be ideally designed and organised, probably causing postponements, expense overruns, reworks, physical harm and low quality. The paper presented the findings of a widespread desk scan, investigation, and case studies that concentrated on detecting precise issues in the management of construction and efficient procedures that are specific to
rural projects. They received answers from the Departments of Transportation of 33 US States out of 52 (63%) and from two provinces in Canada. The questionnaire results were confirmed through interviews with spokespersons of seven rural case study plans. The findings indicated that the main challenges for rural transportation projects were records problems; staffing; problems in remote location; issues with small contractor; problems in communication; as well as local and ecological problems. The solutions found for those problems in agency discussions and defined in the paper, offer the principal aimed supply for rural construction management procedures. The paper employed a qualitative approach and based the research on large size companies. In so doing, it failed to capture the SMEs' point of view as well as the quantitative methodology results.

Gui Ye et al. (2014) have analysed the Causes of Reworks in the Chinese Construction Projects. They stated that even though rework is usually an occurrence in the construction sector of China and considerably the success of projects, the motives behind rework continue to be mostly unidentified and the majority of construction companies are not capable of effectively handling the matter. In order to study the origins of rework in projects of construction, 39 causes were identified at first using an all-inclusive review of literature as well as semi structured interviews with 13 skilled Chinese construction professionals. Furthermore, a survey was performed to rank those causes, where the highest ranking was vague project process supervision, low quality of technology in construction, and the usage of low-quality construction resources. This work provides an examination of the core reasons for rework identified by construction professionals working in the world’s largest developing country, which is distinguished by its distinctive systems pertaining to economy and social. This study’s focus was on the qualitative methodology employed thus failing in providing a quantitative point of view.

David N. Ford (2002) developed a study based on Achieving Multiple Project Objectives through Contingency Management. They stated in their work the use of budgets by project managers to fulfil various goals, for example control of cost, reduced time as well as high quality. Gaining knowledge on the way managers apply contingencies of budget demands a strong information-processing model of the way managers establish a connection between the high complexity of a project and the restricted capacity of management. The authors reported the findings about the gathering of contingency management procedures of project managers in real estate development and described an active simulation model of the management of contingency. The model was utilised to test theories about the efficiency of strategies of managing aggressively and passively when it comes to expense, timeliness, and facility value. The results of the study showed that managing individuals were chasing general goals in their contingency management. In the end, a more aggressive strategy revealed itself
more dynamic but had a lower impact compared to a more passive strategy. The study concludes with the frequency of compromises between management of contingency policies that are solid and high performing in projects of construction and the significance of the incorporation of uncertainty in the planning and managing of projects. By focusing on a large company size and a quantitative approach, the study failed to educate on the situation of SMEs and the results of a qualitative approach.

Attalla and Hegazy (2003) focused their work on Predicting Cost Deviation in Reconstruction Projects. Their paper investigated the perplexing area of projects of reconstruction and described the progress of a predictive deviation of cost model in projects with elevated risks. After surveying professionals in construction, information was acquired on the issues behind cost overruns and low quality from 50 projects of reconstruction. From the data received, 36 elements were acknowledged for their direct influence on the cost performance of projects of reconstruction. Two procedures were employed in the development of models of prediction for cost deviation: a statistical analysis as well as the Artificial Neural Networks (ANNs). Even though the two models were similar in accurateness, the results showed that the ANN model was more sensible to most variables. The study helped to further understand the causes of cost deviation in projects of reconstruction and provided a decision support instrument or quantifying that deviation. A quantitative approach was used by this and focused on large companies. The study failed to cover a qualitative methodology and the application of work in SMEs (Small Medium Enterprises).

Koehn and Datta (2003) based their work on the Quality, Environmental, Health and Safety Management Systems for Construction Engineering. The thinking behind the managing systems of quality, environmental and safety (QES) is a notion recognised by numerous contractors. The authors stated that an operative QES program did not just guarantee a product of quality but also decreased cost, and improved productivity. It is a top-down process, meaning that upper managers, line managers as well as other workers design the program then encourage the personnel to abide by that process. The paper offered an argument for developing a segment of a system of QES management that has been used by a company of a medium to large size but fails to show an application for a small construction company. The study has more of a qualitative methodology and therefore fails to provide results based on a quantitative approach.

Love and Smith (2003) focused their research on Benchmarking, Bench Action, and Bench Learning: Rework Mitigation in Projects. According to the authors, the government of Australia has delivered numerous demands for the improvement of the construction industry’s performance. A deficiency in the availability of benchmark measures made it hard for
companies to identify which mattered to aim for the improvement of processes. A major influence found to be a factor in the poor performance of administrations and projects is rework. Making use of the findings of a survey, this paper presented and discussed a sequence of benchmark measures for the sources and expenses of rework for 161 construction projects. The study proposed a standard structure for rework benchmark around the life cycle of a project and used unstructured interviews to have the structure that it proposed validated by experts in the industry. The study’s focus on a qualitative methodology fails to educate the reader on the results issuing from a quantitative methodology.

Prakash Shetty (2009) investigated the incorporation of nutritional considerations when addressing food insecurity. Speaking about the issues of the food security of the world would profit from the coinciding nutritional priorities incorporation that are part of the population’s good health. Including thoughts about nutrition, while improving accessibility to food, widens the scope and goals of agriculture as well as food production and consequently play a part in the integration of the concept of food and nutrition security. The low food quality and dearth of variety in the usual food regime of people living in emerging countries inflicts huge costs on civilisations in terms of sickness, deaths, diminished economical productivity and low life quality. Sustainable food-based methods to allow proper intake of micronutrients consist of nutritional diversification as well as biofortification. The sector of agriculture and agricultural biotechnology do not just present the chance of augmenting the harvests of crops, thus increasing the security of food, but also possess the possibility for better micronutrient content in foods, thereby participating in the attainment of the security of food and nutrition. This research utilised a qualitative methodology to investigate the matter and consequently failed to yield results from a quantitative point of view.

B. Li et al. (2001) discussed the Principle and Simulation of Fixture Configuration Design for Sheet Metal Assembly with Laser Welding. The authors stated that the quality of the procedure of stamping had an immediate impact on laser welded sheet metal assembly. The element has a crucial position in the adequate metal fit-up entailed by laser welding. The usual “3-2-1” locating system would not be sufficient for the deformable laser sheet metal assembly procedure any longer. Due to the usually low quality of stamping, a multifaceted die fixture had to be utilised to fill the requirements of metal fit-up. The die fixture matches an “infinite-2-1” locating system where the cost of tooling is incredibly elevated and still is not flexible. It restricts the implementation of laser welding. The study proposed a different locating system having total locating as well as direct locating for welds. A total locating system is utilised to identify the general assembly, whereas a direct locating system is employed to locate the location of the weld, which is crucial to ensure proper metal fit-up. The paper developed a finite-element model and a prevention and correction technique for the direct locator setting.
The authors demonstrated that the suggested technique is effective for sheet metal assembly for laser welding used through case study. The study applied a quantitative methodology to a large size company thus failing to provide an application for an SME and to develop a qualitative approach to the research.

Darius Mehri’s (2006) point of interest was the darker side of lean: An insider’s perspectives on the realities of the Toyota Production System (TPS). TPS has been acclaimed for being the summit of flexibility, just-in-time design and manufacturing and for being the originator of “lean work” systems, stating to better the quality of manufactured goods and the productivity of workers. Carmakers in America eagerly implemented the “Toyota Way”. The author of this paper worked in a Toyota company group for three years, studying the process first-hand and leading his personal qualitative study on what he believed to be the real influence of lean work, the human resource cost. A division that is crucial to comprehending Japanese culture and business leads Mehri’s evaluation: tatemae (what is supposed to be felt or done) and honne (what is actually felt or done). Mehris (2006) considers that the eagerness of the world for TPS ensues from the lack of discernment of the western observers for the honne inside the tatemae. The author reveals the convention and communications from the managing team at Toyota - the tatemae - that confuses the veracities - the honne - of the Toyota Way, restricted possibility for originality and novelty, limited skills of profession, segregation and harassment of workers, hazardous environments over the line of production, industrial cover-ups of accidents, unnecessary additional hours, and low quality of life for employees. Although the author brought significant contribution, the study failed to provide a quantitative approach to the work.

In this paper, Tam and Tam (2006) evaluate Existing Waste Recycling Methods: A Hong Kong Study. They stipulate that environmental issues were regarded as a serious situation in the construction sector of Hong Kong. The management of wastes is persistent about the disturbing signal trying to warn the sector. Reusing, recycling and reducing wastes are seen as the single means of recovering from the produced waste; yet, the applications still have a lot of room for progress. As a bid to improve the prevailing circumstances, the research studied assessments of the current waste recycling techniques. The study investigated an interview via telephone of the recyclers, visits of the sites of construction and demolition as well as the centralised recycling plant located in Tuen Mun Area 38. The authors also investigated complications faced for various recycling crews. Instead of the low quality created by the recyclable materials, they found that the major barriers for them were caused by the high investment cost, long demolition period and restricted space. Based on findings, a few recommendations were suggested. The study utilised the qualitative methodology and gave
results based on the study of large company. The failed to provide a quantitative approach and perspective from a small enterprise.

Karen A. Brown et al. (2000) focused on predicting safe employee behaviour in the steel industry: Development and test of a sociotechnical model. Safety in the industry is a crucial matter for operations managers as it has repercussions for cost, supply, quality, and social concern. Insignificant accidents can obstruct production in numerous ways and a serious accident can lead to the closure on an entire operation. In this perspective, questions about the sources of factory accidents are of major significance. There is a widespread belief that workers’ risky behaviour are the main reasons behind workplace accidents, but some researchers propose a viewpoint that emphasises impact from operating and social systems. The study took up the topic by evaluating steelworkers’ answers to a survey regarding social, technical, and personal elements connected to safe work behaviours. The results offer proof that a series of events of technical and social concepts function through personnel to encourage safe behaviours. These results established that safety risks, safety philosophy, and production demands can impact safety efficiency and inconsiderate attitudes, on a trail leading to safe or unsafe work behaviours. The study adopted a quantitative methodology in the research and failed in considering and providing a qualitative approach.

Sagar and Kumar (2010) based their work on the recent advances in drying and dehydration of fruits and vegetables: a review. Fruits and vegetables are dried to improve storing stability, minimise wrapping condition and reduce transportation weight. Conservation of fruits and vegetables by the use sun and solar drying methods causes low quality and deterioration of the product. The use of energy and the dried products quality represent important factors in the choice of the drying process. The optimal drying methods for preparing dehydrated products of good quality would be cost efficient as it would cut down the time of drying and would damage the product the least. To decrease the use of energy and the cost of operations; new technologies were developed in drying practises. Amongst those technologies, osmotic dehydration, vacuum drying, freeze drying, superheated steam drying, heat pump drying and spray drying give huge opportunity in the manufacture of dried products and powders of high quality. The research was done through a qualitative approach which resulted in a failure to cover a quantitative methodology.

Bin Liu et al. (2013) subject of research was Large-Scale Synthesis of Transition-Metal-Doped TiO2 Nanowires with Controllable Overpotential. The practical application of one-dimensional semiconductors in appliances able to exploit their unique features is usually delayed by the products’ low profits, low quality resources, elevated cost of production, or general dearth of synthetic control. In this paper, the authors showed that a molten-salt flux scheme could be
utilised in the manufacture of great amounts of high quality, single-crystalline TiO2 nanowires with dimensions that can be controlled. Moreover, in situ dopant combination of numerous metals of transition consent to altering features optically, electrically, and catalytically. With the arrangement of control, sturdiness, and scalability, the molten-salt flux system could deliver TiO2 nanowires of good quality to fulfil a wide variety of application needs from photovoltaics to photocatalysis. The quantitative methodology applied in this study show a failure from the authors to cover a qualitative study.

A. Shokrani et al. (2012) based their work on Environmentally Conscious Machining of Difficult-to-Machine Materials concerning Cutting Fluids. Machining difficult-to-machine resources such as alloys employed in aerospace, nuclear and medical industries are generally followed by low productivity, poor quality surface and short tool life. Despite the broad usage of the expression difficult-to-machine or hard-to-cut resources or materials, the area of these type of resources and their properties are not yet well-defined. Alternatively, using cutting fluids is a usual technique for bettering machinability and has been recognised since early 20th century. Nevertheless, the environmental and health dangers associated with the utilisation of regular cutting fluids together with developing governmental protocols have caused an increase in machining costs. The goal of this study is to assess and classify the materials called difficult-to-machine and their features. Additionally, the paper studied various cutting fluids and defined major health and environmental concerns about their utilisation in material cutting industries. Finally, the study reviewed and discussed progresses in reducing and/or eliminating the utilisation of regular cutting fluids. The authors based their research on a quantitative approach and focused on large enterprises and neglected to provide a use for SMEs and a qualitative point of view.

A.O. Olotuah’s (2002) work was centred on the Recourse to earth for low-cost housing in Nigeria. The focus of this paper was the provision of low-cost houses for the poor in Nigeria. The author stipulates that quality accommodation improves the fitness and wellbeing of people and contributes greatly to productivity, thus highlighting its significance as an essential need. Providing houses of low costs is linked to the accessibility of strong and reasonably priced building resources.

This paper supported the utilisation of building earth because of its fairly lower cost than that of more common modern materials and availability in huge quantities in Nigeria. Additionally, the material has thermal assets which make it idyllic for building in the tropical climate. This study’s methodology was mostly qualitative which failed to enlighten the reader on the quantitative approach to this problem.
Li Huang et al. (2012) studied the demand for air movement in a warm environment. They stated that as the leading regulation instrument of indoor thermal environment in hot weather, air-conditioners are utilised to maintain a cold atmosphere. The use of air conditioning generates difficulties of enormous electricity utilisation and low quality of air inside. In comparison, electric fans guarantee a cooling effect indoors as well as low energy utilisation. This justifies the investigation of the utilisation of air flow. The study debates on the findings of a research comprising an online survey as well as a series of experiment in a climate chamber to investigate the needs of the users for air flow daily. The findings yielded by the online survey demonstrated that electric fans were generally accepted in homes as well as office spaces as they were environmentally sensible, less costly and could offer a cool environment. The findings of the experiment in climate chamber found appropriate collection of indoor temperatures to utilise electric fans and their equivalent array of air speeds. With rational use, electric fans can deliver a healthy and energy-efficient method to control the atmosphere indoors. The focus of this research was on a quantitative methodology. The authors failed to consider a qualitative approach to the issue.

Tao and Tam (2012) work was about the system reliability optimisation model for construction projects via system reliability theory. In the past decade, the construction sector has had a bad reputation because of the low quality of its products. Even though System Reliability Optimisation (SRO) is a stimulating topic, very low achievement has resulted from its implementations in the construction sector. The goal of the research was to increase the quality of project performance through SRO. An actual case of construction was utilised to assess the usability of the suggested SRO system and the findings completely proved its rationality and reasonableness. This research's major impact is effectively introducing the idea of reliability and implementing SRO in the optimisation of quality for projects of construction. The study focused on a larger company size and a quantitative method of study thus failing to generate an application for SMEs in the construction sector as well as a qualitative outcome to the research.

Tewari et al. (2017) researched the right approach to selecting a quality improvement project in manufacturing industries. Continuous improvement is the fundamental building block of any successful company as stated by the authors. This type of improvement is possible in various sector of industry in areas such as improvement of quality, reduction of waste, improvement of process, improvement of layout, ergonomic improvement, cost reductions... The case study considered as example a manufacturing organisation desiring to begin a Quality Improvement Project (QIP) on its grounds. The authors’ goal was the comparison of three methods, i.e., Cost of Poor Quality, conditional probability and fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) for choosing the proper project according to this
particular company. The advantages and disadvantages of those methods were also explored. This paper’s focus was on a qualitative approach with the use of a case study therefore failing in providing results that could have been generated from a quantitative approach.

El-Gohary and Aziz (2013) concentrated on the factors Influencing Construction Labour Productivity in Egypt. Construction remains a labour-intensive business. The labour productivity of this sector is of major significance for the success of the majority the projects in construction. Numerous construction sector areas are facing constant issues like weak management, low working circumstances, and unsatisfactory quality. Various scholars have classified the issues as elements impacting the throughput of construction and will impact the performance of a company as well as a country’s economic trajectory. The paper’s goal is to categorize, examine and classify factors alleged to influence construction labour productivity in the construction industry of Egypt’s perspective pertaining to their corresponding significance. To reach this goal, specialists and professionals constituting a statistically illustrative sample were requested to contribute in a structured questionnaire study. The study showed that the next five elements classified in a downward order, are the most essential in their influences on the productivity of the Egyptian construction workforce: labour knowledge and talents; motivation plans; accessibility of resources and easiness of control; direction and capability of the managing team of construction; and ability of labour control. Experts in the industry and scholars can utilise the principal results of the study to develop practices to increase and better the productivity of the Egyptian construction labour. The authors adopted a quantitative approach to their study and in so doing failed to address the possible qualitative results.

Yue Dai et al. (2012) explored the Competitive and Collaborative Quality and Warranty Management in Supply Chains. The coverage of the quality and warranty of products are two significant and narrowly correlated matters in operations. An extended period of warranty protection could increase sales but could also cause a dramatic increase of warranty cost if the quality of the product is low. To study the link between these two matters and their impact on the supply chain performance, the authors developed a single-period model with a provider supplying a manufactured good to an original manufacturer of equipment, who in turn vends it to clients. They analysed two separate situations depending on the party establishing the period of warranty of manufacturer and supplier. They analysed those spread out systems and presented the features of the balanced strategies’ structure. Their numerical study additionally demonstrates that, in decentralised situations, when the firm sharing the bigger section of total warranty costs establishes the warranty period, the supply chain can accomplish better system-wide revenue. The two organisations can therefore profit from correctly assigning the decision of warranty and splitting the subsequent extra revenue. Their work is mostly
qualitative and although they make an important input to the body of knowledge, the failed to cover the quantitative aspect of the results.

Sha and Jiang (2003) worked on improving rural labourers’ status in the Chinese construction sector. The condition of human resources in the construction industry in China offers substantial issues for the economy of the country as well as for the efficacy of the construction industry. The paper studied rules and useful queries for improving the big rural workforce’s quality and efficiency in construction. Manual workers of the countryside represent 90% of the country’s labour however 90% of them do not have any formal work training. Present challenges troubling manual workers in rural regions comprise production of low quality, low wages, substandard conditions of work, poor quality of life and high employee turnover. The suggested solution should include training supplies for manual workers in rural regions to develop their work talents and general quality; generating structured workforce to solidify the steadiness of the labour force; generating an appropriate system of labour-cost and generating a detailed labour market. The methodology used in this research is qualitative, resulting in a failure to include results that could have been generated by a quantitative method.

Chen et al. (2008) developed a research based on the Performance of Dowel Bar Retrofit Projects in Texas, US. Many kilometres of simple Jointed Concrete Pavement (JCP) were built in Texas lacking suitable weight transferring tools like dowels. Following years of use, some JCP segments lacking dowels displayed deteriorations presented as errors at transverse joints. The JCP road surface design was unsuccessful with the errors at transverse joints causing a low-quality ride. Dowel Bar Retrofit (DBR) was done on four jobs with the hope of repairing the condition of the road surface. Generally, DBR fixed the efficacy of the transfer of load and brought about bettering of ride quality. Properly set up DBR effectually repaired pavement state with fewer errors after years of use. The proper setting of DBR indicated that DBR is capable of minimising the errors even with poor base/subgrade support. The work done by Chen et al. (2008) had a quantitative approach to the study thus failing to bring about results from a qualitative methodology.

Nix et al. (2015) based their work on the strategies for reducing poor indoor air quality and adverse temperature exposure in Delhi, India’s households: A multi-objective assessment. Heat, a tremendously unclean ambient atmosphere with discrepancies in the quality of housing and household electricity consumption, show-overheating danger and low quality of the air inside homes in Delhi. In this research, the authors explored a series of solutions to decrease opposing temperature contact as well as improve the quality of the air indoors, concentrating on PM2.5, and the case study was made of homes built in order to cover the variety of types of communities in Delhi. Interferences are run from dynamic thermal
simulation, comprising a variety of alterations to residence operations and construction material, along with extra construction elements. A weighted multi-objective evaluation bearing in mind yearly electricity use, involvement expense, as well as a health measure comprising warmth, coolness and exposure to PM2.5, is utilised to record how suitable the strategies are for every kind of settlement. The most efficient technique was found to be a blend of alterations in construction material with evaporative cooling and cooking ventilation in every model. The focus of this research was on a quantitative methodology and therefore the study failed to provide a qualitative outcome.

Hajforoosh et al. (2015) developed a study based on real-time charging coordination of plug-in electric vehicles based on hybrid fuzzy discrete particle swarm optimisation. The major effect of Plug-in Electric Vehicle (PEV) that are uncoordinated being charged is tallying different time-variant loads that could upsurge the pressures on the units of generation, transmission and systems of distribution that might cause intolerable declines in voltage and lower quality of power. The study suggested two dynamic online tactics for the coordination of PEV charging founded on Fuzzy Genetic Algorithm (FGA) and Fuzzy Discrete Particle Swarm Optimisation (FDPSO). This study presented findings from simulation for uncoordinated, Dissipative Particle Swarm Optimisation (DPSO), FGA and FDPSO coordinated charging and those results were related to a 449-node network occupied with PEVs. The findings were likened to the formerly published PEV coordinated charging based on Maximum Sensitivity Selections (MSS). This study’s approach was mostly quantitative and thus did not cover a more qualitative point of view.

Sean Francis McCarthy (2012) based their study on the development of an Australian Code of Construction Ethics. This article observed the growing necessity to consider the role of ethics in the construction sector. Throughout history the industry has been tested by claims of a serious deficit in ethical standards. Only restricted efforts in Australia have been made to deal with that concern to date. This paper considered major historical progresses in ethical philosophy as well as modern thinking on ethics for professional sub-sets. The author also reviewed contemporary methods of attending to ethics in construction and in other industries. This paper argued that the way forward is creating a code of ethics, reinforced by other measures. The author’s goal is to encourage further discussion and encourage the writing of a code. The author quoted Uff (2006) in saying that the time for reform has come, and there is a crucial necessity for an independent body to take charge, lest floundering happens and the results only constituting ‘another debating topic’. The research adopted a quantitative approach to the work and in so doing, failed to bring about results from a quantitative point of view.
Xiao and Proverbs (2012) based their study on an investigation into factors influencing construction costs based on Japanese, UK and US contractor practice. Costs in construction are a critical factor for customers and contractors due to economic effect on both parties. The goal of the research was to categorise the factors impacting on the cost of construction of building jobs. Using a theoretical construction endeavour framed in concrete with six stories, a questionnaire study was conducted in three of the main industries in construction namely the Japanese, the British and the American construction sectors, to gather data on the performance of contractor cost and additional significant evidence. A construction cost model was established because of the methods of contractors in those three nations, which detected the dominant elements found to affect contractor cost performance and to emphasise on the potential means for improvement. A multiple regression analysis showed that the overheads percentage in the cost per unit, the quantity of deviations from the original design during the building process, as well as the utilisation of prefabrication for the theoretical project were detected as being directly related to the cost performance of the contractor. The study was based on a quantitative research methodology and thereby failing to provide a qualitative approach to the work.

Pan et al. (2008) focused their research on the Leading UK housebuilders’ utilisation of offsite construction methods. In the past few years the construction industry has been pressured to increase its use of offsite machineries, or ‘Modern Methods of Construction’ (MMC), with the purpose of addressing the under-supply and housing’s low build quality. In spite of the well-rehearsed profits of such technologies, the response within the industry has been slow. This paper reported on studies that assessed housebuilders’ practices and approaches concerning the utilisation of offsite-MMC. A questionnaire survey of the UK’s top 100 housebuilders and a sequence of interviews were employed to reveal the degree to which such technologies are being used and the factors which have a bearing on their popularity. The results suggest that present offsite-MMC usage in big housebuilders is low, but the level is expected to rise because of the insistence to improve quality, time, cost, productivity, health and safety. The extensive acceptance of offsite-MMC is nevertheless hindered by apparent higher capital expenses, interfacing issues, long lead time, delayed planning process and present manufacturing capacity. Based on these discoveries, the paper offers a set of tactics for improving offsite-MMC procedures amongst housebuilders. It is anticipated to help bring about an improvement of housing supply in the UK. The study focused on large companies and utilized a qualitative approach to the methodology, thus failing to give an application for SMEs as well as a quantitative approach.

Gibb and Isack (2003) focused on the notion of re-engineering through pre-assembly: client expectations and drivers. Pre-assembly is a crucial aspect of the approach to re-design
construction. It could be regarded as modular building, volumetric pre-assembly, non-
volumetric pre-assembly and module manufacture/subassembly. The research offers the
findings of an interview survey of important clients in construction and drivers regarding the
expectations they had of pre-assembly on their building projects. Specifically, time, expense,
quality and productivity profits by minimising on-site activities and duration of the project
reduced bottlenecks on the construction site and improved health and safety. Also, higher and
more expected quality are identified. In order to get the maximum from pre-assembly,
customers recognise that they need to be capable of settling the plans very early and give
equitable duration times and offer time for pre-site prototyping. The previous experience of
clients varied with a few of them mentioning concrete advantages and others facing products
of low quality and a restricted and fragmented chain of supply. – This worked against attempts
to expand pre-assembly as belonging to the re-engineering world. Customers generally
agreed that providers ought to be implicated quickly although many of them do not re-design
the method and push important matters way later in the course of maximising profits. The
majority of suppliers desired to witness a rise in utilisation of the preassembly technique on
their own projects, but the supply chain ought to change to take into account perspective of
the client and take advantage of this opportunity. Though pre-assembly is not new, and many
have written on the topic, the viewpoint of customers was not properly considered.
Manufacturers, contractors and even some designers might grasp pre-assembly properly but
if the customer does not grasp its profits and restrictions, their misinterpretations and
preconceptions will remain an obstacle to more development. This research applied a mixed
strategy to the methodology, combining both quantitative and qualitative, failing to focus on
one particular approach.

Mills et al (2009) conducted a study on the Defect Costs in Residential Construction of
Australia. They stated that the residential construction industry is a crucial element of the
Australian economy; the industry utilises a very prominent section of the nation’s labour force,
and yet the sector is afflicted by faulty work and low quality. They argued that past studies
have shown that flaws and rework are widespread in the residential part. The study discussed
the character of the major errors and examined the effect of contractor type and building type.
To compute the extent of defects recorded in recent residential buildings this work offers an
examination of flaws documented by a housing insurance firm owned by the government
namely the Housing Guarantee Fund. The data utilised in their research was not centred on a
sample like the past works they reviewed but as an alternative and it represented all recent
housing buildings built in Victoria, Australia from 1982 to 1997. After analysing the information,
they found out that out of eight houses, one described flaws and that the expense associated
with restoration consisted of 4% of the total value of the construction contract. Their study
leaned more on the quantitative approach and therefore failed to provide a qualitative approach which would have provided different results. This paper also failed to focus on the cost associated with the poor quality of the constructions.

2.3. Lesson Learned

After the review of thirty studies on the Cost of Poor Quality in various industries, the observation is that most of the studies focused on large size companies and usually employed a qualitative methodology. Though most of the studies focused on the construction sector, there is a considerable lack of publications based on studies done in South Africa on the Cost of Poor Quality especially in the construction sector. This work will revolve around the Cost of Poor Quality with a focus on South African’s Small and Medium Enterprises (SMMEs) in the construction sector.
CHAPTER 3 OVERVIEW OF COST OF POOR QUALITY

As expressed by Bryman and Bell (2011), the reason behind the study of literature is to acquire information to establish the current reasoning on the particular topic. The review of the literature provides a platform to support the questions generated by the research and helps in gathering and analysis of data. As per Gillham (2009), getting a general view of the topic of research is vital as it leads to the specific end goal of gaining an understanding and later going further into the particulars of the area of interest. Andersen (1994) proceeds in underscoring the fact that the information related to the research topic should first be expansive at which point a more profound investigation on the research topic can be made. A broad of sources should be looked into at inception and then narrowed down to precise sources. The thesis begins by a general study with the goal of obtaining a vast array of information about quality management and after that extended into Cost of Poor Quality.

3.1. Introduction to quality

Quality is a notion comprising a vast range of meanings as well as definitions (Amegashie, 2019). Formerly, managers have had to worry about the fact that high quality for goods and services was just equivalent to a higher cost. However, that was changed in the seventies (1970s) and eighties (1980s) when organisations discovered that good quality resulted in more profit for investments as well as an expanded portion of the market for the organisation (Lixandru, 2016). The previous spotlight that was placed on quality goods has moved extra activities performed by of all the business areas of the organisation (Sörqvist, 2001).

3.2. Quality Management

Edward W. Deming, Joseph M. Juran and Philip B. Crosby were three of the pioneers examining the management of quality and they all proposed diverse methodologies with regards to quality management. Deming (2000) stated that management of quality included the precise description of companies, the significance of leadership as well as the need of decreasing variations in procedures. Juran and De Feo (2010) underline a situation that abides by three sets of actions: quality planning, quality control and improvement. They highlighted that for disposal of deviations, one should utilise statistical tools. Lastly, Crosby (1990) centred on decreasing expenses by using quality improvements, indicating that both top of the line and low-finished products can preserve a high level of quality. Flynn et al. (1994) imply to view quality management as a concept or a way to deal with management, described by various principles, practices and strategies. The principles are depicted by teamwork, continuous improvement and customer focus executed by various practices. For example, gathering client information and breaking down procedures. The principles are thus bolstered by various
strategies such as Pareto Analysis, Customer Surveys, Group Building Techniques and Statistical Process Control.

3.3. Definition of Quality

A typical description of quality is, as indicated by Juran and De Feo (2010), "fitness for use" which has later evolved to "fitness for purpose". It implies that in order for an item to be fit for its purpose, each product and service has to have the correct characteristics to fulfil the needs of clients, and further should conveyed the least number of defects (Juran & De Feo, 2010). Crosby (1990) speaks of quality as "conformance to requirements", expressing that the definition or meaning of quality has to be clearly stated by the managing team. A different explanation is portrayed by Deming (2000), expressing that "quality ought to be aimed towards the requirements of the customers, present and future". Seawright and Young (1996) imply that every definition related to quality share the client-oriented factor, meaning that the provider has to see the quality from the viewpoint of the client. As indicated by Miller (1996), quality driven by client is essential to allow companies to perform on a high level. Deming (2000) stated that keeping up a high level of quality demands a long-term plan focused quality. This is due to the fact that enhanced quality prompt lower costs due to less re-work, less slip-ups, less deferrals and better utilisation of material and time available. This enhances productivity which in turn captures the market with higher quality and low costs. Subsequently the organisation remains in business and provides more work. Reeves and Bednar (1994) say that a high level of quality brings about growth in productivity, less expenses, and often the demand for the goods and services provided by the organisation’s increases. Juran and De Feo (2010) see the quality notion from two points of view: the goal of the whole organisation in general to accomplish high quality products and the goal of every individual department to accomplish high quality production. Bringing quality problems to light among workers in the organisation is essential (Harvey and Greene, 1993). Different languages are spoken by workers from different divisions of the company and thus a need exists for various intercommunication methods, finance related terms for the management team, both financial and machinery language for the lower management and machinery language for the personnel. Because of the distinctive languages spoken in the organisation and diverse methods for translating data, quality should be taught and clarified in various ways (Juran & De Feo, 2010).

3.4. Total Quality Management

One of the critical standards of Total Quality Management and the fundamental substance of the Malcolm Baldrige National Quality Award is management built on facts. Nowadays, experts in the industry exist in a data and technology driven world. It then becomes then crucial that
manager and supervisors settle on choices based on data and certainties, not theory or supposition. As indicated by Powell (1995) “there are no information more crucial in a company – in supervised basic leadership – than cost data”. Companies taking a stab at execution excellence utilise cost data, which fluctuates from workers and contract workers to recognise and show quality cost information to upper management.

Industry systems these days have started to present the idea that accomplishing desired quality and consumer satisfaction is no longer enough. Quality must be achieved at the most reduced conceivable cost too. Keeping in mind the end goal to encourage this, organisations and entrepreneurs now think about the idea of pinpointing expenses related to quality. This isn't a clear undertaking as there has been some conversation about what these expenses incorporate (Hackman and Wageman, 1995). As a rule, the cost of quality can be comprehended as the cost of uniformity and in addition the cost of non-uniformity. The cost of uniformity would incorporate costs brought about to counteract low quality, for instance assessments and quality appraisal while the cost of non-uniformity would incorporate expenses acquired because of good or poor performance, for example, reviews, returns or revise. The broadly acknowledged meaning of the cost of quality, as indicated by Samson and Terziovski (1999) is the costs that are caused in the plan, execution, task and support of a quality management framework, the cost of assets focused on consistent improvement, the cost of framework, good and service poor performance, and additionally some other vital and non-esteem added tasks required to accomplish a quality item or service. The role of COQ endeavours to connect the advantages of enhancing quality to consumer satisfaction and connect them with a related cost. This is otherwise called the idea of coupling diminished expenses and expanded advantages. Utilising this rationale, we can exhibit that the cost of quality is a trade-off between the cost of uniformity and the cost of non-uniformity (Ghobadian and Gallear, 1996). Due to the expanded significance of joining Cost of Quality to the business activities of numerous companies, an ever-increasing number of organisations have started to look for the hypothesis behind numerous quality models utilised for this kind of investigation. Despite the increasing significance of this point, Kaynak (2003) has recommended that there remains an absence of innovative work referencing this subject, particularly Japanese writing given their reputation for quality practices in different sectors. Despite this he additionally recommends that a modest source of references is required to completely capture what is required to be considered when addressing COQ models. Zbaracki (1998) focus around the verifiable improvement of quality costing and in addition the diverse point of views about utilising COQ models in business activities. Some consideration similarly given to the information accumulation methods utilised as a part of distinctive companies and in addition quality costing information released from a few enterprises with effective COQ results is
exhibited in their work. An additional advantage to this examination is that they list and break down all the quality costing strategy deficiencies and restrictions.

Douglas and Judge (2001) presented in their paper an action-based costing where the essential COQ model utilised was Prevention, Appraisal and Failure technique (PAF). Prevention costs are recognised as the expenses acquired for keeping a non-congruity by guaranteeing the procedure is set up and is equipped for conveying brilliant goods or services. Hendricks and Singhal (2001) best portrayed prevention costs as all sums spent or contributed to forestall or decrease blunders or imperfections to support exercises directed towards eradication of reasons for errors. Appraisal costs are related to the estimation framework used to evaluate the quality of an item or service. At the end of the day, it is the identification of mistakes or defects by estimating performance against the required quality level: issued building and structural illustrations, work in process, incoming and finished material review (Hendricks and Singhal, 2001). Failure costs are the endeavours set up to revise a non-congruity that has occurred previously or after conveyance to the client. Failure costs are in this manner qualified as interior errors and outer errors. Inward failures would incorporate expenses caused by rejecting or modifying damaged item or pay for delays in conveyance though outer failures would incorporate costs that are acquired once the item or service has been conveyed to client, for example, cost of repairs, returns, managing grievances and wages. Easton and Jarrell (1998) presented a costing strategy comparable with that of Juran's PAF technique. However, they considered quality to be a measure of conformance to necessities and hence characterised COQ as the cost of conformance. It includes the cost of doing things right at the first attempt and the cost of non-conformance, which is the cash squandered when an item or service neglects to convey its purpose of fitting in with client requirements. The process cost model, which was created by Ross (1977) and then utilised by Marsh (1989), speaks to a quality costing strategy that is based on process instead of being oriented towards goods and services. This strategy alongside a few others concentrated on the immaterial expenses related with benefit not earned, lessened income or loss of clients due to the non-conformance of items to customer necessities. Dean and Bowen (1994) stressed the significance of including impalpable and opportunity costs while thinking about the cost of low quality. Chenhall (1997) proposed another technique for COQ examination that entails the recognition of the cost of everything that has turned out badly in a procedure. This strategy came particularly later stage than the strategies that were created at an earlier stage.

Despite the different diverse costing strategies, the idea of recognising the cost of quality envelopes one essential thought: to connect all zones of improvement to a cost or client desire that is quantifiable and accordingly an adequately significant lowering of the general cost of quality. Spencer (1994) gave an investigation of the quality costing practices of four effective
organisations. The investigation focused on the way these organisations gather measure and control quality costs and the costing estimations that were made and the Cost of Quality strategy that was used. Each organisation considered had entrenched quality projects and each organisation was from varying industrial sectors. While investigating the four organisations it was observed that the business and size of the organisation impacts the quality strategies and endeavours applied. Cutting edge organisations, for example, organisations A, which operates in the broadcast communications industry, B, which is placed within the electronics business, and C, which operates within the aeronautic business, tend to actualise more organised quality projects that need a more elevated amount of help and discipline to accomplish 100% quality or zero error. Organisation D, which seems by all accounts, to be less innovative, fabricating home items, endeavours to fulfil just a set target and no genuine effort is directed towards accomplishing anything else. Organisation A is the main organisation that measures both non-conformance and conformance costs which permits organisation A to properly improve their Cost of Quality. Organisations B and C however, just measure their non-conformance costs. This is legitimised because of the significance set on their items to perform. Organisation B is in the electronics business and therefore it must place its items according usefulness first and organisation C operating in the aviation business should normally put safety as their main need. This subsequently makes the two organisations commit just about 100% of their endeavours on getting rid of non-conformances therefore slighting the cost of consistence. Organisation D despite having a place within the manufacturing business, seems to be winning by executing endeavours for estimating the cost of compliance. This enables them to streamline their quality related expenses and enhance their quality approaches. In 2000, Reed et al. (2000) additionally examined this model by paying close considerations to the constraints.

3.5. Introduction to Cost of Poor Quality

In 1951, Juran was the first person to examine costs related to low quality levels and their influence on the organisation. Five years later, Feigenbaum was the first person to arrange those expenses into classes (Harrington, 1999). Throughout the years, a wide range of articulations have been utilised. For example, Cost of Poor Quality and quality expenses however as clarified by Prashar (2014) these are not the correct terms as they give the feeling that quality is expensive, whereas what is expensive is actually the absence of quality. Prashar (2014), along these lines instructs to utilise the term Cost of Poor Quality which will be utilised all throughout this master’s thesis to signify all expenses related to low quality. Chen and Tang (1992) characterises CoPQ as “the aggregate losses caused by the improper items and processes of an organization”. Andersen and Moen (1999) then again characterise CoPQ as "all the cost acquired to enable the worker to carry out the activity right every time and cost of
deciding whether the result is satisfactory. In addition to any cost brought about by the organisation and the client on the grounds that the result did not meet particulars as well as client desires”.

3.6. Visible and Invisible Cost of Poor Quality

Cost of Poor Quality can be hard to distinguish or identify (Chiadamrong, 2003). Consequently Dahlgaard et al. (1992), Yang (2008), Hwang and Aspinwall (1996) and Srivastava (2008) isolate the Cost of Poor Quality into visible and invisible expenses paying little respect to groupings, expressing that visible Cost of Poor Quality are anything but difficult to recognise and measure whereas invisible Cost of Poor Quality is hard to distinguish and measure. Expressed by Eppler and Helfert (2004) visible and invisible Cost of Poor Quality could be pictured as the tip of an iceberg, with just a little part of the expenses seen and the rest below the water.

Moreover, Cheah et al. (2011) have subdivided invisible Cost of Poor Quality into ten classifications while Giakatis et al. (2001) have an alternate approach with regards to visible and invisible expenses and separate those into five classes relying upon their capacity to be estimated or measured. In time, it is possible to select only parts of visible Cost of Poor Quality and invisible CoPQ (Giakatis et al., 2001). An important portion of invisible Cost of Poor Quality goes unnoticed in organisations as they are neither measured, nor spoken about (Srivastava, 2008). Further, invisible expenses go unnoticed as expenses are insufficiently recorded in the company or not found by any means (Sansalvador and Brotons, 2013). As an outcome management choice are regularly light of the data of visible costs (Su et al., 2009). The different authors contrastingly portray the measure of invisible Cost of Poor Quality, where Prickett and Rapley (2001) states that invisible Cost of Poor Quality equals to three or four times the visible expenses whereas Srivastava (2008) declares that invisible Cost of Poor Quality can happen to be as high as three to ten times visible expenses.

3.7. Classification of Cost of Poor Quality

With the goal of clearly explaining what Cost of Poor Quality implies and applying it more in a specific organisation, the different cost items which mirror the Cost of Poor Quality must be recognised (Isaksson, 2005). Clarified by Harrington (1999), the grouping of Cost of Poor Quality is firstly separated in classes and then the classifications are partitioned in cost items.

Omachonu et al. (2004) portrayed prevention costs as expenses "related with the plan, usage and support of the quality administration framework”. It is every activity keeping low quality from happening in the production of goods and services (Superville and Gupta, 2001) and can be believed to be proactive costs identified with building quality into the item (Chopra and
As per Juran and De Feo (2010), prevention costs limit the evaluation of failure costs. Moreover, the appraisal costs will be expenses related to keeping up the level of quality in the organisation (Sui Pheng and Ke-Wei, 1996). On the other hand, expressed in a different way they are all expenses made in order to determine if the activities are properly performed in all circumstance (Omachonu et al., 2004). Sörqvist (2001) builds up the meaning of appraisal costs, expressing that they are expenses that emerge while checking that correct quality is conveyed in all areas of a company. Failure costs will be expenses associated with the outcome of failing to meet the requirements in the organisation and with the client. These failure costs are subdivided into internal failure costs as well as external failure costs (Illes and Szuda, 2015).

The internal and external failure expenses are comparative yet vary in the fact that the internal failure expenses incorporate low quality inside the organisation, whereas the external failure expenses incorporate low quality outside the organisation (Baiman et al., 2000). Furthermore, the internal failure expense will only influence the organisation’s management whereas the external failure expenses causes issues for the client as far as deficient items or services (Krishnan, 2006). Clarified by Cauchick Miguel and Pontel (2004) the PAF-model could additionally be subdivided into a micro and macro framework. The macro framework depends on the external client and provider relationship with a company (Buthmann, 2010), while the micro framework centres around the internal client and provider inside a division or a system. The micro framework is like the macro framework with the difference being that the entire company is separated in divisions and segment before its implementation (Schiffauerova and Thomson, 2006). Besides the characterisation of CoPQ by Juran and De Feo (2010) depends on the PAF framework however there is a vital distinction; the prevention and appraisal expenses are left out and evaluation and examination costs are included. The appraisal and investigation expenses allude to Plunkett and Dale’s (1987) categorisation as appraisal expenses, since review expenses are incorporated into the category. Further, Juran and De Feo (2010) exclude prevention costs in the order however do not elaborate on why. In any case, Sörqvist (2001) avoids the prevention expenses since those expenses are not thought to be an expense caused by low quality however a speculation for good quality.

Sandoval-Chavez and Beruvides (1998) grow the first perspective of interior and outside failure expenses by separating the internal failure expenses into inside inability to meet client prerequisites and expenses of wasteful procedures, while the external failure expenses are partitioned into outside inability to meet client necessities and examination expenses.

In addition, Love and Li (2000) communicate a view similar to Sörqvist (2001) which keep out prevention expenses with a critical distinction. Love and Li (2000) isolate the appraisal and
prevention expenses into: prevention losses and evaluation losses. The argument to split that is because if the projects are effective, the company saves financially but if they are not, the company could lose the investment money and incur additional losses. Both Love and Li (2000) and Sörqvist (2001) share a similar viewpoint with the distinction being that Love and Li (2000) developed and made a distinction amongst successful and unsuccessful projects whereas Sörqvist (2001) stated that prevention expenses are constantly great projects.

Love and Li (2000) additionally include two regular costs: production costs and design costs. These expenses were created in order to compensate in case of potential failure loss and are sufficiently substantial and therefore should not be neglected in manufacturing organisations. Manufacturing costs may incur by the wasteful utilisation of assets, while design costs may happen due to the fact that requirements for the product are modified which generate more costs all together for the new needs to be met. Another method for the review of Cost of Poor Quality is depicted by Godfrey and Pasewark (1988), which incorporate two extra classes, cost of quality design and cost of wasteful usage of assets, to the PAF-expenses (Feigenbaum, 1991). Godfrey and Pasewark (1988) incorporated these for they believed that organisations utilise Statistical Process Control (SPC), which is the classification of items to distinguish low quality and Just-in-Time (JIT) to enhance the quality in the company. A cost of quality program corresponds with the SPC by reducing the manufacturing procedure, process control and item examination while C Cost of Poor Quality connects to JIT with low use the quality expenses are high.

Gryna and Juran (1999) communicate a different way to categorise CoPQ and subdivided them into direct costs and indirect costs. The direct costs and indirect costs are subdivided into visible and invisible costs (Campanella, 1999). Incorporated into the direct expenses are the PAF-costs (Freeman, 1995), together with expenses that add no value and equipment expenses (Josephson et al., 2002). The explanation behind including costs that add no value is, as per Freeman (1995), that inefficiency outlined into the procedures is more expensive than issues made by the procedures. The expenses that add no value are activities which have nothing to do with the item that the external client needs. Along these lines, it is practice that make no incentive to the client yet adds expenses to the processes (Freeman, 1995). Equipment expenses will be expenses related to the equipment utilised for estimating, approving or controlling an item and the space the hardware takes (Freeman, 1995). Equipment expenses are additionally specified by Josephson et al. (2002) however alluded to as capital ventures in quality data equipment built to gauge the item’s quality. As indicated by Josephson et al. (2002) indirect expenses can be partitioned into four important cost-classifications: client caused, client dissatisfaction, reputation loss, and opportunity loss. Freeman (1995) clarifies client caused expenses as the expenses for when the result fails to
reach client needs. The client disappointment expenses emerge when the clients are disappointed about the items or services, whereby an awful quality level of an item brings about lost income. Loss-of-reputation expenses are harder to gauge and foresee than the other aberrant expenses. The expenses influence the entire organisation and all items negatively and not just as a solitary item (Freeman, 1995). The lost-opportunity costs emerge when the organisation misses a client order because of misguided thinking or poor result (Freeman, 1995). Yang (2008) has a comparable view as Freeman (1995), by including visible and invisible expenses in the categorisation. On the other hand, Yang (2008) arranges it in a table where the expenses on the one side are subdivided into internal and external failure expenses, similarly to Feigenbaum (1991) where prevention and appraisal expenses are incorporated. On the opposite side these expenses are subdivided in visible and invisible expenses. Besides, Barber et al. (2000) introduced another perspective of CoPQ, which includes a value-chain viewpoint to depict where in the value-chain distinctive expense products happen to give a reasonable picture where endeavours must be set. The view starts from the PAF-framework (Freeman, 1995) yet is partitioned into provider/subcontractor, organisation/in-house, as well as client by coordinating them for every expense into a matrix. The purpose behind the division is to interface the Cost of Poor Quality with different business expenses and make it simpler for workers to recognise the PAF-costs when utilising the framework.

3.8. Use of Cost of Poor Quality Measurements

By directing estimations of CoPQ in an organisation, changing the sentiment of the managing team and the workers of the organisation is possible (Sörqvist, 1997). Generating commitment from the managing team is also possible (Isaksson, 2005). The measuring of Cost of Poor Quality could be utilised for translating the impacts of low quality in fiscal terms with the goal of illustrating it for the managing team as well as for the workers so that they may become mindful of what the expenses are (Andersen and Moen, 1999). In so doing, the chances that the managing team will utilise the measuring as opposed to dismissing it are great (Malmi et al., 2004). In addition, measuring Cost of Poor Quality could serve as an inspiration for supervisors as well as middle managers to show the costs that emerge in their respective area of expertise (Malmi et al., 2004). In any case, for the workers to utilise the measurement frameworks, there must be a show of commitment from the managing team, or else it will not be utilised (Chen and Tang, 1992). Furthermore, if the measuring is not done accurately, the data from the calculations could be insufficient hence making it erroneous. Thus, a possibility exists that the managing team will not effectively make use of this data. In any case, to beat this issue the organisation can begin estimating just a set number of cost items and later grow the estimation framework (Sörqvist, 2001). Furthermore, the utilisation of Cost of Poor Quality
estimations will likewise give the organisation an instrument to recognise issue zones and to organise (Teli et al., 2013) and locate the areas of potential improvements (Prashar, 2014). Albeit, certain cost items, especially invisible expenses, are hard to measure and that creates a vulnerability for the organisation with regards to the identification of these expenses (Sörqvist, 2001). Utilising Cost of Poor Quality provides the organisation with a basic and justifiable instrument for estimating the impacts of low quality as well as the costs saved by improvements (Teli et al., 2012). Nonetheless, Harrington (1999) expresses that a correlation could be made between divisions; however, outside correlation must be avoided. The trouble of correlation is due to the fact that organisations incorporate diverse cost items in the estimation or distinguish distinctive cost items inside various branches of the organisation (Isaksson, 2005).

In this way, each organisation must conduct their very own individual Cost of Poor Quality estimations to locate the pertinent expenses (Andersen and Moen, 1999). As per Sörqvist (2001), it could be hard to identify which cost items should be incorporated as Cost of Poor Quality. Cost items such as re-work and recovery can undoubtedly be considered Cost of Poor Quality however different expenses can be hard and subtle to recognise thereby generating a hazy area where every organisation needs to settle on a choice of expenses to incorporate. However, cost items are difficult to characterise could valuably be avoided (Sörqvist, 2001) and generally cost items lacking relation to the organisation can be calculated (Malmi et al., 2004). Expressed by Harrington (1999), every division in an organisation causes issues and therefore it is similarly imperative to incorporate cost items from the manufacturing division with respect to the administration, where the administration can be considered an invisible expense. The earlier the measuring of Cost of Poor Quality is performed, the less cost effect for the organisation is generated and in this way the organisation needs to endeavour to discover the costs ahead of time to avoid major and costly re-work and scrap as well as possible dissatisfaction of clients or loss of reputation (Harrington, 1999).

On the other hand, as expressed by Prashar (2014) "it costs less to dismiss flawed material at the products internal stage than it does to scrap a fabricated product that has had the defective material consolidated into it". Chen and Tang (1992) additionally express that the invisible quality expenses have the tendency to augment as a progressively outstretching influence down the line, and because of that, issues arising in a specific division would generate additional work for a different division. The classification of cost items could be an issue since a quality-related movement can be frequently incorporated into various classes (Teli et al., 2013). A case of this is provided by Sörqvist (1997) whereas a design review could be seen as prevention expenses, an appraisal expense or a failure expense because of the way it is and where it is utilised as a part of the procedure. Expressed by Prashar (2014) as
well as Chen and Tang (1992), it could be hard to measure prevention expenses. Because all properly managed companies try to anticipate quality issues, it has proved to be difficult to isolate preventive actions from prevention quality-exercises. This implies that the company experiences difficulty in comprehending what to incorporate or eliminate when it comes to measuring prevention expenses. Lastly, realising that just estimating Cost of Poor Quality will not resolve the issues of an organisation is essential, rather it would just provide a general view of the activities that should be performed in order to enhance the level of quality of the organisation (Harrington, 1999).

The measuring of Cost of Poor Quality can reveal itself to be responsive, just responding to the issues estimated and checked if an organisation measured a high Cost of Poor Quality, it must not to be considered a bad thing for the organisation, rather it is proof of that the organisation has helpful estimation strategies that uncover the majority of the cost items (Sörqvist, 1997).

3.9. COQ in Manufacturing

Productivity has been viewed as an essential focus within the manufacturing sector. The higher the production, there is an increase in sales thereby maximising gains. In the beginning of manufacturing, production capacity and quality were viewed as two separate elements. Moreover, it was for the most part believed that an expansion in quality implied an augmentation in cost. This is wrong and since the start of quality improvement it has turned out to be broadly acknowledged, particularly in the manufacturing business that an expansion in quality brought about less cost by enhancing productivity through the end of revamp and superfluous assessments (Omachonu et al., 2004). The significance of quality costing turns out to be consistently clear. A current report on manufacturing organisations in Malaysia demonstrates the importance of actualising quality expenses. The discoveries had recommended that utilising quality costing strategies into the day by day activities enhances execution and productivity and that it was a viable route for an organisation to affect their bottom line (Campanella, 1999). It can be seen that quality has outperformed the part of basic examinations by turning into a vital factor when settling on vital instruments that have an impact in expanding the productivity of an organisation, or specifically an assembly line by enhancing the use of assets and fulfilling client requirements.

This is in conjunction with cost and reliability contemplations. Diallo et al. (1995) tried to clarify how a few manufacturers challenge the generally acknowledged "production logic". When compared with their rivals, they do not just improve quality items, but they perform similarly at fundamentally low cost edges, with a more tried and true process that reacts faster to changing business sector necessities. Gray (1995) recommended that the reconciliation of quality into
work forms is decentralised, that every office is in charge of its own quality guidelines and that their individual goals should bolster the general objective of the company. Remembering this, one should take note that every division is obliged by the parameters of the rest of offices under the company and in this way an integrative way to deal with quality by all offices ought to be considered. Besides, it is recommended that there must be a smooth stream of data concerning the organisation's objectives and approaches. While considering productivity and quality manufacturing, one must investigate how the dramatic augmentation in robotisation in the manufacturing business has influenced the result. Information workers, maintenance personnel, administrators, designers, and so on all play a huge part in conveying high quality and productivity. They are the main feasible methods for utilising an integrative way to deal with quality by drawing in all divisions in all work forms, and as outlined earlier the cross functional way to deal with quality improvement is highly suggested.

The manufacturing sector has a few ideas that can be utilised, keeping in mind the end goal to enhance productivity and quality. Just in Time (JIT) manufacturing, which is utilised as a part of and regularly alluded to as the Toyota Production System, is a production methodology that plans to lessen inventory expenses by having parts delivered "just in time" for delivery to happen. The procedure depends on kanban, a term depicting signals in the quality practice, to show when the following part ought to be made. Zero Inventories (ZI) is another idea like JIT in that it aims to build overall revenues by decreasing stock and in this way taking out the requirement for stockrooms or other expensive techniques for storage. Total Quality Management (TQM) is another methodology utilised at numerous manufacturing companies. TQM works on the preface that an item's or service's quality is the duty of everybody who is associated with the procedures relating to creating or conveying that item/service. It expands the association of management, the workforce, providers and sometimes even clients to accomplish customer satisfaction (Rust, 1995). All these manufacturing techniques greatly affect productivity and quality improvement. A lot of research has been done on the methods for enhancing quality and productivity in the manufacturing business. The majority of this examination talks about advantages accomplished by limited improvements, for example, cluster production, reduced setup and the utilisation of current PCs. Campanella (1999) offers a key approach on the best way to enhance productivity and quality of an entire company against the business approach. The cost of quality as far as gain and loss must be considered as the COQ is the basic estimating technique of any quality improvement endeavours. The estimation of factors at some points in a procedure is fundamental while figuring out what quality improvement activities can be taken. It is important to comprehend where a procedure might be softened or wasteful to execute significant improvement. These estimations, taken at different phases of the procedure, give knowledge as to where improvements can be made.
keeping in mind the end goal to streamline or settle the procedure and additionally give data on the execution of a production line. Rivalry in the manufacturing sector has prompted a few methodology changes and more up to date systems of estimating performance. Estimation, planning and improvement can be incorporated into a key procedure. Quality estimations are frequently non-budgetary and can be measured utilising task based costing. Another overall technique for quality improvement in the manufacturing sector (among different sectors) is the ISO 9000 series. It provides a rule on setting up and keeping up a quality framework and intensely including the right documentation. It revolves vigorously around the thought that organisations' work force must understand that quality falls within their control of internal procedures.

3.10. COQ in the Construction Industry

In the construction industry, quality is seen as the capacity to meet the needs of customers (Abdelsalam and Gad, 2009). The financial aspects of the quality idea can be traced back to the mid-1950s when the 'Cost of Quality' was mentioned for the first time in Juran's Handbook about Quality Control (Jafari and Rodchua, 2014). Cost of Quality is an estimation framework that deciphers the dialect of quality management into money related terms that each partner can comprehend (Tawfek et al., 2012). The American Society for Quality, Quality Cost Committee called Cost of Quality a measure of the expenses particularly connected to the production or lack thereof of good or quality. CoQ incorporates:

1. Prevention expenses for non-conformance to prerequisites;
2. Cost of item or service appraisal for conformance to prerequisites; and
3. Failure expenses for items that do not meet the prerequisites (Campanella, 1999).

CoQ is also considered as the total of expenses of conformance as well as non-conformance. The conformance expense is the cost incurred for avoiding low quality whereas the cost of non-conformance is the cost incurred for item and service failure because of low quality (Al-Tmeemy et al., 2012). Rosenfeld (2009) express two stages in quality costing, as they perceive it: categorisation and measurement. CoQ categorisation relies upon the models created, and estimating CoQ demands exact cost data records. In any case, conventional cost bookkeeping frameworks neglect to give precise cost data to management, and this contorts CoQ estimations. A CoQ examination by Rezaian (2011) points towards possibilities for sparing while at the same time enhancing quality over an undefined time frame. A few manufacturing companies have effectively created and executed quality management projects to lessen operational expenses. For instance, Motorola, an American electronics maker, is a decent achievement example of an organisation being awarded the Malcolm Baldrige National Award for quality projects. Motorola started its quality improvement plan and built up an
instructional hub and gathered information from workers, client surveys, complaints and different sources which they utilised as a part of their quality improvement and item advancement endeavours.

Through the quality improvement plan, Motorola lessened the cost of non-conformance from 13% to 8% of yearly incomes over a space of three years and created a reserve fund of around $480 million (Barber et al., 2000). Gunawardena et al. (2004) say that quality expenses can be diminished by 33% when a cost-effective quality management framework is actualised. Section 7 of the Government of India Planning Commission (2011), Eleventh Five-Year Plan (2007–2012), demonstrates a breakdown of development cost classifications in light of a study by the Construction Industry Development Council. This categorisation of construction expenses demonstrates that the material related expenses were the most astounding (47–49%) and construction equipment and labour expenses were in the scope of 13–15%. Using a viable quality cost program, those costs could be lessened. It is vital to know which components can prompt a fruitful execution program. As indicated by Hall and Tomkins (2001), the essential hindrances to quality management framework being executed were the dynamic idea of projects of construction, the various parties engaged with the process of construction, non-institutionalisation, and the idea of the bidding procedure. Barlow (2009) additionally expressed that the critical explanations behind not executing CoQ frameworks in manufacturing companies were the absence of legitimate management, the monetary state of firms, absence of information about how to track costs of quality, the absence of satisfactory bookkeeping and computer frameworks and the incapacity to see the advantages of CoQ. As per Heravi and Jafari’s (2014) study on elements and issues of quality costing frameworks usage in the manufacturing area, the essential factors that guide the accomplishment of quality costing frameworks were management support and dedication, powerful frameworks and application, understanding the CoQ ideas, and participation from different divisions. In addition, she found that among the principle issues experienced in executing quality costing programs are:

- **Measurements** – Absence of a fitting framework as well as mistaken strategies for gathering cost of quality classes.
- **Personnel issues** – Absence of support from the senior managing team, resistance from the bookkeeping and finance offices, and supervisors and workers lacking knowledge and training on CoQ.
- **Process** – Irregularity among the different plants and ineffectual process guidelines.
- **Information** – Absence of clear guideline and deficient data for appropriate plan and execution.
Applying quality projects in the construction sector is a moderately new idea. It is typical for big construction companies to execute a point by point quality program other than the regular place ISO standards and even less work on estimating cost of quality. Devi and Chitra (2013) studied organisations and consultant companies in Australia and their practices, or deficiency in that department, of quality costing. Noting that it is not the norm to practice quality costing techniques in their daily business culture, it is hard to decide the advantages these organisations gain by estimating their quality expenses. Devi and Chitra (2013) state that even though direct quality expenses, for example, pay rates, documentation and review expenses can be estimated with an adequate level of precision, their related benefits are significantly harder to measure. Numerous compelling procedures in the Engineering, Procurement, Construction and Management industry (EPCM) enormously affect the cost of quality failures. The procurement procedure, for instance has turned out to be infamous for prompting cost overruns on ventures.

It has turned out to be evident that so as to enhance a project's execution, the causes and expenses of revise must be resolved. An intriguing examination done on the perception of time, cost and quality management on construction ventures uncovered that the view of the customers, contract workers and consultants associated with a similar task are not uniform. Customers trust that their desires for time, cost and quality are reasonable though their contract workers and consultants think the opposite. In the investigation, the conclusion demonstrated that customers had evaluated quality as more vital than project execution time while the contract workers and experts believed that with the specific end goal being to satisfy the customer, they needed to contribute their assets on time and expense. (Basu, 2015) mentioned previously, ISO 9000 principles are the most generally utilised quality activities among construction organisations. It has been embraced by a few nations globally and is connected by all enterprises and in addition engineering and construction.

3.11. **Advantages of a Quality Costing System**

Each section of the construction sector can profit by quantitative investigation of projects related to quality. It is essential to decide the general cost of low quality in construction and design. As indicated by Rasamanie and Kanapathy (2011), quality deviations might not be easily identified without a formal deliberate management of quality framework set up. Data is lost and actions that should be enhanced with a specific end goal to lessen or wipe out rework cannot be discovered. The development of a satisfactory quality cost gathering, and estimation framework is vital to setting up a quality-costing framework. The execution of quality costing will have the capacity to deliver the huge advantages mentioned bellow:
• It can be utilised as a method of evaluating the potential advantages to be increased through a quality improvement process (Zimak, 2000), and it could help venture the money related advantages and implications of the proposed changes (Chatzipetrou and Moschidis, 2016).
• It assesses quality program achievement (Djekic et al., 2013) and focuses on the advantages and disadvantages of a quality framework (Zimwara et al., 2013).
• It warns against the potential effect of low quality on the money related execution of the organisation (Kirlioğlu and Çevik, 2013.).
• It enables companies to figure out where quality expenses have been acquired and where issues exist (Karipidis et al., 2009), and plays a role as an instrument for concentrating on territories of poor execution needing improvement (Campanella, 1999).
• It gives remedial activity to keep the event of non-conformances from occurring (Maani et al., 1994; Love & Li, 2000).
• It recognises and kills organisational actions that do not bring or improve quality (Abdelsalam & Gad, 2009), and encourages management to decide on the kinds of exercises that are more helpful for decreasing quality expenses (Diallo et al., 1995).
• It exchanges lessons figured out how to different zones (Love and Li, 2000). It centres consideration around the inception of failures and what they cost, making those capable mindful and responsible for acquiring such costs, accordingly helping them be more effective in their occupations (Tye et al., 2011).
• It decreases revamps and consequently diminishes claims (Barber et al., 2000).
• It persuades workers to work towards seeking quality objectives (Love and Li, 2000).

The lack of such a CoQ framework has made numerous companies create isolated approaches to keep control over their territory of obligation. Data collection, reporting, and management in a task end up disorganised, and numerous re-drawing and re-keying of data should be undertaken. This eventually brings about idle time, unavoidable expenses, augmented mistakes and misunderstanding. The requirement for improvement for those problems have proven to be essential variables of time and cost overruns in projects of construction (Tye et al., 2011).

A contract worker’s quality assurance program is important for recognising and forestalling the recurrence of quality related issues. The ISO was created in 1926 when it started to be perceived that standardising work procedures guarantees limiting fluctuation and consequently if every best practice is recorded as techniques; standardising would likewise diminish non-similarities and imperfections. Berawi (2004) examined the utilisation of ISO
9000 guidelines in construction. They specified that efficient work of quality diminishes the expenses of failures in one's own work as well as in the final product through consistency. In this manner a contract worker's in-house quality assurance program is absolutely critical to accomplishing consumer satisfaction. By distinguishing and counteracting failures, the customer has more certainty that the task will be executed as arranged. Especially in construction, there is dependably a danger of not finishing a task on time or within spending plan and to add to this, there is a security viewpoint to consider if an undertaking is not finished due to the fitting level of quality. It has turned out to be notable that construction and contracting organisations are in an ideal situation having an incorporated quality assurance program to guarantee prompt recognition and prevention of quality and construction related issues. After inquiring about twelve construction organisations in Saudi Arabia, it was discovered that the essential explanation behind enrolling for the ISO 9001 certification are top management's interest for the guidelines potential to enhance the quality of their ventures and also adjusting to what clients anticipate from their services. They are striving to be one stage ahead of their rivals when ISO certification turns into a compulsory prerequisite (Powell, 1995).

Research by Powell (1995) was additionally done on the benefit that ISO certification adds to a contract worker or company working inside the construction business. A greater part of these organisations recognised the advantages they stand to gain from being certified however a couple of the i contract workers interviewed made a couple of reservations about whether certification increased the value of construction related procedures. ISO certification surveys a procedure instead of an item or a service and its imperative to take note of the fact that there might be a few procedures in the construction business that albeit required by contract to accomplish, do not really include any value or enhance a venture's quality. Non-value added tasks like these incorporate process deferrals, transitory or lasting storage, reviews and any rework required to meet consumer satisfaction or engineering determinations. There are a couple of elements that should be included for a procedure to be value included; first there must be a detectable change that is wanted by the client, second the client must be willing to pay for outcomes that a specific procedure will convey and thirdly the procedure must be well executed at first attempt.

A large portion of the contract workers met announced that there are couple of challenges with applying an ISO quality program while the other half had a couple of concerns that ISO 9001 is extremely record based in that it requires proper documentation for each important procedure performed. For a few contract workers, particularly the smaller ones that may have staff constraints and numerous speedy straightforward work forms, keeping up documentation
as required by ISO prove to be an extremely monotonous and superfluous job. Since being ISO certified additionally implies that subcontractors ought to either be ISO certified themselves or in any event follow ISO principles, big firms frequently have challenges controlling their subcontractors. It was discovered that the full usage of an ISO program is troublesome making deviations from the program a conceivable plausibility. For legal records, ISO clauses can contain language that may not similarly translated by all organisations. There is a requirement for the accessibility of assets to go along with all ISO necessities, and frequently these assets do not exist, and it turns into an additional workload to workers whose essential job obligations lie somewhere else. There is a general lack of quality staff in the engineering business thus making it hard to enlist workers with that experience (Powell, 1995). Notwithstanding the challenges with fitting in with ISO, there is generally a few reasons as to why a few organisations are disheartened from executing ISO certification within their work procedures. As a result of the additional costs that would be brought about and secondly on the grounds that there is dependably a specific hindrance towards change while actualising another program that is not familiar for staff and management.

There is a danger of losing productivity because of the endeavours applied in implementing a framework among workers that have different obligations and this ties into limited staff. Regularly in construction ventures, there is a probability of a task being performed from various workplaces including a remote occupation site that makes coordination and correspondence troublesome, particularly when diverse time zones, dialects and societies difference exists. Powell (1995) offer a few comments about ISO 9001 by adding that there is by all accounts a misguided judgment of the principles. Through their study they have discovered that a portion of the contract workers that were interviewed believe that ISO principles simply require a reported "reliable" level of quality instead of an archive best practice process. The ideal solution that should be implemented for the contract workers is contract worker is Deming's Plan, Do, Check and Act Cycle (PDCA) that requires a firm to first archive their accepted procedures previously institutionalising any of their work forms. This is then followed by continual checking and updating of their work procedures to guarantee that any "better" practices are recorded.

A final comment made by their study is that numerous organisations are deficient in organising improvements within their work procedure and this is an essential mentality for an organisation to have in order to execute a a quality program effectively. A typical quality practice in the development business is Total Quality Management (TQM). It was portrayed by Burati and Oswald (1993) as a journey instead of a goal. The advantages of executing TQM include higher consumer satisfaction, better quality items and services and higher entrenchment within the market. Similar to other Quality projects, actualising TQM requires that the whole
organisation's business culture to be transformed to adopt a theory whereby all staff take responsibility for quality improvement. TQM requires the entire workforce to participate in creating objectives, procedures, companies and ensuring that tasks are performed correctly at first attempt. Every worker must consider both the information and result of their own procedure. They should know about how their association in a procedure chain will influence the general population in the following phase of production and to additionally control and evaluate this, it is important that estimations must be made along the way. TQM additionally involves that as opposed to concentrating on the 80% that is doing great, an organisation should basically focus on the 20% that is either falling flat or requires prompt change (Porter and Rayner, 1992).

Dale and Plunkett (2017) added to this idea by guaranteeing that always checking, estimating and breaking down variables that have huge impact on execution will drive a programmed improvement. To viably utilise the data processes from these estimations, evaluating a cost of quality is the rational way ahead. Burati and Oswald (1993) related the cost of quality in construction as the cost of conformance to prerequisites including expenses generated because of Prevention and Appraisal and additionally the cost of non-conformance to prerequisites. Thus, Strange and Vaughan (1993) hypothesis, a study done by Culp et al. (1993), additionally proposes that there is a typical misguided judgment by contract workers (and manufacturers) that executing TQM is a costly procedure. This is a misguided judgment and ought to be supplanted by the understanding that it is not the effective usage of a quality program that is costly but instead the expenses acquired when non-conformance to quality is revised. These expenses incorporate the cost of rework, fixing mistakes, responding to client objections, having insufficient venture budgets because of lack of forecast and coordination and also missing due dates.

Research done by Chase (1993), demonstrated that activities can keep running up to 12% of their aggregate costs spent on adjusting their non-compliances to quality or client prerequisites additionally underlining the requirement for proactively executing a quality program, for example, TQM. A few construction organisations have a quality costing strategy set up to gauge their quality level. Construction organisations have just genuinely grasped quality as quality assurance as it is commanded for all legislature related contracts (Culp et al., 1993). Quality assurance does not enhance a company's intensity and execution (Federle and Chase, 1993). To properly quantify execution, recognise and actualise improvements, organisations must have a compelling quality costing framework. Without an exhaustive quality cost examination of the organisations’ ways of managing money, it is extremely testing to figure out where expenses can be cut or where spending must increase keeping in mind the end goal to encourage for a quality execution at ideal cost. (Federle and Chase, 1993).
The absence of quality costing duty has brought about quality failures turning into an endemic component in the construction sector (McCabe, 1996). Recognising quality expenses is a method for providing management data about process failures and the jobs that should be completed to avert repeat of failures. In manufacturing, quality costing is a more typical culture, however this is not the situation in construction and the conceivable explanations behind this vary.

From the start, the construction business has an extremely powerful nature. It is venture based and each undertaking is diverse making a bland quality costing framework difficult to actualise. In addition, activities have distinctive stages where each stage comprises of new work procedures, specific staff and diverse result desires. Keeping in mind the end goal to build up a compelling quality costing framework, organisations need to willingly create one that works for them (Biggar, 1990). There are some specific construction components that could be distinguished and evaluated for about all construction companies and a general layout of a costing framework can be designed.

Chase and Federle (1992) characterised quality costing in the construction field as either the cost of control or the cost of inability to control. The cost of control included Prevention and Appraisal costs while inability to control comprised of inner failure and outer failure, much like Juran's quality cost definition. Inner failure expenses were expenses related with rework, material waste and other unavoidable losses that necessitates for an expansion in tasks. Outer failure expenses were failures that brought about lost gain for example, legal cases, deformity amendment and loss of reputation and future work. Appraisal expenses incorporate all expenses brought about to the recognition of errors by estimating every single expected process against a required level of value or congruity. In construction, these things incorporate issued building and structural illustrations, work in process, incoming resources and completed products (Pheng and Teo, 2004). Prevention expenses are considered as all expenses acquired to forestall or decrease mistakes or errors and such expenses include the financing of exercises that expect to dispose of or diminish mistakes (Pheng and Teo, 2004).

Another definition to quality expenses investigated before is the cost of conformance instead of the cost of non-conformance. Cost of conformance is the Prevention and Appraisal expenses, for example, preparing, inculcation, confirmation, approval, testing, review, support and reviews. Non-conformance costs were revamp, material misuse and guarantee repairs (Pheng and Teo, 2004). McIntyre and Kirschenman (2000) recommended that if organisations were to sufficiently keep up their quality costing framework and execute distinguished enhancements, their Prevention expenses should augment along these lines diminishing their Appraisal, inner failure and outer failure expenses by a noteworthy edge gaining them a lot of funds and the best chance to expect savings in interior failures. Without a satisfactory quality
costing framework set up in any case, quality deviations would be unidentifiable and hence these upgrades do not equate to a vast opportunity cost.

3.12. Organizations in Construction

The standard structure of a company or venture in the construction sector comprises of a customer, a general contract worker and consequent subcontractors and providers. Robinson et al. (2005) characterised an inventory network as a system of elements with upstream and downstream linkages of procedures and activities that offer some benefit as either an item or service to the relating buyer. The general contract worker is the link in this system that is in charge of taking care of the requests of the customer. General contract workers are, however, reliant on subcontractors and providers to encourage meeting the customer’s desires.

The construction business is regularly scrutinised for contravening their legally binding needs through poor execution (Edum-Fotwe and McCaffer, 2000). It, experiences budget overruns and plan delays before finishing an undertaking and there are various explanations behind this and a few of which are attributed to the broad production network. The business contains a large number of various callings, sets of expectations and associations all commanded together to convey a completed task. The customer will procure the general contract worker who at that point enlists subcontractors and providers who enlist their own providers. The general contract worker will guarantee every one of the requirements of the customer are met by being mindful of all agreements and the subcontractors and providers will be mindful of their own agreements with the general contract worker. Moreover, the general contract worker will focus on benefit generation which implies higher income from the customer and low cost contracts with subcontractors who additionally focus on benefit generation while customers keep their objective of limiting expenses. This web of companies can end up bringing about numerous contrasting objectives thus decentralising quality management (Zayed et al., 2012).

Love and Irani (2003) proposed that the aim of supply chain management is to establish trust, trade data, grow new items and lessen the pool of providers in order to enable management assets to construct long lasting connections. Concerning construction, supply chain management would have an essential spotlight on the general contract worker and how the worker can ideally oversee and use the assets of its subcontractors by successful and helpful association (Eadie et al., 2010). O’Brien and Al-Soufi (1993) called attention to the fact that the present general contract workers have the most difficult and essential capacity of agreeably executing every single acknowledged contract. They should take their customers thoughts and transform them into a substantial reality. The completed item is normally an arrangement of illustrations and details. The reasons general contract workers usually enlist subcontractors are on the grounds that they have the specific aptitude of specialised building
or construction abilities that a general contract worker would somehow need or in light of the fact that the subcontractor can expand the work constrains at a lower cost subsequently expanding the general contract worker’s in-house capacity. Another essential preferred standpoint to subcontracting is the expanded adaptability and decreased long haul sense of duty regarding assets required for the activity. For example, if there is a considerable measure of work to be done, a subcontractor can offer the utilisation of additional material or a working plant to help in conveying the required work on time and in times of low work, there is no excess or additional assets that are not financially. A lot of capital stands to be spared when general contract workers outsource their work to subcontractors (Eadie et al., 2010).

With these huge advantages come extraordinary dangers and concerns. Subcontractors by nature are generally small enterprises and not financially stable thereby making their work procedures irregular and less institutionalised thus not providing assurance that the required quality standard will be conveyed (Aouad & Price, 1994). They frequently manage hard labour work on location making them especially difficult to control from the general contract workers point of view. Liability for poor execution or unsuitable work would seldom be able to be placed in the hands of subcontractors. General contract workers should regularly expect extraordinary hazard in entrusting subcontractors to effectively finish the work with satisfactory quality. This prompts a basic requirement for subcontractor supervision by the general contract worker which normally is an additional expense (Eadie et al., 2010).

3.13. Procurement Process in Construction

The procurement procedure is apparently the most vital function in the construction business. It can involve between 50-70% of the aggregate estimation of the task and there is a major placed on this procedure to perform satisfactorily and effectively (Love 2002). Schedule restrictions are among the biggest weights that the procurement division faces. The securing of materials in a timely way for the most part decides the major way of a task and along these lines finishing an undertaking on schedule falls vigorously on the shoulders of the procurement work. The need to manage a few distinct substances can be testing. The procurement office in a general contracting organisation frequently manages every one of the providers, the engineering division, the construction office, the contracts office and in addition employed contract workers. Being the unified association for such a significant number of these parties can make coordination extremely tedious and troublesome (Love 2002).

Moreover, inside the construction industry, procurement alludes to what is purchased, as well as to a different cluster of strategies for gaining a tremendous scope of resolute resources (Matthews et al., 1996). The way toward choosing capable providers is known as the procedure of procurement (Ward et al., 1991). Indeed, Mulholland and Christian (1999)
characterise procurement as the procedure which makes, oversees, and satisfies contracts identifying with the arrangement of resources, services or designing and construction works, the employing of anything, transfer, and the securing of any rights and concessions. These definitions recommend that the manner in which customers, designers, contract workers and providers cooperate as a group is controlled by the procurement system and the nature of agreement entered between venture members and the customers (Kumaraswamy and Dulaime, 2001). Procurement frameworks have imperative ramifications for the way venture dangers can be distributed among venture members, management of the dangers, and the techniques for getting the required incentive as far as important undertaking factors (Matthews et al., 1996). The implication is that to streamline construction execution, it is crucial to see all parts of procurement (Walker and Hampson, 2008). For instance, hazard avoidance is a fundamental piece of procurement. At the end of the day, contracts are utilised for chance avoidance since they make a road for diverting dangers from the customer. There are two routes accessible to proprietors to complete work. Built environment resources that are immovable can either be secured in-house or outsourced. An in-house approach alludes to proprietors undertaking the work utilising their assets and abilities. Previously it was not abnormal for a South African city engineer to embrace routine construction and maintenance works in-house. Lately the preferred option in the public sector is outsourcing. There are two conceivable purposes behind this option, one is technical and the other financial.

The literature recommends that procurement in the construction business, universal and local, is administered by various controls authorised with a specific end goal to guarantee tangible delivery and contract worker determination process (Mulholland and Christian, 1999). Keeping in mind the end goal to coordinate capacities with necessities in the determination of a principle contract worker, various set up steps/systems may be taken. Such delicate assessment strategies include the pre-qualification of contract workers as far as specialised and management abilities fundamental for the work. It additionally incorporates meetings and work area assessments of offer as far as price (commercial assessment) and technical contemplations. For example, management group, staff issues, proposed way to deal with work, environmental practices and solution, efficiency, H&S, quality assurance, and job materials (Mulholland & Christian, 1999). This strategy regularly culminated in the award of agreement subsequent to relegating proper weightings to the cost/quality proportions (Mulholland and Christian, 1999).

The effect of the obtained items on the general quality of the execution and completed product of the venture is important to as it impacts heavily on the procurement work have faultless execution. In conclusion, the procurement division responsible for the vital supplies to be availed on location at the correct indicated times for construction. This is an important factor
since, in construction, almost all components are interrelated and have priority relationships (Love 2002).

Pesämaa et al. (2009) deduced in research conducted on the procurement procedure of the public sector construction sector, that a portion of the procurement issues were through wasteful tendering process. The least value bidder is generally y selected and diminishes the quality of supply chain as expenses are constantly run down. This further caused a strain on the connections of providers and contract workers probably causing more execution issues amid the life cycle of the undertaking.

Pesämaa et al. (2009) specified how for organisations that constantly tendered their new tasks, there was an absence of motivating forces for the procured (sub) contract workers and providers to perform well as new openings for work were not dependent on past exhibitions. Because of these high weights, it is likely that procurement experts tend to utilise a most optimised plan of attack approach keeping in mind the end goal to serve every one of the requirements of the task at the least conceivable cost without affecting calendar. They expect to complete their capacities in a sped up and fluid way constantly. Thus, it is vital to survey quality down the supply chain. An article written in the applied mathematical modelling journal built up a model for production network design and insisted on the significance of processing COQ for the whole supply chain as opposed to isolate discreet entities. It recommends that figuring COQ in the supply chain is the main step to coordinating COQ in the basic leadership process as it permits the investigation of interrelationships between various business segments (Briscoe and Dainty, 2005).

3.14. Conclusion

This chapter defined terms that appear throughout the study, such as cost of quality, cost of poor quality, construction sector etc. Crucial concepts such as cost of quality, total quality management, etc., were also explained. These are frequently used terms and concepts and are therefore important to the study. The following chapter will review the construction industries of two countries outside African continent and the challenges they face as well as lessons learnt from the respective countries.
CHAPTER 4 CONSTRUCTION INDUSTRY FROM INTERNATIONAL CASE

Chapter 4 of this study will review the literature relating to two international countries namely Malaysia and Australia. This chapter will focus on the overall review of each country and thereafter a review of the construction industry in each country will be provided.

An the challenges they face regarding the performance of their construction projects will be outlined. Lastly, this chapter will examine lessons that can be derived from the countries regarding factors affecting the performance of construction projects.

4.1. Overview of the Global Construction Industry

The construction industry significantly contributes to the global economy. This industry’s products deliver the necessary public infrastructure and private physical structures for daily activities such as services, commerce, utilities, and other industries. The industry is not only important for its finished product, but it also employs a large number of people (directly and indirectly) hence the effect on the economy of a country during the actual construction process (Sarkar et al., 1998).

Strassman and Wells (1988) noted the solid connection between the construction business and economic development, with explicit reference to capital foundation. Various studies have taken notice of the significance of the construction sector and its numerous valuable contributions (Spence and Mulligan, 1995; Baloi and Price, 2003; Razak et al., 2010; and Ruddock, 2002), on the Gross Domestic Products (GDP), monetary activities, government incomes, benefit of investment and employments across the country.

Currently, the construction industry globally is recovering from the financial meltdown between 2007 and 2009 and countries are putting in place measures to guarantee the success of their construction sectors. As indicated by Hampson et al. (2014), obliged loaning and fiscal standards to deal with budget deficiencies in grown markets, for example the United Kingdom (UK), will have a great effect on deciding the eventual fate of the construction business. On the other hand, in markets developing quickly, for example Asia and Latin America including the front markets in the Middle East, pressures of population will generate demand for interest in the built environment and financial space will enable governments to seek after these plans. In emerging countries, for example, Malaysia, Indonesia, and Vietnam, the construction sector is just too vital to even be permitted to stagnate or experience further decliner. Raftery et al., (1998) added that the extra pressure from trade liberalisation in the construction industry will soon start extreme enhancement during the construction process.
4.2. **Construction Industry As a Catalyst For Economic Growth**

The construction sector performs as an economical accelerator and multiplier (Miller, 2002; Anaman and Osei-Amponsah, (2007)). The concept of economical multipliers and accelerators emanates from vital economic notions. The multiplier effect happens when a variation happens on the level of investment in profits and employment in one economy as well as the rise of value of aggregated demand increase is higher than the amount of the value of the original investment (Abidin, 2010).

This is because of the large variety of activities performed by the industry and it depends on the size of those projects type as well as the required trade and professional skills. The costs of projects themselves could fluctuate between a few hundred pounds and several million pounds (Smith et al., 2001). It means that over the course of an economic decline, the demand of construction should increase in order to revive economical activities by the use of the multiplier effect (Gann, 1997).

Yong and Mustaffa (2013) supported this concept and citing the work of Henriod (1984), showed that throughout a phase of heightened economic growth, the construction industry grown than other sectors of the economy thus showing the cumulative collaboration of multiplier and accelerator influences on the construction demand because of changes in the entire economy.

The accelerator effect in the construction industry happens when a minor change in the consumer goods demand and the consumer services demand for instance food, apparel and home appliances rises because of a surge in the demand of the production factors utilised for the satisfaction of such demands (Dainty et al., 2004; Li et al., 2000). As an example, the enlargement of a factory might cause the demand for the plant and building services production to increase.

4.3. **Industry Structure**

The structure of the sector reveals the type of demand for its outputs, the multiplicity of types of projects and the easy access into the sector for companies. The easy access might be a result of subcontracting abilities, technology or further elements. The sector comprises of a high quantity of construction companies and building resource traders. The majority of building companies are divided into small- or medium-sized firms (Chiang et al., 2001) and focus on a number of classes of work (Abdel-Razek and Mccaffer, 1987).

According to O'brien and Al-Soufi (1993), every organisation holds an identical position in the sector. It is best to concentrate on separate parts of the construction sector in order to
comprehend its nature and particular features. Ofori (1990) has been able to offer a general idea of the parts forming the construction sector.

Figure 4.1 demonstrates that the sector demands involvements from various participants in order to get its finished products. This demand reveals the significance of the sector in the stimulation of the economy through the building of construction developments. Every element will then interact with other subdivisions in the production of their own outputs. For instance, the production division of building companies needs manpower, equipment, construction resources, supplies of electricity and water in order to properly fulfil their responsibilities. A construction company must acquire construction resources from a seller in order to do its job.

The supplier of construction resources has its very own production division in order to accomplish its work-related jobs. The company must acquire construction materials from industrialists and needs labour supply as well as transportation to carry its products. Those needs prompt other organisations as well. Consequently, the construction industry’s function is to encourage economic growth or to prompt the economy through a recession.
Figure 4.1. Usual Portrayal of the Construction Industry. (adapted from Ofori, G., 1990)
4.4. Characteristics of the Sector

The sector varies from other sectors in many ways especially when it comes to its activities and products (Chen, 1998; Ofori, 1990). In some measure, every project in construction is different, unique (O'brien and Al-Biqami, 1999) and discrete (Ball, 2003); there cannot be identical jobs, even if similar designs exist (Shirazi et al., 1996).

Numerous writers in the field of construction economics have tried to define the industry’s key structures. For example, as stated by Ofori (1990), the main factors of projects of construction are their immobility, uniqueness, heaviness, bulkiness, complexity, expensiveness and durability and their need for long completion time. The industry is also recognised for its heterogeneity (O'brien and Al-Biqami, 1999; Shirazi et al., 1996) and massive complexity (Zakaria et al., 2012; Stone, 1983). After the review of writings from numerous authors about the unique features of the construction sector, Ofori (1990) mentions the features below:

- **Size:** Products of construction are for the most part large in size, immovable (Abraham, 2003; Ofori, 1990), bulky and costly (de Valence, 2010). Therefore, planning investments before executing in order to guarantee a profit is necessary (Ofori, 1990).

- **The Government as a Client:** The sector of construction is closely linked to the government, especially when one of the industry’s major clients is the government due to the vast capital investment needed for the construction of buildings and infrastructure (Ofori, 1990). Around 30% of the government expenses are reserved for products of construction (London and Kenley, 2001). Furthermore, the government has the responsibility to deliver buildings, infrastructure and services, as the government is responsible for the public (Ofori, 1990).

- **High Cost:** The industry’s products require great amounts of capital. Therefore, it is crucial to perform feasibility research about the viability of a project in order to guarantee a return on investments for the clients. Even though a few customers want to use the finished products for their own selves, this alternative still seen as risky.

- **Nature of Demand:** The same resources are not required at the same levels of the procedure of construction for the setting up of a project. Therefore, planning continuous labour for their workers is hard for contractors and firms. Moreover, the product being fixed on the terrain distinguishes it compared to other merchandises in the economy (Ofori, 1990).

- **Durability:** The output of construction is more long lasting than other types of goods (London and Kenley, 2001; Ofori, 1990). The durability is a necessary component in order to meet the requirements of the design and its regulatory needs and to guarantee a safe stay. Therefore, products of construction need to be made out of strong and
durable materials. Consequently, the final product cannot be easily changed, and changes would demand a significant cost. A civilisation’s achievements as well as its failures are often defined by the products of its construction industry (Ofori, 1990).

- **Work Nature**: The nature of construction work could be defined using the “3Ds”: dirty, difficult and dangerous (Kashiwagi *et al.*, 2009). Construction works rely intensely on labour (Lansley, 1987; Ofori, 1990). Workers are subject to extreme weather conditions because of its outdoor nature. The construction site is generally unclean, unsafe and messy. The way building materials, construction plants and machines are placed on site endangers the workers. The construction sector has a higher casualty rate than other industries (Carlson *et al.*, 2000; Ofori, 1990).

- **Technology**: The sector of construction makes use of broader collection of technologies than the rest the manufacturing sector (Ofori, 1990). That is primarily caused by numerous projects having specifically different designs (Rivard, 2000). Nevertheless, technological advancement in the industry of construction has advanced at a different speed than the manufacturing industry (Peansupap and Walker, 2006). Compared to other technologies that have the tendency of becoming out-of-date over a period of time, new technologies in the sector of construction have a tendency toward the adaptation from previous ones. It means that the sector of construction expands from the old technology rather than altering it entirely. That trend proves that the sector is capable of adapting to industrial advancement (Ofori, 1990).

- **Organisation**: As mentioned earlier, the process of the sector of construction can be viewed as momentary. To be precise, short-term groups can be put in place for a specific project. The short-term group comprises teams of professionals and contractors. Those teams will be broken up when the period of construction ends (Orange *et al.*, 1999; Akintoye *et al.*, 2000; Ofori, 1990) and will move out to other projects of construction (Varnäs *et al.*, 2009). Correspondingly, employees are not to stay at the site of construction forever. They will carry on to other construction projects for new work. The continual change causes a restriction in communication among members of the team as new individuals are familiarised to new projects (Ofori, 1990).

- **Time Lag**: This sector is notoriously known for the delays in time of completion (Goh, 1998; Chinda and Mohamed, 2008). Those postponements are a result of the very nature of the works of construction and its process. The delays on site might occur for various reasons, to name a few, the unpredictability of the weather, the dearth of sufficient labour, deferments in the supply of building resources, the construction design changes and numerous others.
4.5. **Key Players of the Construction Sector**

The sector of construction contains different parts with knowledge that are unique joining forces to execute a project of construction. It is therefore vital to detect those key players to provide an understanding of the connexions among them.

Gould and Joyce (2003) provided the categorisation of the construction team. They had mentioned the focus of each skilled discipline on their respective contribution as well as the relation to other team members of the project. As said by Blayse and Manley (2004), seeing how the sector of construction conveys the service to its consumers and society as a whole is crucial, taking into consideration the various function of each team member. The team could be subdivided into 5 leading groups, which are the builders, the designers, the regulators, the purchasers, and the buildings users.

- **Builder:** Fabricating the output of the sector of construction. In recent time, consist of focus of the managing team and co-ordination of other entities. Contractors, is what they are generally referred as.
- **Designer:** Consist of architects and consultant in engineering of design. They design the construction industry’s products. Conventionally, architects lead the construction project teams.
- **Regulator:** Guarantee that buildings and work of modification complies with the local construction rules. In that way, serious issues such as the safety of finished buildings can be managed.
- **Purchaser:** Financial sponsoring and controlling of cost of construction project. Certain dissatisfaction is guaranteed in the event of the purchasers’ anticipations not fulfilled.
- **User:** Construction projects consumers. The imposition of regulations protects the interest of the user. In recent times, involving users from the start of a construction project has become encouraged to guarantee the full utilisation and benefit of the finished project for its users.

Each one of those groups has precise roles to play and function in the implementation of a project of construction. Proper management and human interaction between all the parties concerned is required of the interrelated web of various players in the industry of construction in the realisation process of the final product.

4.6. **Current Challenges in the Construction Sector**

As the industry of construction of the world improves from the turmoil of the economic recession of the world, it is crucial that the trials that the construction industry’s key players
are facing be acknowledged in order to take actions for the improvement of the state of industry. Reviewing current literature has made known a few of the existing challenges inside the sector; sustainability inclinations in construction along with human resources issues and labour market of construction which additionally demonstrates the necessity for partnership in the industry of construction.

What have resulted in the industry of construction embracing efforts of sustainability in its practices and results, are stresses from the world of business as well as the situation of the global economy. Datta (2000) emphasised on the three fundamental areas that are part of sustainability in the sector of construction: environmental accountability, social mindfulness and economic cost-effectiveness.

Sustainability projects aim to reach satisfaction in the present-day without jeopardising the needs of the coming generations (WCED, 1987). While showing the way forward for the place of sustainability in the industry of construction, Datta (2000) claimed that reaching a place of sustainability in construction demands connecting the needs of the client and mindfulness in ecological concerns and what is considered sustainable process and results in the sector of construction.

On the other side of the effort of the industry in reaching sustainability, multiple works (Helander, 1980; Ofori, 2000; Palalani, 2000) looked at the use of prefabricated constructions or Industrialised Building Systems (IBS) to prompt an increase of sustainability in building projects. However, the adoption of those ways and means have met some reluctance in the industry of construction (Zhou and Lowe, 2003). The hesitancy in the face of the application of those practices could be linked to the client misunderstanding; that misunderstanding could be remedied with the cooperation and participation of the design team, the building professionals as well as the user/customer early on from the conception of the project through partnering contacts.

4.7. The Impact of the Construction Sector on the Global Economic Growth

The construction industry embodies an essential component of economies. In line with the European Construction Industry Federation (FIEC), the sector of construction involved approximately three million companies in the European Union (EU27) in 2008, of which 95% have quite a small workforce (fewer than 20 workers). In 2008, the industry caused 50% of the overall formation of fixed capital and was a major employer, accounting for approximately 8% of the total employment rate (EU27)—about 30% of ‘industrial’ employment (FIEC, 2009).
On top of being a major employer in every economy, the sector of construction holds a sizeable share of the GDP: in 2007, construction contributed about 11% of the GDP in the EU27 (FIEC, 2007).

4.8. MALAYSIA

The industry of construction is one of the most prominent sectors contributing to the economic growth of Malaysia. This industry contributed close to 3.3% of GDP in 2005 and kept around 600,000 people working including 109,000 foreigners (Sambasivan and Soon, 2007). The projects in the Malaysian sector of construction being of big volume and being complex present to numerous organisations in the industry a huge trial and offer an abundance of chances. The Malaysian sector of construction can be subdivided in four large sections: office, retail, residential and infrastructure. The industry went through a momentary crisis from 1997 to 2000 (ASEAN crisis) and it has begun improving.

In spite of its minor input to the Malaysian GDP of 5.7% in 2011 (Abdul-Rahman et al., 2006), the number dropped to 3.5% in the year 2012 and rose a little to 3.7% in 2013 (Shehu et al., 2014). The construction sector of Malaysia has a position of equal status to other sectors, particularly in the fact that it plays the role of a catalyst and offers a multiplier sense to other sectors like manufacturing, professional service and education.

The government of Malaysia is a major players in the development of projects in construction because it offers the nation’s infrastructure (Chan, 2009; Tumi et al., 2009; Nima et al., 2001). That is revealed in the majority of the Federal Government expenses between 2006 and 2009, over the course of which more than ZAR449.6 billion was used by the government under the Ninth Malaysia Plan (9MP), also in the participations from financial stimulus set projects of high value.

4.8.1. Historical Background of the Malaysian Construction Sector

Malaysia is a federal kingdom having a constitution in the Southeast of the Asian continent. The nation is constituted of 13 states and 3 federal regions, with more than 27.5 million habitants. Malaysia is made of 329,847 Km², divided by the South China Sea into two territories of similar size; Peninsular Malaysia (called West Malaysia by the natives) and Malaysian Borneo (called East Malaysia). Kuala Lumpur, Putrajaya, and Selangor are the most inhabited states/federal regions, all located in the central area of Peninsular Malaysia; Penang in the north area; and Johor in the south of Peninsular Malaysia. Kuala Lumpur is the capital of Malaysia, whereas Putrajaya houses the federal government (Latiffi et al., 2013).

In 1957, Malaysia became independent from the British Kingdom. From then on, the sector of construction of Malaysia has grown from a low-tech, workforce centred, craft-based sector to
one capable of delivering remarkable buildings and infrastructure through intensely mechanised methods of production like in the Petronas Twin Towers project, and the Kuala Lumpur International Airport. Consequently, Din et al. (2012) noticed that Malaysia possesses a two-level construction sector when it comes to the company sizes. Generally, the sector is divided into two sections; the bigger companies focusing on metropolitan regions and breaking through the international market, primarily in the Middle East, and the rural building firms, generally regarded as SME companies. Most of the SME organisations in the sector of construction still function traditionally by opting for the utilisation of ineffective methods, time consuming and manpower centred, and their most prominent incentive is just survival (Abdul-Rahman et al., 2012). The varied levels have in some way participated in the issue in the construction sector of Malaysia, because bigger companies having greater ability remain capable of engaging in more complicated projects with higher earnings; predictably adding points to their already extraordinary portfolio. Then again, the SME companies, constituting 90 percent of the whole sector (Din et al., 2012), can only contribute in smaller rural projects with smaller earnings.

Because of the fluctuations in the economy of the world, the sector of construction of Malaysia is frequently influenced by the good and bad facets of progress and wealth. The rising authority of the economies of Far-East Asia has somehow affected the Malaysian country as a result of it being near this country and comparable ethnic origins. Those latest advances have lead the growth in construction procurement organisation of Malaysia (Alaghbari et al., 2007).

4.8.2. Economic Performance of the Malaysian Construction Industry

There was a drop in the amount of infrastructure developments of wide span as a result of the accomplishment of various important projects around 7 years ago, and that is at the same time as the world’s economic move. Subsequently, there was a drop of 29.5 percent in worth as opposed to the ZAR271.7 billion of developments granted during 2008. It is implied that the value drop is a result of private sector investment reducing (San and Heng, 2011).

Nevertheless, the government instigated a number of mega-projects in hopes of stimulating the economy, for instance the Iskandar Region project in Johor valued at ZAR335 Billion.

The overall worth of construction work over the course of the beginning of 2013 grew 13.8 percent to ZAR145.1 billion, with the biggest cut given by civil engineering works, at 36.1 percent. Current infrastructure developments still ongoing and tunnel projects contain the Besraya eastern extension; the Seremban - Gemas - Johor electrified double-tracking project; and, the extension of the Kelana Jaya and Ampang Light Rail Transit (LRT) lines; along with an Express Rail Link (ERL) from KLIA to KLIA2 (Ministry of Finance Malaysia, 2013).
The business life cycle of the sector of construction varies in a predictable manner, which makes it a sector that could be confidently more predictable than other sectors having more variations. Consequently, reviewing the GDP and the growth tendencies of construction over a period of 30 years reveals a trend where the fluctuations of the business cycle that the sector of construction underwent remarkably surpass those that the movement of GDP mentioned (Khan et al., 2014).

Generally, the sector of construction of Malaysia has achieved the impact on its economic growth through the implementation of public infrastructure. As it is a nation moderately industrialised, the Malaysian economy continues to develop and a lot of the current economic movement was because of the government expending on public infrastructure. It demonstrates that the sector as well as the government have an effect on the managing of the performance of the economy.

4.8.3. Background

Considerable public spending has massively encouraged the construction sector of Malaysia to sponsor the building of elementary infrastructure for the enhancement of economic activities and providing of reasonable public housing. Because of a drop in public spending from 2003 to 2004, the value added of the sector of construction decreased by 0.9 percent, 1.8 percent and 0.5 percent in 2004, 2005 and 2006, correspondingly. Near the end of 2007, the Construction Industry Development Board (CIDB) of Malaysia released a master plan of 10 years (CIDB Malaysia, 2007) to be implemented between 2006 and 2015 in order to refocus the strategic position and to chart the sector’s next course. The major element in the strategy was the sector recording a mean yearly growth of just 0.7% over the space of 2000 to 2007 compared to a mean yearly GDP growth of 5.5 percent over the course of the same period. Worries arose about the sector of construction, majorly supporting industrialisation and contributing greatly to the economic development, not executing at its fullest potential and consequently not being capable of facing the twofold challenge of open markets and bigger world competition. Therefore, the master plan was initiated for the establishment of construction sector that is innovative, sustainable, professional, profitable and excellent.

One can count cost as one of the main concerns all through the project management’s life cycle and regard it as one of the project's most significant elements and the conductor of the achievement of a project. Even though it has proven its importance, it happens that a project of construction does not achieve its goals within the stated cost. Cost overrun can be a very common occurrence and can nearly be associated with almost every project in the industry (Jaafar et al., 2007). The issue of cost overruns seems grave there is a need for studying it more in order to lighten this matter in the coming years. They also reveal cost overruns as
being a serious issue in growing as well as developed nations (Ali, 2006). The tendency is more intense in emerging nations where those overruns occasionally surpasses 100% of the predicted project cost. Several elements influence the cost of construction and numerous research have been led hoping to report on these elements. Resources of low quality bring about building costs more elevated than projected as material is lost during construction. That emanates from the absence of standards for resources and managing structures. The inability to avoid cost overruns or to manage building costs results in the failure of many construction firms (Chong and Rosli, 2009).

A research into the time-delays and cost rise in the building of private residential projects in Kuwait demonstrated the quantity of delays and cost-rises as being higher when the overall cost of a residential project was greater. One of the main contributions to the time-delay and cost-increase was the shortage of money and time set aside for the designing stage. The three major reasons behind time-delays were, in order, the number of order changes, financial restrictions and lack of skill of the owners in construction. The three reasons behind cost overruns alternatively were, in order, issues related to contractor and resources and, again, financial restrictions (Bakar et al., 2011).

Modifications in the design, insufficient planning, irregular weather and variations in the cost of construction supplies are the usual elements resulting in cost overruns (Kong and Gray, 2006). In Ghana, there was a study conducted on the twenty-six factors that result in cost overruns in ground water projects. Contractors and consultants stated that the difficulty in periodic payments was the major factor causing cost overruns, while owners ranked poor management as being the main factor. In spite of the dissimilarity in opinions between the three parties studied, they agree on the way they rank the factors. The total results of ranking show the three parties feeling that the main elements capable of causing excessive cost overruns in the groundwater project of emerging nations are the following: poor contractor management, difficulty in monthly payment, procurement of materials, low technical performance, and rise of resource prices (Goh and Abdul-Rahman, 2013).

4.8.4. Malaysian Systems of Procurement

The current systems of procurement of most of the emerging nations came from the countries that colonised them (Ofori, 2007; Shu Hui et al., 2011). Such as Malaysia getting the system of procurement from England (Salleh et al., 2006). Previously, both the public and private sectors made use of the traditional system of procurement to carry out projects. Starting in the 1990s, Malaysians embraced a different system of procurement to handle the rising number of implemented projects, the complex construction requirements and mega infrastructure projects in support of the nation’s development (Hashim et al., 2006). The institution of new
‘fast-tracking’ systems of procurement is the industry trying to provide superior offers to its customers, as they are increasingly more aware of the significance of ‘value for money’ for their plans in terms of cost, time, and quality. D&B, BOT and PMC are the different techniques of procurement said to be ‘fast tracking’. Nevertheless, the PMCs, supervising and handling a big number of government projects, failed in controlling costs, designing and establishing the projects’ scope, which brought about higher costs (Yusoff et al., 2010). Abdul Rashid et al. (2006) stated in 2003 that the Ministry of Works showed that a few public projects that few PMCs managed failed in completing within the appointed time and the most awful result of this technique was the low quality workmanship (Adham and Siwar, 2012; Abu Hassim et al., 2010). The projects’ lack of success have caused a delusion in the advantages of PMCs to the sector of construction throughout the whole nation.

Usually, three kinds of systems of procurement exist and are embraced by the industry of construction of Malaysia: the Traditional/Conventional system, the Design and Build system and the Management system (Cheong Yong and Mustaffa, 2012; Abdul Rashid, et. al., 2006; Adham and Siwar, 2012; Kaliannan and Awang, 2008; Rose et al., 2009). However, a fourth system, called Relational (sometimes called ‘Modern’) system, covering present-day techniques like Alliancing and Private Finance Initiatives (Hashim et al., 2006) appears to be the ‘new thing’ particularly for large and special projects such as hospitals and tertiary education facilities. Hashim, et al, (2006) discovered that both Malaysian client sectors are presently making use of the conventional system of procurement as opposed to other kinds of procurement.

As is the case of other nations, the sector of construction of Malaysia keeps facing numerous issues that are a threat to its growth and impede its sustainability if not discussed and correctly handled. The industry of construction remains an essential element in the economy of the country, by solidifying and supporting other industries, while fulfilling the basic requirements of the infrastructure and simultaneously assisting social projects. A few dominant elements, especially those related to productivity, quality, time and cost, have generated major difficulties for the development of the Malaysian sector of construction (Kassim and Hussin, 2013; Alaghbari et al., 2007; Thanh Luu and Eng Chen, 2003; Abdul Rashid et.al, 2006). For instance, Kassim and Hussin (2013), Alaghbari et al. (2007), and Abdul Rashid et al (2006) highlighted that some of the projects are not efficient in ‘cost’, ‘time’ and ‘quality’. The Director General of Public Works Department in Malaysia at the time, Anuar Othman et al. (2006) debated that the sector of construction of Malaysia is not much different from the 1960s as far as the building technology is concerned regardless of the incredible rates of growth that the economic reports presented. CIDB (2009) sustained the results mentioned above as it quoted
that the sector of construction in Malaysia generates low profit and restricts capital for training, research and development.

4.9. AUSTRALIA

4.9.1. Australia’s Economy

As a nation evolved traditionally, the economy of Australia has a major position in the Pacific Asian zone; one could even say the world. The Australian economy ranked third as the freest in the 2013 Index of Economic Freedom (Tyers, 2015). Australia ranked twelfth as the largest economy in the world and ranked fifth for the highest GDP per capita (nominal) and it is second in Human Development Index of the UN 2011 and highest in Legatum’s 2008 Prosperity Index (Bulkeley, 2001). Furthermore, all of the main Australian cities scored well in global examinations comparing liveability. For instance, Melbourne ranked first in 2011 on the lists of the world’s most liveable cities by The Economist, second came Sydney, Perth, and Adelaide ranked sixth, eighth, and ninth place correspondingly (Carson, 2011).

4.9.2. Historical Background of the Australian Construction Industry

The sector contributed close to 8% of the workforce and 5.5% of the GDP between 1999 and 2000. The influence it has on the overall economy goes way beyond the simple buildings erected as it is connected to various industries especially because of the quantity and different types of individuals concerned directly or indirectly. The industry of construction is seen as being a critical driver of productivity for the Australian economic development (Lingard and Francis, 2004).

4.9.3. Australia’s Construction Industry and Market

The sector of construction of Australia functions in the private as well as the public sectors and constitutes of two subsections – general building and building trade services (McGrath-Champ et al., 2011). General building consists of three broad areas:

- Residential (houses, flats, etc.),
- Non-residential (offices, shops, hotels, etc.), and
- Engineering buildings (airports, bridges, water and sewerage, highways, etc.).

The private sector has the lead in the residential construction. The private as well the public sectors take on non-residential building and engineering construction. The public sector has an important position particularly for the health and education related activities. Some important public infrastructure endeavours are delivered progressively by the collaborations
between the private and the public (McGrath-Champ et al., 2011). Building trade services are composed of five groups:

- Preparing services
- Construction structure services
- Installing job services
- Construction completion services and
- Other building services

### 4.9.4. Economic Performance of the Australian Construction Industry

The sector of construction of Australia has an essential place in the Australian economy. The sector of construction ranked fourth as the biggest provider to the GDP in the economy of Australia between 2008 and 2009 at contemporary price terms, and holds an important position in the determination of the economic growth. In terms of chain volume, the sector of construction contributed to 6.8% of GDP between 2008 and 2009 (Borys, 2012). The sector of construction also offers infrastructure to different industries, such as:

(a) Some of the manufacturing, wholesalers and retails as well as finance sectors, by the supply of parts, fittings and furnishings, and in funding the building and construction,
(b) Some of the professional service industries, for example the architectural and engineering jobs for planning and techniques of erection adopting both established and innovative technologies and products.

In the May quarter of 2009, the sector of construction utilised 984,100 individuals, which constitutes 9.1% of the labour force of Australia, becoming the fourth biggest industry of Australia (Loosemore and Galea, 2008).

Australia’s sector of construction also accomplished outstanding successes and growth in the national as well as the international markets in the past few years. Table 4.1 gives different key pointers of the sector of construction of Australia. The gross value added of Australia’s construction sector increased from ZAR 560660 million between 2001 and 2002 to ZAR 928237 between 2008 and 2009. After a slight decrease between 2009 and 2010, the gross value added of Australia’s construction sector got to ZAR 977419 between 2010 and 2011. The mean increase level of Australia’s construction sector between 2001-02 and 2010-11 was 6.45% (Australia, 2010).
Table 4.1. Key indicators of the Australian construction industry (Australia, 2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross Value Added ZARm</th>
<th>No. of firms</th>
<th>Operating profit before tax ZARm</th>
<th>Margin rate</th>
<th>Employee (000) (quarter average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-2002</td>
<td>560660</td>
<td>344561</td>
<td>105805</td>
<td>9.3</td>
<td>670.4</td>
</tr>
<tr>
<td>2002-2003</td>
<td>654323</td>
<td>339982</td>
<td>123195</td>
<td>9.5</td>
<td>692.95</td>
</tr>
<tr>
<td>2003-2004</td>
<td>696147</td>
<td>365781</td>
<td>150108</td>
<td>10.1</td>
<td>717.65</td>
</tr>
<tr>
<td>2004-2005</td>
<td>728336</td>
<td>383517</td>
<td>159481</td>
<td>9.9</td>
<td>773.7</td>
</tr>
<tr>
<td>2005-2006</td>
<td>786070</td>
<td>407188</td>
<td>183549</td>
<td>9.9</td>
<td>832.85</td>
</tr>
<tr>
<td>2006-2007</td>
<td>834838</td>
<td>316029</td>
<td>313526</td>
<td>14.3</td>
<td>877.575</td>
</tr>
<tr>
<td>2007-2008</td>
<td>886450</td>
<td>323071</td>
<td>230865</td>
<td>9.7</td>
<td>943.3</td>
</tr>
<tr>
<td>2008-2009</td>
<td>928237</td>
<td>273276</td>
<td>219298</td>
<td>8.9</td>
<td>971.5</td>
</tr>
<tr>
<td>2009-2010</td>
<td>925920</td>
<td>238530</td>
<td>335493</td>
<td>12.6</td>
<td>1001.725</td>
</tr>
<tr>
<td>2010-2011</td>
<td>977419</td>
<td>213352</td>
<td>286302</td>
<td>10.2</td>
<td>1003.75</td>
</tr>
</tbody>
</table>

4.9.5. Factors Affecting the Australian Construction Sector

There are eight main presently active and strength-having factors:

1. Better processes and culture led by the industry;
2. Financial resources and investor confidence;
3. Human skills and culture of transparency;
4. Governmental rules and approaches that support the construction business;
5. Research and growth for construction;
6. Construction culture that relies on itself;
7. Institutional support;
8. Aid agencies supportive attitudes.

In the development of the sector of construction, there exists six main elements essential in the future:

1. Long-term vision and policy for the industry;
2. Basic resources and infrastructure (physical and institutional);
3. Financial and human resources;
4. Thinking positively and behaving positively (a culture of better practice);
5. A culture of learning;
6. Methods and technologies that support high production performance.
After the comparison between the factors of current strength and the six factors important in future, the major dissimilarity is located in the zone of leadership and the sector’s image. It is essential to insist that for the future growth of the sector, there must be a solid vision strengthened by a logical strategy (Jefferies et al., 2002).

4.10. Conclusion

This chapter presented a review of the literature concerning the Malaysian and Australian construction industries. The chapter further provided an overview of the problems faced by the industries in each of these countries. The following chapter will review the literature relating to two countries from the African continent, their construction industry, as well as problems they face.
CHAPTER 5 CONSTRUCTION INDUSTRY FROM AFRICAN CASE

This chapter will review the literature regarding two African countries: Angola and Tanzania. This chapter will start by providing an overview of each country; each country’s construction industry will then be reviewed as well as the problems and challenges faced by both the Ghanaian and Nigerian construction industries, and lastly the lessons that can be learnt from these construction industries will be identified.

5.1. Introduction

The sector of construction is known as a part of the economy that converts numerous materials into built physical economic and social infrastructure essential to the socioeconomic growth (Lopes, 1998). It adopts the process by which the said physical infrastructure are planned, designed, procured, built or produced, modified, fixed, sustained, and destroyed. The built infrastructure in line with the rules comprises buildings, systems of transport and services such as airports, docks, freeways, tunnels, bridges, railways, systems of transit, pipelines and transmission and electricity lines, structures for the containment of liquids, control and distribution such as treatment of water and systems of distribution, sedimentation lagoons, barrages, irrigation and canal systems and underground structures, such as tunnels and mines (Ugwu and Haupt, 2007).

The sector of construction comprises an essential portion of the output of the country of developed as well as emerging countries, as it is evident by seeing the account statistics of any nation. It also holds an important position in the satisfaction of a large variety of physical, economic and social requirements, counting shelter and creating jobs. Because of its amazing ability to adjust to various framework situations, the activities in the sector of construction can relatively centre itself on capital according to the accessible resources and goals of the country (Baloyi and Bekker, 2011).

The sector of construction is also a land of opportunity for the collaboration among nations- another crucial matter in the development plans. As Adebayo (2002) highlighted, the size of the sector, the type of operations, and the fact that it is present in every developmental action cause it to be an appealing region for transferring, adapting, and developing technologies in line with the goals of developmental of developing countries.

5.2. Overview of the African Construction Sector

In the past, the sector of construction was linked to the economic process of growth and development. A country’s economic development can be seen as a consistent rise of its people and product per capita. The increase in people demands more products "that permit us to feed, clothe, and shelter ourselves- the structures in which our goods are produced and
stored, over which goods are shipped to market, and in which goods are consumed" (Goldman, 2003). The rise in per capita and the rise per product are linked to the industry of construction in that numerous sector of construction activities offer the amenities needed for the development of different industries in the country’s economy. In addition, the industry of construction has straight connections to the industry of manufacturing: the major ally of the industry of construction in the economic growth and development process.

While the immediate impact of construction on the economic growth is considerable, it also participates in the elementary goals of development such as creating jobs, generating income and re-distributing. The level of balance of the growth and job creation is largely dependent on technical, economic and social situations. The industry could have a major place in the resolution of this struggle, as it is technologically flexible, meaning that the majority of its operations can be relatively centred on labour according to technical circumstances and accessible supplies in the nation at the time (Windapo, 2016).

Numerous authors (Bowen et al., 2007; Muya et al., 2006; Bon, 1992) have discussed the position of construction in the economic growth and development. An important function derived from those studies is the general adoption of the idea that is directly linked to the output levels of the industry of construction on the economic stage of a nation’s development. Additionally, in the same note, construction as an essential element of the capital generation of a nation holds a significant position in the economic growth system. Bon (1992) sees that the products of construction in the majority of advanced industrial countries (AICs) will drop totally sooner or later, not just somewhat, according to the common habit of the industry of manufacturing in the growth process.

5.3. ANGOLA

Angola is an independent republic. It is bound north and northeast by the Democratic Republic of Congo (formerly Zaire) and by Zambia, on the south by Namibia and on the west by the Atlantic Ocean.

The economy of Angola is in disorder due to twenty-five years of almost constant fighting. In spite of its rich natural assets, the output is counted amongst the lowest in the world. Violence continues and millions of landmines remain (Agadjanian and Prata, 2002).

For its economy to take a new turn, amongst other moves, Angola will have to cease its struggle and keep restructuring government’s procedures. In spite of the drop in warfare during 1998, the economy has grown by a valued 5% in 2000 (De Oliveira, 2007). Constant development rests on intense reductions in inflation, more economic improvement and decreased fighting.
5.3.1. Angola’s Economy

The system of Angola’s finances has recently gone through a chain of restructurings for the liberalisation and privatisation of the system of finance managed before by the state. The World Bank and IMF have had an important place in the introduction of changes in the financial sector by the Financial Institutions Modernization project (1992 to 2002), whereas the sectors of banking as well as insurance got relaxed and different methods of regulation and supervision were installed (Dos Santos, 1990).

The Central Bank of Angola, which was formerly one of the two main banking institutions in Angola, was renamed Banco Nacional de Angola (BNA). Its key goal is ensuring the sustainability of the national money’s value. Furthermore, it holds the right of supervision over financial organisations, controlling their liquidity as well as their solvency, and maintaining their deposit accounts under terms and conditions decided by the Board of Directors before liberalising, the banking industry had banking institutions owned by the state. The industry has since grown, now including 13 commercial banks, with two owned by Portugal. A different law suggested for the industry is set to expand the range of the financial tasks of the banking institutions and significantly augment the sector’s appeal to investors from outside the country. Angola is currently seen as a leading developing market in Africa, causing a rise in awareness from banking institutions from outside the country wanting access to the markets of Angola. Various banking institutions from Portugal and South Africa have planted new subdivisions in Angola. In midyear 2005, the full assets of the banking sector attained USD 4.6 billion (USD 3 billion in deposits), up from USD 3.5 billion in 2004 (Cilliers and Dietrich, 2000).

There is presently no Angolan stock exchange. Nevertheless, a Financial Markets law was passed which envisions the first institution of the Angolan Stock Exchange. Once opened, the exchange could make approximately a billion USD in tax revenue each year and would begin with an original contribution of ten organisations with a cumulated market capitalisation of approximately 5.5 billion USD. When it functions, international and domestic investors will have the same access to the listed shares (Sogge, 2009).

Also based on the report, capital and money market transactions, capital repatriation and personal capital movements are bound by firm controls. Those trades usually demand authorisation and/or licensing by the central bank. It is envisaged, nevertheless, that creating a stock exchange in the near future will give international investors same access to listed securities (Ferreira, 2006).
5.3.2. Historical background of the Angolan Construction Sector

The biggest customer in Angola’s sector is the government. At the end of the twenty-seven years of civil war and after the return of peace, Angola is now reconstructing. Because of the war that left no institutions and no opportunity for commercial trade along with over a third of the people of Angola who have run away from the land, the government of Angola is evidently incapable of insuring the rebuilding of the nation on its own. The absence of appropriate skills, no money in the public treasure as well as no appropriate establishments to set or not set policies, only represent a few of the issues it has face (Corkin, 2012).

The latest explosion in its oil industry has brought investors in the nation and for more money than produced by the state in the public treasure. Even though the oil industry has made of Angola one of the biggest African nation producing oil, it was not capable of helping Angola in its reconstruction and helping provide what the people of Angola truly need every day. That is the reason behind it seeking assistance from international financial institutions.

However, that assistance being conditional has rendered the desired fund unable to reach the state as fast as it needed. That explains why the funding from the government of China was seen with a positive outlook. These funds from China are available to the government of Angola with no conditions and at an extremely low interest rate, the only condition being that they get the permission of exploiting oil from the state of Angola. To the government of Angola, this can be known as a ‘cheap loan’. The PRC-given loan is then added to the loans given by the foreign institutions as well as those given by nations such as Portugal.

The government of Angola is dedicated to the reconstruction of its nation as quickly as possible. When it is about services such as construction, there is no alternative. Even with a high cost for obtaining such services, it is impossible for the government of Angola to move from the services offered by the companies to other services. Prior to the introduction of construction companies from China, Angola’s bargain power was noticeably restricted to the availability of their funds and they did not have much of a choice due to the arrangements they had with the donors along with the conditions by the international financial organisations. But the introduction companies from China have augmented the bargain power of the state over the other international companies, possible due to the competitive price advantage the Chinese companies have over other international organisations as well as the partnership between China and Angola.

5.3.3. Angolan Construction Industry and Market

Corkin and Burke’s (2006) research demonstrates that the Angolan state has just come out of the twenty-seven year civil war. The virtual political steadiness, which came after the signing
of the peace accord in 2002, has heightened the prospective for the Angolan economic growth course. As stated by the authors, the introduction of China's construction firms in the Angolan state has indicated a period of fast infrastructural restoration and consequently a rise in GDP in the industry of construction.

Corkin and Burke (2006) state that before introducing China’s construction firms near the end of 2004, the Angolan industry of construction was controlled by Portuguese, Brazilian and South African businesses. They are the original participants in the Angolan construction market.

The authors described the presence of organisations from Portugal and Brazil among major players in the industry of construction as the outcomes of the common colonial history between the Portuguese and the Brazilian states along with the quantity of loan offered by those nations to the Angolan state.

This was done with the awareness that the loans would be utilised for contracting construction companies from Portugal or Brazil (Corkin & Burke, 2006). But China entering into the construction market of Angola, has to some extent moved the original commercial interests of those two nations, and this was doable due to the broad assistance given by the PRC (People Republic of China) government (Corkin & Burke, 2006). However, when construction firms from China are correctly installed, the only major rivalry they encounter is from each other. In different terms, this can be seen as the competition among Chinese companies.
5.4. **TANZANIA**

Tanzania became a sovereign state, independent from England’s colonial rule, in December 1961. Its name was Tanganyika until 1964 when it was given another name, ‘the United Republic of Tanzania’, after the unification of Tanganyika-Mainland and Zanzibar-Island. Attaining its independence, the new government planned to remove the colonial heritage, an action that started in the years before the independence under the political party TANU, which was in 1954 led by Mwalimu Julius K. Nyerere, Tanzania’s first president (Koponen, 1988).

5.4.1. **Historical Background of the Tanzanian Construction Sector**

The sector of construction in Tanzania, as it is in other nations, is one of the main industries of the economy. The sector contributes over 50% of the capital formation, 6% of the GDP and 9% of jobs (Debrah and Ofori, 2005). Unsurprisingly, the sector infiltrates all industries of the economy for example manufacturing, farming, schooling, etc., thus encouraging their development.

The sector constitutes of organisations, companies, firms and individuals working as consultants, main contractors and sub-contractors, material and component suppliers, plant and equipment providers, builders and merchants. The government is engaged in the sector mostly as a customer, funder and regulator (Debrah and Ofori, 2005).

5.4.2. **Characteristics of the Industry**

The Tanzanian sector compared to advanced nations is small, categorised by high extent of activities centred on the workforce on building sites. An essential part of the work in construction occurs in the informal area of the sector. Around 80% of the people live in the countryside (Debrah and Ofori, 2005). The constructions and other small infrastructure facilities for this majority of the population, are built by the informal sector. The informal building sector contains unregulated and unprotected people involved in economic operations, which comprise the supply of workforce, resources and building parts to the formal building sector directly responding to customers’ demands. It also contains jobs performed by people and groups on a self-help basis without any contracts.

Most of the contracting firms in the Tanzanian sector of construction are small with some of them being in the medium category as reflected in Table 5.1. The table demonstrates that 80% of the 1837 registered local building firms in 2007 were small firms, 17% were medium and only 3% were big firms. As stated by the Contractors Registration Board (CRB), small companies are the ones registered in class six and seven, medium companies are the ones registered in class four and five and big companies are the ones registered in class one, two and three.
Table 5.1 Number of registered Building Contractors in Tanzania (Mlinga and Wells, 2002)

<table>
<thead>
<tr>
<th>Class</th>
<th>Local</th>
<th>Foreign</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>33</td>
<td>26</td>
<td>59</td>
</tr>
<tr>
<td>Two</td>
<td>15</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Three</td>
<td>13</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Four</td>
<td>66</td>
<td>0</td>
<td>66</td>
</tr>
<tr>
<td>Five</td>
<td>241</td>
<td>0</td>
<td>241</td>
</tr>
<tr>
<td>Six</td>
<td>245</td>
<td>0</td>
<td>245</td>
</tr>
<tr>
<td>Seven</td>
<td>1224</td>
<td>0</td>
<td>1224</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1837</td>
<td>26</td>
<td>1863</td>
</tr>
</tbody>
</table>

5.4.3. Tanzanian Construction Industry and Market

Various economic meters could be utilised for measuring the participation of the sector of construction to the economy of the country. According to Wells and Wall (2003), Mlinga and Wells (2002), Chileshe and Kikwasi (2014) and Burke (2007), the most usual indicators are the amount of workforce hired by the sector and the input to the GDP and the Gross Fixed Capital Formation (GFCF).

The GDP is the overall worth of all the products and services created by one nation (Hillebrandt, 2000). The UNCHS (1984) and the World Bank (1991) submitted that the finished product of the industry of construction as a fraction share of the GDP is habitually ranging between three and eight percent, even though significant variations happen among different nations. As said by Muhegi and Malongo (2004), the input of the construction sector to the GDP signifies the value added by the sector or the net construction product, which is the total value of construction output minus the value of the material input and the depreciation of plant and equipment.

5.5. Conclusion

This chapter has reviewed the construction industry of two African countries, Angola and Tanzania, and the problems and challenges they face in terms of the performance of their construction sectors. The following chapter will review the literature on South Africa, its economy and its construction industry.
CHAPTER 6 CONSTRUCTION INDUSTRY: SOUTH AFRICAN CASE

The chapter reviews the literature concerning the sector of construction of South Africa, its structure as well as its importance. Additionally, the chapter will discuss the impact of the industry on the South African economy.

6.1. Introduction

The sector of construction in South Africa was marked for progress and growth from early 1993. The sector was expected to hold an essential place in the nation’s socioeconomic growth (Ugwu and Haupt, 2007). In conjunction with stable growth in the sector of construction from 1999 to 2008 and with the positive submission for hosting the 2010 FIFA Soccer World Cup, this expectation was satisfied. As the Reserve Bank of South Africa stated, the gross value cumulated at basic costs of construction is rising each year (South African Reserve Bank, 2014), an optimistic indication for the South African sector of construction.

The position of the South African sector of construction is made up of two extremes. On one side, the sector could not be more dynamic, sliding from the 2010 FIFA Soccer World Cup the sector has lingering motion and it looks promising. On the other, it looks less promising following a drop to 55 points in the construction confidence directory in the three months starting 2014 from a good look of 66 points when 2013 was closing (Ibem and Laryea, 2015). The so-called “middle ground” for the directory is 50 points (Lopes, 1998). That middle ground was attained between July and September 2014, largely as a result of an increase in joblessness and stresses on cost-effectiveness (Ibem and Laryea, 2015). The quarterly in-house research of StatsSA’s workforce pointed to a major loss of work in the industry of approximately 17 000 positions between April and June 2014, with the total construction employment of 1 182 000 positions over the same period, approximately representing 8% of the South African total (StatsSA, 2014).

6.2. Overview of the South African Construction Sector

6.2.1. Structure of the Sector

Table 6.1 shows the divisions of construction firms per economic sector. The table points out that building firms in grades 2 to 4 are small building organisations with a maximum contract amount of four million Rand (R4m) and less. Their managing ability varies between very poor and fair. Those are informal as well as formal building firms. The table further shows that building companies in grades 5 to 6 are considered medium building organisations with a maximum contract amount of thirteen million Rand (R13m) and managing ability levels ranging from good to very good. Those between grades 7 and 8 are considered large companies having a maximum contract amount of one hundred and thirty million Rand (R130m).
Companies in grade 9 are also seen as large organisations having no limits in their contract value. They can handle any construction projects.

Table 6.1 Divisions of building firms per economic sector (Dlungwana et al.;2002)

<table>
<thead>
<tr>
<th>Cidb Grade</th>
<th>Category</th>
<th>Economic Sector</th>
<th>Maximum Contract Value considered of handling</th>
<th>Management Skills level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4</td>
<td>Small</td>
<td>Formal/informal</td>
<td>Less than R650,000-R4M</td>
<td>Very Poor &amp; Fair</td>
</tr>
<tr>
<td>5-6</td>
<td>Medium</td>
<td>Formal/informal</td>
<td>R6.5M-R13M</td>
<td>Poor, Fair, Good &amp; Very good</td>
</tr>
<tr>
<td>7-8</td>
<td>Large</td>
<td>Formal</td>
<td>Above R40M-R130M</td>
<td>Fair, Good &amp; Very good</td>
</tr>
<tr>
<td>9</td>
<td>Large</td>
<td>Formal</td>
<td>No Limit</td>
<td>Good and Very Good</td>
</tr>
</tbody>
</table>

Table 6.2 and Figure 6.1 demonstrate the structure of the sector of construction in South Africa in terms of distributing number of contracts per grade and public sector grants by value.

Table 6.2 Distribution of number of contractors by grade and public sector awards and by value (Windapo and Cattell, 2013)

<table>
<thead>
<tr>
<th>Grade</th>
<th>No. of contractors on the cidb register</th>
<th>Public sector awards by value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Building</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>9</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>7&amp;8</td>
<td>279</td>
<td>310</td>
</tr>
<tr>
<td>5&amp;6</td>
<td>1033</td>
<td>1173</td>
</tr>
<tr>
<td>2-4</td>
<td>3501</td>
<td>2853</td>
</tr>
<tr>
<td>Total</td>
<td>4853</td>
<td>4386</td>
</tr>
</tbody>
</table>
Figure 6.1 Distribution of number of contractors by grade and public sector awards and by value (Windapo and Cattell, 2013)

The sector of construction also consists of intricate sectors of operations behaving like supply chains, which includes numerous members functioning from different parts in and out of the sector (Merrifield, 2000). Those supply chains consist of the professional services sector; contracting sector; public sector; finance and funding sector; resource production and supply sector; and machinery maker, supply and hire sector. Figure 6.2 illustratively represents the sectors of the supply chain in the industry.
6.2.2. Importance of the Construction Sector

The sector of construction can be considered a large selection of industries and sectors adding value by creating and maintaining the fixed properties in the built environment (Bowen et al., 2007). It can also be defined as an establishment developing and maintaining the built environment (Nicholas et al., 2007) and exhibiting technological connexions and transfer of information from one sector to another in the industry (Othman, 2012). The sector of construction assists customers in realising better value for money, for results achieved by construction companies by improving of local building firms (Ofori, 2000). It acts as a mainstay of the local economy in any nation (Nkado and Meyer, 2001) and as the government’s arm of regulation the facilitation or slowing down of economic activities (Ebohon and Rwelamila, 2001). It is also considered an industry offering services that bring about construction outputs. It includes initiation, design, building, occupation or operation and demolition stages. It is a highly risky, low profitable industry and has a reputation for a lot of client dissatisfaction (Thwala and Phaladi, 2009). Same opinions shared by Thwala and Phaladi (2009) are that the sector of construction is at risk as a result of political, legal, financial and cultural complexities. Loushine et al. (2006) calls it an institution of design and build.

Loushine’s et al. (2006) definition as well highlights construction activities against design. A broader definition of the industry of construction offers a universal perspective as one dealing with new structures and alteration, extension, refurbishment, maintenance, repair and
demolition of existing constructions. Structures as labelled by Lizarralde and Massyn (2008) are said to be housing buildings, commercial or social buildings, streets, civil works and industrial facilities. It is evident based on all the definitions mentioned, that the sector of construction reaches various aspects of human life and adds to them (Smallwood, 1998). The former points out that the sector of construction is an essential element of the economy and has numerous back and forth connexions to other industries.

The sector of construction hypothetically participates greatly to socioeconomic growth and work (Adebayo, 2002; Giang and Pheng, 2011). It is an essential gauge for economic actions and the government often utilise it for the stimulation of evolution or assistance in economic recuperation from recession. Additionally, it gives an opportunity for contractors to compete (Chinyio and Olomolaiye, 2009).

6.2.3. The Impact of Construction Industry on the South African Economic Growth

The sector of construction contributes greatly to the GDP in any nation and its participation is a reflection of the size of the sector. Along with Bohlmann and Van Heerden (2008) statement, the industry participates massively to the GDP, forming of capital and jobs. Allmers and Maennig (2009), speculate that the sector of construction's performance via building firms solidifies the socioeconomic growth of countries. The industry is estimated to contribute 8 to 14% based on Bowen, Edwards and Cattell (2012), showing that the sector of construction has an essential place in the economy. One research performed by the World Bank (1994) set that the enlargement of infrastructure and production services within the sector of construction also boosts economic development. The participation to the GDP by the involving construction through the delivery of infrastructure alone has been measured at 3 to 5% for emerging nations and 5 to 8% for more advanced nations (Mbachu and Nkado, 2007; Giang & Pheng, 2011; Mathonsi and Thwala, 2012).

The sector of construction is considered the leader and a boost to any economy (Abor and Quartey, 2010). Its production level has a big impact on the economic development of the country (Chia, Skitmore, Runeson & Bridge, 2010). Rashid & Morledge's (1998) study of the economy and construction sector of Malaysia showed that economic development is directly proportionate to the rate of rise in employment. A report by the Ministry of Finance of Malaysia specifies the rise in construction GDP between 1988 and 1996. It shows that the sector of construction utilised a growing number of individuals, in so doing enhancing the national employment and the national economic development. The sector of construction drives the socioeconomic development in emerging countries through the creation of employment by activities related to construction and further boosts the development of other industries such as infrastructure supply (Mlinga & Wells, 2002). Chia, Skitmore, Runeson & Bridge, (2010)
have, nevertheless, claimed that the sector of construction in the majority of emerging nations has a reputation for mediocre performance.

6.3. South African Economy

6.3.1. Historical Background of the Construction Industry of South Africa

South Africa is one of the world’s newest democracies, resulting in gender and racial disparity. Following the battling against discrimination and racial separation, that is to say apartheid, the nation was in its twenty-first year of democracy (Balogun et al., 2016). Nevertheless, the impact of apartheid is still present in the sector of construction; it is the same for every industry after apartheid. Attempting to fix the disparities of the previous times, the government of South Africa enforced the Black Economic Empowerment Act (BEE) giving economic freedom to formerly deprived ethnic groups that was not available to them in the past (Mukuka et al., 2015). The BEE legislation executed processes allowing special skills growth, proprietorship, job preference and special procurement to those formerly deprived groups of people. Organisations were in the obligation of employing a particular percentage of particular demographics, despite their educations or capability. For that, BEE has become one of South Africa’s most disputed idioms today (Skeepers and Mbohwa, 2015). The concept of BEE is the redistribution of properties, wealth and economic opportunity trying to make the nation’s economy more evocative of the racial demographics and to encourage economic development. The ones not abiding by these rules risk jail time of a maximum of ten years (Bowen et al., 2012).

Enforced in 2003 and inundated by bribery and fraudulence as stated by a full piece written by Southall (2004), the programme received criticism for only favouring certain formerly deprived groups and was subsequently substituted in 2007 by a programme named Broad-Based Black Economic Empowerment (B-BBEE) (Southall, 2004). While under BEE, only a small number of formerly deprived persons gained immensely, the concept of B-BBEE is the distribution of wealth, not just to some people but instead to a large selection of formerly deprived members of society. Summarily, in the space of approximately 15 years, organisations owned by black people have flourished exponentially and have made themselves key participants in the sector of construction with around R600-billion exchanged in BEE transactions since 1995 (Ibem and Laryea, 2015). The issue unfortunately is that a lot (and some go as far as say the large majority) of those organisations not well prepared to perform the works that they bid for. A major issue is the fact that this push for economic egalitarianism and distribution of wealth, by the empowerment of the formerly deprived and disadvantaging the formerly empowered, has resulted in a case where experienced people have been evicted from their jobs for people with no experience under the BEE act;
consequently segregating against some sectors and demographic groups from the economy, according to Emuze and Adlam (2013).

6.3.2. Contribution of the Construction Sector of South Africa

According to global trends, the sector of construction of South Africa is a significant participant to the GDP and employment of the nation. South Africa’s sector of construction accounted for 5.1% of the GDP in 2002; building activities themselves valued at R45.4 billion (about US $7.5 billion) (Oyekunle et al., 2013). The sector of construction accounts for approximately 35% of the Gross Domestic Fixed Investment (GDFI); current forecasts of future infrastructure needs show that its participation to the GDFI might be twice the value in five to ten years (Ogwueleka and Maritz, 2013). South Africa’s structure of the sector of construction causes it to be an economic sector centred on the labour. That is due to South Africa’s construction sector including a high quantity of SMMEs and SMEs. Even though 60% of the sector is made of micro, small and medium companies (Ntuli and Allopi, 2013), SMEs have the tendency to be more centred on the workforce than large companies do (Moloi, 2013). Hence, when SMEs have the chance to develop, there is job creation, rise in the economy and promotion of social equity (Agumba, 2006). A solid construction sector promotes national employment directly.

Additionally, present circumstances in the country offer chances for substantial development in the industry of construction. The country’s scarcity of houses suggests a major scope for future employment generation in the industry (Ntuli and Allopi, 2013). The sector of construction offers the physical infrastructure fundamental to the growth of a nation and its projects have an impact on the lives of all the habitants of South Africa (Oyekunle et al., 2013). The government of South Africa considers the sector of construction a national strength needing to be developed and sustained (Windapo, 2014).

6.3.3. Economic Performance of the South African Construction Industry

An article released on the SA Commercial Property News website between July and September 2014 stated that there is a suggestion that the JSE’s Construction and Materials Index point at an industry that is struggling. The industry is said to be in trouble, due to slow economic development along with a slowdown in government using within the multi-trillion rand infrastructure plan (Tucker et al., 2015). This article clarifies that building firms are about to face a few hard years as incomes are predicted to drop, along with handling careful stock investors, with key participants in the sector of construction like Basil Read having a mediocre yearly headline earnings-per-share. The industry did nonetheless exhibit a growth in the region of Asia-Pacific, because of the demand for natural resources dominating from the avid economy of China that caused major growth of gas as well as oil projects in this area.
6.3.4. The South African Construction Industry Development Board (CIDB) Grading Criteria

The grading of contractors is usually defined as the process of inspecting, qualifying and categorising building service provider according to their skills, reliability and responsibility and as a measuring criteria of contractors’ capacities. It consequently gets rid of incompetent, underfunded and inexperienced contractors (Aigbavboa and Thwala, 2014; Haupt and Fester, 2012; Ratshisusu, 2014).

The South African CIDB grades contractors according to their financial capacity and work capability. Financial capacity implies the financial past (gross revenue) of the contractor and the value of the working capital or available capital that the contractor can either utilise to lock a contract or fund a project (Tshivhase and Worku, 2013) (available capital means the cash available to the contractor, including loans and any financial aid). Works capability is the standard of the biggest contract carried out and achieved in the contractor’s register of construction works, number of workers, as well as the contractor’s fulfilment of relevant legal requests (CIDB, 2011; Emuze and Adlam, 2013). The CIDB grading ranks from grade 1 to grade 9. Contractors must register for the class of works they are able to undertake on a construction project (CIDB, 2011; Manana et al., 2012).

6.4. Conclusion

Chapter six was a review of the South African-related literature, its construction sector, its importance and place in the country’s economy. The next chapter addresses and explains the methodology utilised in this work.
CHAPTER 7 METHODOLOGY

7.1. Introduction

This chapter describes the research methodology implemented in the course of this study, relating to the research problem, in hopes of meeting the objectives of the research. Furthermore, the chapter defines the physical area of the conduction of the study, as well as the design of the study and sampling of the population. Furthermore, this chapter shows the instrument used in the collection of data, including techniques applied to keep the instrument legitimate and reliable.

7.2. Research Approach and Strategy

This study adopted a quantitative approach, making use of a questionnaire survey as the measurement tool. Newman and Benz (1998) states that quantitative research is the statistical illustration and management of opinions in order to describe and explain the occurrences reflected by those opinions. It is applied for a large selection of natural and social sciences, such as physics, biology, psychology, sociology and geology (Newman and Benz, 1998).

The research method aimed at the identification of the crucial elements having an impact on the construction projects’ performance, the identification of the benefits and challenges of implementing a cost of quality program as well as the establishment of recommendations that can lead to improving the performance of construction projects in Gauteng, South Africa.

The primary data was collected via a questionnaire survey. These were the main data used for the analysis in this study. Because this study is descriptive, it adopted a non-experimental design. A random cross-sectional survey is often linked to descriptive and exploratory studies where various groups of individuals are observed at one point in time (Bryman, 2006).

7.3. Research Area

The study was done in the South African province of Gauteng. The selection of this province is due to it being home to a big number of construction and engineering firms. A different reason was the big amount of construction projects in progress during the conduction of the study. The study comprised construction professionals and experts working in Gauteng, in the public as well as the private sectors.

7.4. Targeted Population

A population is made of every subject to be examined. The target population is the group of people or those concerned by the survey. In addition, Trotter (2012) defined a target
population as the people capable of responding to the questions and to whom the findings of the study are applicable.

The target population of this research constituted of experts and professionals in the sector of construction in South Africa, in the private as well as the public sector, who have been or are implicated in the execution of construction project. The choice of professionals in the construction sector is due to their likelihood to possess a profound understanding of the factors having an effect on building projects in Gauteng, South Africa.

7.5. Sampling

Teddlie and Yu (2007) definition of sampling is the selection act, process, or technique for an appropriate sample, or a portion representing the population for the determination of limitations or features of the entire population. There exist two standard classifications of the sampling technique: probability sampling also called random sampling and non-probability sampling also called non-random sampling. Thus, the study made use of a random sampling method being the purest type of probability sampling and every member of the ‘population’ has an equal opportunity of to be chosen.

7.6. Sample Size

The sample picked contained professionals in the industry, for example architects, quantity surveyors, structural engineers, electrical engineers, mechanical engineers, civil engineers, project managers, construction managers and construction project managers, from contracting companies, consultant offices and public and private sector owners, that had been implicated in the execution of building projects in Gauteng, South Africa.

From the 100 questionnaires sent out, 67 were sent back representing 67% of the total return rate, forming the basis of this study. As stated by Krejcie and Morgan (1970), survey findings can be seen as biased and of small worth if the return rate is below 30% to 40%. Consequently, based on this notion, the return rate for this research was seen as satisfactory for analysis.

7.7. Reliability and Validity of the Questionnaire

In order to have reliability, a questionnaire has to measure something numerous times and still result in the same outcome (Larsson, 2015). A questionnaire is considered reliable when the similar result will be achieved after being used repetitively on the identical study with the identical sample (Santos, 1999). Johns (1992) prompts us to ponder on two notions about the reliability of a tool; the tool’s capability for making reliable measurements and the regularity in the measuring results of the tool.
Validity is an instrument’s ability to complete the task intended. Golafshani’s (2003) definition for validity is the researcher’s measurement according to the determined level of measurement. According to Potter and Levine-Donnerstein (1999), validity in quantitative research comprises three classes: construct validity, predictive validity and content validity. Yet, Kimberlin and Winterstein (2008) oppose by claiming that validity is made of four folds being content validity, face validity, criterion validity and construct validity.

7.8. Conclusion

This chapter described the research methodology utilised for the study, which included the research approach and strategy, research area, targeted population, sampling, sample size as well as the reliability and validity of the study. In the next chapter the data analysis and discussion of the data will be presented.
CHAPTER 8 DATA ANALYSIS AND DISCUSSION

This chapter shows the data results gotten from the structured questionnaires administered to the following research respondents: architect, quantity surveyor, structural engineer, electrical engineer, mechanical engineer, civil engineer, project manager, construction manager, and construction project manager in the construction sector of South Africa. The analysis of the data and interpretation of the results are based on the information acquired from the questionnaires and it was the basis for this quantitative data collection. The analysis is based on 67 completed and usable questionnaires out of 100 sent out, reflecting a response rate of 67%.

8.1. Section A: Background Information

8.1.1. Distribution of Sample According to Gender

The distribution of the sample according to gender shows that 53.7 percent of the respondents are male, while females accounted for 46.3 percent. This is presented in Fig 8.1.

8.1.2. Distribution of Sample According to Ethnicity

The distribution of the sample according to ethnicity is shown in Fig 8.2. This shows that 77.6 percent of the respondents are black, 13.4 percent are white, 3.0 percent are coloured, 4.5 percent are Indian and 1.5 percent are Asian.
8.1.3. Distribution of Sample According to Highest Education Qualification

The distribution of the sample according to the respondents’ educational qualifications is shown in Fig 8.3. This reveals that the majority of the respondents possess a Bachelor degree, representing 35.8 percent, followed by those with a doctoral degree representing 26.9 percent, master’s degree holders represent 23.9 percent and those with a diploma representing 11.9 percent.
8.1.4. Distribution of Sample According to Type of Organisation

The distribution of the sample according to the respondents’ current employers is presented in Fig 8.4. This shows that 32.8 percent are employees of private cooperation client, 29.9 percent are employees of a private sector consultant, 19.4 percent are private sector contractor employees and 17.9 percent are employed by clients. There are no respondents from the public sector (government) therefore it is invalid.

8.1.5. Distribution of Sample According to Job Title

Figure 8.5. shows a visual representation of the respondents’ job titles. The data showed that 22.4% of the respondents are both project managers and quantity surveyors, 14.9% are architects, 10.4% are structural engineers, 6.0% are both construction managers and construction project managers, 4.5% are civil engineers, 3.0% are mechanical engineers, 1.5% of the respondents are electrical engineers and the remaining 9.0% selected the option ‘other’
8.1.6. Distribution of Sample According to Type of Employment

As described by Figure 8.6., 68.7% of respondents have permanent employment, 26.9% work under contract and the remaining 4.5% work under a temporary employment.
8.1.7. Distribution of Sample According to Length of Service in the Construction Industry

The distribution of the sample according to the respondents’ years of experience in the construction industry is shown in Fig 8.7. This reveals that 41.8 percent have experience that range between 0 and 5 years as well as between 5 and 10 years, with the remaining 16.4 percent having experience ranging from 10 to 15 years. None of the respondents have experience of more than 15 years so that option is excluded.

![Figure 8.7. Respondents' Length of Service](image)

8.1.8. Distribution of Sample According to Types of Projects Executed by Organisation

The types of projects executed by the organisations of the respondents are represented in figure 8.8. Some organisations perform more than just one of projects. The findings show that 33 respondents’ organisations perform building projects, 17 organisations perform renovation projects, 10 organisations are involved in road and transport projects, 9 in mechanical engineering projects, 8 in structural engineering projects, 7 are involved in electrical engineering projects, 6 in water and sewage projects and 6 respondents' organisations are involved in “other” types of projects.
8.1.9. Distribution of Sample According to Company Size

Figure 8.9 shows the company size of the respondents. It indicates that 9% of the respondents work in companies of 1 to 10 people, 20.9% in companies of 11 to 20 people, 25.4% in companies of 21 to 50 people, 38.8% of respondents work in organisations of 51 to 200 people and 6% in companies of more than 200 people.

8.1.10. Distribution of Sample According to Organisations’ CIDB Grading

The CIDB grading of respondents’ companies is given in Figure 8.10; 9.5% of the respondents’ companies are Grade 2, 20.6% are Grade 3, 11.1% are Grade 4, 9.5% are Grade 5, 7.9% are Grade 6, 17.5% are Grade 7, 6.4% are Grade 8 and 17.5% of the respondents’ companies...
are Grade 9 of the CIDB grading. There are no respondents’ companies graded 1 so it is excluded.

![Bar chart showing respondents' CIDB grading distribution]

**Figure 8.10. Respondents' Organisation's CIDB Grading**

### 8.1.11. Distribution of Sample According to Number of Projects Respondents are Involved in

The distribution of the sample according to the respondents' number of construction projects currently involved in is shown in Fig 8.11. This reveals that the majority are involved in 3 projects representing 25.6 percent, followed by 2 projects representing 20.5 percent. Respondents that are currently involved in 4 construction projects represent 17.9 percent, followed by those involved in only one project representing 7.7 percent, 7 projects representing 5.1 percent and lastly, 6, 10, 11, 12 and 40 projects representing 2.6 percent each.
8.1.12. Distribution of Sample According to Projects in the Last Five Years

Figure 8.12 represents the number of projects the respondent executed in the past five years. The figure reveals that 10.8% of the respondents executed 2 or 10 projects, 8.1% executed 3, 6 or 20 projects, 5.4% executed 7, 8, 9, 11 and 12 projects and lastly 2.7% of the respondents executed 1, 5, 16, 21, 22, 23, 25, 34, 100 or 300 construction projects in the past five years.
8.2. Section B: Factors Affecting the Performance of Construction Projects

8.2.1. Descriptive Statistics

Table 8.1 reveals the respondents’ ranking of the cost factors influencing the performance of projects of construction in Gauteng, South Africa. According to all respondents “profit rate of project” and “project labour cost” were the most important cost factor as they were ranked first with a mean score of 3.46 and a standard deviation (SD) of 0.663 and 0.668 respectively; “overhead percentage of project” was ranked second with a mean score of 3.39 and SD = 0.686; ranked third was “liquidity of organisation” with SD = 0.910 and project overrun cost with SD = 0.782, both with a mean score of 3.37.

Cost factors that were ranked the least important affecting the performance of construction projects are as follows: “Cost control system” was ranked 10 with a mean score of 3.21 and SD=0.883, “exchange rate” was ranked 11 with a mean score of 3.18 and SD=0.984 and finally according to all respondents the cost factor that least affects the performance of construction projects is “cost of rework” with a mean score of 3.17 and SD = 0.827.

Table 8.1. Cost factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Cost Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit rate of project</td>
<td>3.46</td>
<td>0.663</td>
<td>1</td>
</tr>
<tr>
<td>Project labour cost</td>
<td>3.46</td>
<td>0.668</td>
<td>1</td>
</tr>
<tr>
<td>Overhead percentage of project</td>
<td>3.39</td>
<td>0.686</td>
<td>2</td>
</tr>
<tr>
<td>Liquidity of organisation</td>
<td>3.37</td>
<td>0.910</td>
<td>3</td>
</tr>
<tr>
<td>Project overrun cost</td>
<td>3.37</td>
<td>0.782</td>
<td>3</td>
</tr>
<tr>
<td>Cash flow of project</td>
<td>3.35</td>
<td>0.799</td>
<td>4</td>
</tr>
<tr>
<td>Material and equipment cost</td>
<td>3.35</td>
<td>0.774</td>
<td>4</td>
</tr>
<tr>
<td>Market share of organisation</td>
<td>3.30</td>
<td>0.888</td>
<td>5</td>
</tr>
<tr>
<td>Escalation of material prices</td>
<td>3.28</td>
<td>0.806</td>
<td>6</td>
</tr>
<tr>
<td>Regular project budget update</td>
<td>3.27</td>
<td>0.926</td>
<td>7</td>
</tr>
<tr>
<td>Project design cost</td>
<td>3.26</td>
<td>0.882</td>
<td>8</td>
</tr>
<tr>
<td>Cost of variation orders</td>
<td>3.24</td>
<td>0.761</td>
<td>9</td>
</tr>
<tr>
<td>Waste rate of materials</td>
<td>3.24</td>
<td>0.911</td>
<td>9</td>
</tr>
<tr>
<td>Cost control system</td>
<td>3.21</td>
<td>0.883</td>
<td>10</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>3.18</td>
<td>0.984</td>
<td>11</td>
</tr>
<tr>
<td>Cost of rework</td>
<td>3.17</td>
<td>0.827</td>
<td>12</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank
Table 8.2 reveals the respondents’ ranking of the time factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents “availability of resources” was the most important time factor as it was ranked first with a mean score of 3.48 and a standard deviation (SD) of 0.664; “Time needed to rectify defects” was ranked second with a mean score of 3.43 and SD = 0.790; ranked third was “site preparation time” with SD = 0.882 with a mean score of 3.42.

Time factors that were ranked the least important affecting the performance of construction projects are as follows; “Time needed to implement variation orders” was ranked 7 with a mean score of 3.20 and SD=0.845 and finally according to all respondents the time factor that least affects the performance of construction projects is “planned time for project construction” with a mean score of 3.18 and SD = 0.922.

Table 8.2. Time factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Time Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of resources (labour, material &amp; equipment)</td>
<td>3.48</td>
<td>0.664</td>
<td>1</td>
</tr>
<tr>
<td>as planned through project duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time needed to rectify defects</td>
<td>3.43</td>
<td>0.790</td>
<td>2</td>
</tr>
<tr>
<td>Site preparation time</td>
<td>3.42</td>
<td>0.882</td>
<td>3</td>
</tr>
<tr>
<td>Average delay in payment from owner to contractor</td>
<td>3.34</td>
<td>0.853</td>
<td>4</td>
</tr>
<tr>
<td>Average delay because of closures and materials shortage</td>
<td>3.25</td>
<td>0.888</td>
<td>5</td>
</tr>
<tr>
<td>Percentage of orders delivered late</td>
<td>3.21</td>
<td>0.937</td>
<td>6</td>
</tr>
<tr>
<td>Average delay in claim approval</td>
<td>3.21</td>
<td>0.886</td>
<td>6</td>
</tr>
<tr>
<td>Time needed to implement variation orders</td>
<td>3.20</td>
<td>0.845</td>
<td>7</td>
</tr>
<tr>
<td>Planned time for project construction</td>
<td>3.18</td>
<td>0.922</td>
<td>8</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.3 reveals the respondents’ ranking of the quality factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents “quality of equipment and raw materials in project” was the most important quality factor as it was ranked first with a mean score of 3.44 and a standard deviation (SD) of 0.726; “Availability of personnel with high experience and qualification” was ranked second with a mean score of 3.39 and SD = 0.820; ranked third was “quality assessment system in organisation” with SD = 0.869 with a mean score of 3.38.

Quality factors that were ranked the least important affecting the performance of construction projects are as follows; “Participation of managerial levels with decision making” was ranked
6 with a mean score of 3.30 and SD=0.798 and finally according to all respondents the time factor that least affects the performance of construction projects is “quality auditing” with a mean score of 3.28 and SD = 0.884.

Table 8.3. Quality factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Quality Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of equipment and raw materials in project</td>
<td>3.44</td>
<td>0.726</td>
<td>1</td>
</tr>
<tr>
<td>Availability of personnel with high experience and qualification</td>
<td>3.39</td>
<td>0.820</td>
<td>2</td>
</tr>
<tr>
<td>Quality assessment system in organisation</td>
<td>3.38</td>
<td>0.869</td>
<td>3</td>
</tr>
<tr>
<td>Conformance to specification</td>
<td>3.34</td>
<td>0.895</td>
<td>4</td>
</tr>
<tr>
<td>Quality training/meeting</td>
<td>3.31</td>
<td>0.925</td>
<td>5</td>
</tr>
<tr>
<td>Participation of managerial levels with decision making</td>
<td>3.30</td>
<td>0.798</td>
<td>6</td>
</tr>
<tr>
<td>Quality auditing</td>
<td>3.28</td>
<td>0.884</td>
<td>7</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.4 reveals the respondents’ ranking of the productivity factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents “management-labour relationship” was the most important quality factor as it was ranked first with a mean score of 3.45 and a standard deviation (SD) of 0.662; “Project complexity” was ranked second with a mean score of 3.40 and SD = 0.735.

Productivity factors that were ranked the least important affecting the performance of construction projects are as follows; “Number of new projects/year” was ranked 4 with a mean score of 3.26 and SD=0.713 and finally according to all respondents, the productivity factor that least affects the performance of construction projects is “Sequencing of work according to schedule” with a mean score of 3.20 and SD = 0.962.

Table 8.4. Productive factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Productivity Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management-labour relationship</td>
<td>3.45</td>
<td>0.662</td>
<td>1</td>
</tr>
<tr>
<td>Project complexity</td>
<td>3.40</td>
<td>0.735</td>
<td>2</td>
</tr>
<tr>
<td>Absenteeism rate through project</td>
<td>3.31</td>
<td>0.900</td>
<td>3</td>
</tr>
<tr>
<td>Number of new projects/year</td>
<td>3.26</td>
<td>0.713</td>
<td>4</td>
</tr>
<tr>
<td>Sequencing of work according to schedule</td>
<td>3.20</td>
<td>0.962</td>
<td>5</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank
Table 8.5 reveals the respondents' ranking of the client satisfaction factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents “Number of reworks” was the most important client satisfaction factor as it was ranked first with a mean score of 3.50 and a standard deviation (SD) of 0.707. “Information coordination between owner and project parties” was ranked second with a mean score of 3.39 and SD = 0.789.

Client satisfaction factors that were ranked the least important affecting the performance of construction projects are as follows: “Speed and reliability of service to client” was ranked 4 with a mean score of 3.36 and SD=0.777 and finally according to all respondents the productivity factor that least affects the performance of construction projects is “leadership skills for project management” with a mean score of 3.25 and SD = 0.836.

Table 8.5. Client satisfaction factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Client Satisfaction Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of reworks</td>
<td>3.50</td>
<td>0.707</td>
<td>1</td>
</tr>
<tr>
<td>Information coordination between owner and project parties</td>
<td>3.39</td>
<td>0.789</td>
<td>2</td>
</tr>
<tr>
<td>Number of disputes between owner and project parties</td>
<td>3.37</td>
<td>0.758</td>
<td>3</td>
</tr>
<tr>
<td>Speed and reliability of service to client</td>
<td>3.36</td>
<td>0.777</td>
<td>4</td>
</tr>
<tr>
<td>Leadership skills for project management</td>
<td>3.25</td>
<td>0.836</td>
<td>5</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.6 reveals the respondents’ ranking of the regulatory factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents, “application for construction work permit” was the most important regulatory factor as it was ranked first with a mean score of 3.51 and a standard deviation (SD) of 0.693. “Provision of sub regulations” was ranked second with a mean score of 3.49 and SD = 0.664; ranked third was “approval of inspection authority” with SD = 0.799 with a mean score of 3.44.

Regulatory factors that were ranked the most important affecting the performance of construction projects are as follows: “Cost of compliance to regulators requirements” and “offences and penalties” were ranked 6 with a mean score of 3.37 and SD=0.821 and 0.885 respectively, “quality and availability of regulator documentation” was ranked 7 with a mean score of 3.34 and SD=0.718 and finally according to all respondents the regulatory factor that least affects the performance of construction projects is “number of non-compliance to regulation” with a mean score of 3.27 and SD = 0.869.
Table 8.6. Regulatory factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Regulatory Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application for construction work permit</td>
<td>3.51</td>
<td>0.693</td>
<td>1</td>
</tr>
<tr>
<td>Provision of sub regulations</td>
<td>3.49</td>
<td>0.664</td>
<td>2</td>
</tr>
<tr>
<td>Approval of inspection authority</td>
<td>3.44</td>
<td>0.799</td>
<td>3</td>
</tr>
<tr>
<td>Neighbours’ and site conditions problems</td>
<td>3.42</td>
<td>0.745</td>
<td>4</td>
</tr>
<tr>
<td>Housekeeping of site</td>
<td>3.38</td>
<td>0.799</td>
<td>5</td>
</tr>
<tr>
<td>Notification of construction work</td>
<td>3.38</td>
<td>0.724</td>
<td>5</td>
</tr>
<tr>
<td>Cost of compliance to regulators requirements</td>
<td>3.37</td>
<td>0.821</td>
<td>6</td>
</tr>
<tr>
<td>Offences and penalties</td>
<td>3.37</td>
<td>0.885</td>
<td>6</td>
</tr>
<tr>
<td>Quality and availability of regulator documentation</td>
<td>3.34</td>
<td>0.718</td>
<td>7</td>
</tr>
<tr>
<td>Number of non-compliance to regulation</td>
<td>3.27</td>
<td>0.869</td>
<td>8</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.7 reveals the respondents’ ranking of the human resource factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents, “working conditions” was the most important human resource factor as it was ranked first with a mean score of 3.48 and a standard deviation (SD) of 0.704; “Labour attitude towards project” and “employees’ (labourers) motivation” were ranked second with a mean score of 3.45 and SD of 0.683 and 0.771 respectively. Ranked third was “training and education of managers” with SD = 0.762 with a mean score of 3.42.

Human resource factors that were ranked the least important affecting the performance of construction projects are as follows: “Job security” was ranked 9 with a mean score of 3.29 and SD=0.879, “dispute management (client and professionals)” was ranked 10 with a mean score of 3.26 and SD=0.815 and finally according to all respondents the regulatory factor that least affects the performance of construction projects is “frequently changing jobs” with a mean score of 3.25 and SD = 0.884.

Table 8.7. Human resources factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Human Resource Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working conditions</td>
<td>3.48</td>
<td>0.704</td>
<td>1</td>
</tr>
<tr>
<td>Labour attitude towards project</td>
<td>3.45</td>
<td>0.683</td>
<td>2</td>
</tr>
<tr>
<td>Employees (labourers) motivation</td>
<td>3.45</td>
<td>0.771</td>
<td>2</td>
</tr>
<tr>
<td>Training and education of managers</td>
<td>3.42</td>
<td>0.762</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 8.8 reveals the respondents’ ranking of the health and safety factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents, “risk assessment” and “health and safety specifications” were the most important health and safety factors as they were ranked first with a mean score of 3.50 and a standard deviation (SD) of 0.707 and 0.662 respectively. “Easy access to site” (location of project) was ranked second with a mean score of 3.42 and SD = 0.801.

Health and safety factors that were ranked the least important affecting the performance of construction projects are as follows: “Application of health and safety factors in organisation” was ranked 4 with a mean score of 3.33 and SD=0.798 and finally according to all respondents the productivity factor that least affects the performance of construction projects is “access to medical care and facilities” with a mean score of 3.29 and SD = 0.861.

Table 8.8. Health and safety factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Health and Safety Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk assessment</td>
<td>3.50</td>
<td>0.707</td>
<td>1</td>
</tr>
<tr>
<td>Health and safety specifications</td>
<td>3.50</td>
<td>0.662</td>
<td>1</td>
</tr>
<tr>
<td>Easy access to site (location of project)</td>
<td>3.42</td>
<td>0.801</td>
<td>2</td>
</tr>
<tr>
<td>Reportable accidents rate in project</td>
<td>3.37</td>
<td>0.802</td>
<td>3</td>
</tr>
<tr>
<td>Application of health and safety factors in organisation</td>
<td>3.33</td>
<td>0.798</td>
<td>4</td>
</tr>
<tr>
<td>Access to medical care and facilities</td>
<td>3.29</td>
<td>0.861</td>
<td>5</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.9 reveals the respondents’ ranking of the innovation and learning factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents, “learning from best practice and experience of others” was the most important innovation and
learning factor as it was ranked first with a mean score of 3.57 and a standard deviation (SD) of 0.583.

The innovation and learning factor that was ranked the least important affecting the performance of construction projects is “learning from own experience and past history”, ranked 4 with a mean score of 3.40 and SD = 0.787.

Table 8.9. Innovation and learning factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Innovation and Learning Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning from best practice and experience of others</td>
<td>3.57</td>
<td>0.583</td>
<td>1</td>
</tr>
<tr>
<td>Review of failures and solve them</td>
<td>3.52</td>
<td>0.731</td>
<td>2</td>
</tr>
<tr>
<td>Training human resources in the skills demanded by the project</td>
<td>3.49</td>
<td>0.753</td>
<td>3</td>
</tr>
<tr>
<td>Learning from own experience and past history</td>
<td>3.40</td>
<td>0.787</td>
<td>4</td>
</tr>
</tbody>
</table>

σX = Standard deviation; x = mean item score; R = Rank

Table 8.10 reveals the respondents’ ranking of the environmental factors affecting the performance of construction projects in Gauteng, South Africa. According to all respondents “human health” was the most important environmental factor as it was ranked first with a mean score of 3.48 and a standard deviation (SD) of 0.731. “Wastes around the site” was ranked second with a mean score of 3.46 and SD = 0.804.

Environmental factors that were ranked the least important affecting the performance of construction projects are as follows: “Air quality” was ranked 7 with a mean score of 3.29 and SD = 0.824 and finally according to all respondents the environmental factor that least affects the performance of construction projects is “noise level” with a mean score of 3.28 and SD = 0.901.

Table 8.10. Environmental factors affecting the performance of construction projects

<table>
<thead>
<tr>
<th>Environmental Factors</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human health</td>
<td>3.48</td>
<td>0.731</td>
<td>1</td>
</tr>
<tr>
<td>Wastes around the site</td>
<td>3.46</td>
<td>0.804</td>
<td>2</td>
</tr>
<tr>
<td>Climate condition in the site</td>
<td>3.45</td>
<td>0.771</td>
<td>3</td>
</tr>
<tr>
<td>Occupant control</td>
<td>3.42</td>
<td>0.819</td>
<td>4</td>
</tr>
<tr>
<td>Occupant comfort</td>
<td>3.39</td>
<td>0.816</td>
<td>5</td>
</tr>
<tr>
<td>Integrated pest management</td>
<td>3.34</td>
<td>0.801</td>
<td>6</td>
</tr>
<tr>
<td>Air quality</td>
<td>3.29</td>
<td>0.824</td>
<td>7</td>
</tr>
</tbody>
</table>
8.2.2. Reliability Analysis

The reliability of a tool (questionnaire) is the level of consistency in measuring the aspect it is meant to measure. The less there are variations produced by a tool in repetitive measures of an aspect, the better the reliability of that tool. A measuring tool’s reliability can mean how stable, consistent, or dependable that measuring tool is (Gliem and Gliem, 2003; Santos, 1999).

Cronbach’s alpha was utilised for the purpose of measuring reliability. According to Tavakol and Dennick (2011) the purpose of Cronbach’s alpha is to discover how well the elements in a category positively correlates to each other. The Cronbach’s coefficient alphas were calculated for each field for Section B of the survey.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>X</th>
<th>V</th>
<th>σX</th>
<th>No of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>0.950</td>
<td>0.951</td>
<td>53.83</td>
<td>85.950</td>
<td>9.271</td>
<td>16</td>
</tr>
<tr>
<td>Time</td>
<td>0.942</td>
<td>0.943</td>
<td>29.64</td>
<td>41.347</td>
<td>6.430</td>
<td>9</td>
</tr>
<tr>
<td>Quality</td>
<td>0.935</td>
<td>0.936</td>
<td>23.56</td>
<td>25.984</td>
<td>5.097</td>
<td>7</td>
</tr>
<tr>
<td>Productivity</td>
<td>0.893</td>
<td>0.893</td>
<td>16.60</td>
<td>11.031</td>
<td>3.321</td>
<td>5</td>
</tr>
<tr>
<td>Client satisfaction</td>
<td>0.854</td>
<td>0.854</td>
<td>16.82</td>
<td>9.647</td>
<td>3.106</td>
<td>5</td>
</tr>
<tr>
<td>Regulatory</td>
<td>0.921</td>
<td>0.922</td>
<td>33.81</td>
<td>35.625</td>
<td>5.969</td>
<td>10</td>
</tr>
<tr>
<td>Human resource</td>
<td>0.909</td>
<td>0.909</td>
<td>40.38</td>
<td>44.555</td>
<td>6.675</td>
<td>12</td>
</tr>
<tr>
<td>Health and safety</td>
<td>0.877</td>
<td>0.876</td>
<td>20.31</td>
<td>13.527</td>
<td>3.678</td>
<td>6</td>
</tr>
<tr>
<td>Innovation and learning</td>
<td>0.775</td>
<td>0.785</td>
<td>13.97</td>
<td>4.819</td>
<td>2.195</td>
<td>4</td>
</tr>
<tr>
<td>Environmental</td>
<td>0.917</td>
<td>0.916</td>
<td>27.10</td>
<td>26.122</td>
<td>5.111</td>
<td>8</td>
</tr>
</tbody>
</table>

σX = Standard deviation; X = mean; V = Variance
The table above show the results of the reliability analysis of the different factors. It clearly states that the Cronbach’s alpha value of the cost factor is 0.950 with a total mean of 53.83 and a variance of 85.950. For the time factor, the cronbach’s alpha value was 0.942 with a total mean value of 29.64 and a variance 41.347. The quality factor presented a cronbach’s alpha value of 0.935 with a mean of 23.56 and a variance of 25.984. As for the productivity factor, the result generated a cronbach’s alpha value of 0.893 with a total mean of 16.60 and a total variance of 11.031. The client satisfaction sector showed a cronbach’s alpha value of 0.854 with a mean value of 16.82 and a variance value of 9.647. As for the regulatory factor, the cronbach’s alpha value was 0.921 with a total mean value of 33.81 and a total variance value of 35.625. The results state that the human resource factor scored a cronbach’s alpha value of 0.909 with a mean of 40.38 and a variance of 44.555. The table shows that for the health and safety factor, the cronbach’s alpha was 0.877 with a total mean of 20.31 and a total variance of 13.527. The innovation and learning factor scored a cronbach’s alpha value of 0.775 with a mean of 13.97 and a variance of 4.819. Lastly, the environmental factor showed a cronbach’s alpha value of 0.917 with a mean value of 27.10 and a variance value of 26.122.

The Cronbach’s alpha coefficients for all the variables in the questionnaire ranged between 0.775 and 0.950, which indicated that the internal reliability of the individual ideas was quite high. The survey was therefore suitable for the purpose of this study as a value of more than 0.7 is considered as excellent. The closer the reliability coefficient gets to 1.0, the better the reliability of the measuring tool (Tavakol and Dennick, 2011).

8.2.3. Normality Test

To test the supposition that the data gathered follows a normal distribution (Jarque and Bera, 1980) and to clarify that the sample was taken from a population that follows a normal distribution, a normality test was conducted on the ten (10) factors of section B.

The Kolmogorov-Smirnov and Shapiro-Wilk tests helped to test normality on the factors. Table 8.12 below illustrates the normality test on the factors.

<table>
<thead>
<tr>
<th>Table 8.12 Test of normality on factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kolmogorov-Smirnov</strong></td>
</tr>
<tr>
<td>Statistic</td>
</tr>
<tr>
<td>Cost Factors</td>
</tr>
<tr>
<td>Time Factors</td>
</tr>
<tr>
<td>Quality Factors</td>
</tr>
<tr>
<td>Productive Factors</td>
</tr>
</tbody>
</table>
The Kolmogorov-Smirnov test results on the ten factors were as follows: Cost Factors 0.155, Time Factors 0.253, Quality Factors 0.219, Productive Factors 0.223, Client Satisfaction Factors 0.196, Regulatory Factors 0.162, Human Resource Factors 0.140, Health and Safety Factors 0.216, Innovation and Learning Factors 0.214, and Environmental Factors 0.206. Each of the p-values presented is higher than 0.05. According to Ghasemi and Zahediasi (2012), if the p-value is higher than 0.05 then it is an indication of normal distribution.

The Shapiro-Wilk test results indicated the following: Cost Factors 0.883, Time Factors 0.826, Quality Factors 0.826, Productive Factors 0.856, Client Satisfaction Factors 0.868, Regulatory Factors 0.873, Human Resource Factors 0.916, Health and Safety Factors 0.862, Innovation and Learning Factors 0.841, and Environmental Factors 0.832. All the values presented fell between 0 and 1. The values of a normal distribution on a Shapiro-Wilk test fall between 0 and 1 (Razali and Wah, 2011).

### 8.3. Section C: Advantages and Challenges of Cost of Quality Implementation

#### 8.3.1. Distribution of Sample According to Knowledge of Cost of Quality (COQ)

Figure 8.13 illustrates the respondents' familiarity with the concept of cost of quality; the data showed that 52.2% of the respondents were familiar with the concept, 34.3% were very familiar with the concept, 11.9% were vaguely familiar with it and the remaining 1.5% were not familiar with cost of quality.
8.3.2. Distribution of Sample According to Respondents’ View of the Implementation of COQ

The distribution of the sample according to COQ Implementation in Respondents’ Companies is shown in Fig 8.14. This reveals that 65.7% of the respondents implement cost of quality in their companies, 19.4% do not implement COQ and 14.9% do not know whether it is applied or not.
8.3.3. Distribution of Sample According to Respondents’ Competitors’ Implementation of COQ

Figure 8.15 illustrates the respondents’ competitors’ familiarity with the concept of cost of quality or more specifically the respondents’ knowledge of the competitors implementation of COQ; the data showed that 35.8% of the respondents said that the competitors implemented COQ, 29.9% of them stated that their competitors did not implement COQ and 34.3% did not know whether or not their competitors applied cost of quality effectively.

![Figure 8.15. COQ Implementation in Respondents' Competitors' Companies](image)

8.3.4. Cost of Quality Advantages

Table 8.11 reveals the respondents’ ranking of the advantages of implementing the cost of quality concept in an organisation. According to all respondents, the most important advantage of COQ is the fact that it reveals the reasons that cause problems in a system. It ranked first with a mean score of 4.30 and SD of 0.779; Secondly the fact that COQ helps employees achieve quality goals easily was ranked second with a mean score of 4.29 and SD of 0.780; ranked third was the fact that COQ helps to motivate employees towards quality goals with SD = 0.720 with a mean score of 4.24.

Cost of quality advantages that were ranked the least important are as follows: The fact that organisations use COQ technique results as benchmark against other companies ranked 15 with a mean score of 3.96 and SD=0.878. The fact that there are practical solutions that are found only due to COQ implementation ranked 16 with a mean of 3.94 and a SD of 1,028, and finally according to all respondents the cost of quality advantage with the lowest ranking is that
of the whole organisation having a positive feeling towards COQ techniques with a mean of 3.91 and a SD of 1.026.

Table 8.13. Cost of Quality Advantages

<table>
<thead>
<tr>
<th>Cost of Quality Advantages</th>
<th>X</th>
<th>σX</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>COQ reveals the reasons that cause problems in a system.</td>
<td>4.30</td>
<td>0.779</td>
<td>1</td>
</tr>
<tr>
<td>COQ helps employees achieve quality goals EASILY</td>
<td>4.29</td>
<td>0.780</td>
<td>2</td>
</tr>
<tr>
<td>COQ helps to motivate employees towards quality goals.</td>
<td>4.24</td>
<td>0.720</td>
<td>3</td>
</tr>
<tr>
<td>COQ is used to identify high-cost problem areas.</td>
<td>4.22</td>
<td>0.813</td>
<td>4</td>
</tr>
<tr>
<td>COQ highlights the problems that occur in a system more easily</td>
<td>4.21</td>
<td>0.808</td>
<td>5</td>
</tr>
<tr>
<td>COQ helps in evaluating the effectiveness of a quality system.</td>
<td>4.20</td>
<td>0.814</td>
<td>6</td>
</tr>
<tr>
<td>Implementing COQ helps create an edge over competitors</td>
<td>4.18</td>
<td>0.796</td>
<td>7</td>
</tr>
<tr>
<td>The COQ technique is an effective cost saving technique.</td>
<td>4.16</td>
<td>0.771</td>
<td>8</td>
</tr>
<tr>
<td>COQ implementation leads to increase in project completion time</td>
<td>4.15</td>
<td>0.839</td>
<td>9</td>
</tr>
<tr>
<td>COQ is useful for monitoring quality of the product.</td>
<td>4.12</td>
<td>0.789</td>
<td>10</td>
</tr>
<tr>
<td>COQ affects the Productivity improvement positively</td>
<td>4.12</td>
<td>0.862</td>
<td>10</td>
</tr>
<tr>
<td>COQ affects the Technological advancement positively</td>
<td>4.12</td>
<td>0.749</td>
<td>10</td>
</tr>
<tr>
<td>COQ affects the Waste reduction positively</td>
<td>4.07</td>
<td>0.858</td>
<td>11</td>
</tr>
<tr>
<td>The whole organization [or every department of the organization] needs to understand COQ technique.</td>
<td>4.07</td>
<td>0.876</td>
<td>11</td>
</tr>
<tr>
<td>COQ helps a great deal in cost reduction</td>
<td>4.07</td>
<td>0.858</td>
<td>11</td>
</tr>
<tr>
<td>COQ affects the Supplier cost control positively</td>
<td>4.01</td>
<td>0.862</td>
<td>12</td>
</tr>
<tr>
<td>COQ implementation leads to a positive growth</td>
<td>3.99</td>
<td>0.896</td>
<td>13</td>
</tr>
<tr>
<td>Usage of COQ leads to higher savings than the expenses needed to implement it</td>
<td>3.97</td>
<td>0.921</td>
<td>14</td>
</tr>
</tbody>
</table>
Organizations use COQ technique results as benchmark against other companies.

There are practical solutions that are found only due to COQ implementation.

The whole organization has a positive feeling towards COQ techniques.

\[ \sigma_X = \text{Standard deviation}; \ x = \text{mean item score}; \ R = \text{Rank} \]

8.3.5. Cost of Quality Challenges

Table 8.12 reveals the respondents’ ranking of the challenges faced by professionals while implementing the cost of quality concept in an organisation. According to all respondents, the most challenging fact about COQ is that the implementation of COQ is not easy. It ranked first with a mean score of 4.26 and SD of 0.791. Secondly, the need for continuous reporting and documentation being a difficulty behind the implementation of COQ was ranked second with a mean score of 4.25 and SD of 0.859. Ranked third was the fact that COQ is not implemented because of Lack of knowledge with SD = 0.780 with a mean score of 4.24.

Cost of quality challenges that were ranked the least important are as follows: Un-necessary expenditure being a reason behind the failure of COQ after implementation ranked 15 with a mean score of 3.84 and SD=0.963; The fact that Implementing COQ is a waste of time and money ranked 16 with a mean of 3.76 and a SD of 1.304 and finally according to all respondents the cost of quality challenge with the lowest ranking is that Low return on investment (ROI) is a reason behind the failure of COQ after implementation with a mean of 3.75 and a SD of 1.078.

Table 8.14. Cost of quality challenges

<table>
<thead>
<tr>
<th>Cost of Quality Challenges</th>
<th>X</th>
<th>( \sigma_X )</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>The implementation of COQ is not easy</td>
<td>4.26</td>
<td>0.791</td>
<td>1</td>
</tr>
<tr>
<td>Need for continuous reporting and documentation is a difficulty behind the implementation of COQ</td>
<td>4.25</td>
<td>0.859</td>
<td>2</td>
</tr>
<tr>
<td>COQ is not implemented because of Lack of knowledge about COQ</td>
<td>4.24</td>
<td>0.780</td>
<td>3</td>
</tr>
<tr>
<td>The costs due to COQ are considered as an important component while estimating the budget of the project</td>
<td>4.22</td>
<td>0.850</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty in collecting COQ data is a difficulty behind the implementation of COQ</td>
<td>4.15</td>
<td>0.764</td>
<td>5</td>
</tr>
</tbody>
</table>
Lack of information is a difficulty behind the implementation of COQ  
4,14 0,782 6

Lack of senior management commitment is a difficulty behind the implementation of COQ  
4,13 0,796 7

Organization culture is a difficulty behind the implementation of COQ  
4,12 0,930 8

COQ is not implemented because of Insufficient benefits  
4,10 0,956 9

Lack of accountability is a difficulty behind the implementation of COQ  
4,07 0,841 10

Existence of other easier quality control methods is a difficulty behind the implementation of COQ  
4,04 0,806 11

Employee attitudes is a difficulty behind the implementation of COQ  
4,01 0,913 12

Lack of interest from employees is a reason behind the failure of COQ after implementation  
4,01 0,945 12

Incompatibility of existing accounting system is a difficulty behind the implementation of COQ  
3,94 0,933 13

COQ is not implemented because of High costs  
3,91 0,933 14

Un-necessary expenditure is a reason behind the failure of COQ after implementation  
3,84 0,963 15

Implementing COQ is a waste of time and money  
3,76 1,304 16

Low return on investment (ROI) is a reason behind the failure of COQ after implementation  
3,75 1,078 17

σX = Standard deviation; x = mean item score; R = Rank

8.3.6. Reliability Analysis

The Cronbach’s coefficient alphas were calculated for each field for Section B of the questionnaire.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cronbach’s Alpha</th>
<th>Cronbach’s Alpha Based on Standardized Items</th>
<th>X</th>
<th>V</th>
<th>σX</th>
<th>No of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td>0,950</td>
<td>0,951</td>
<td>87,41</td>
<td>143,928</td>
<td>11,997</td>
<td>21</td>
</tr>
<tr>
<td>Challenges</td>
<td>0,926</td>
<td>0,930</td>
<td>73,28</td>
<td>118,328</td>
<td>10,878</td>
<td>18</td>
</tr>
</tbody>
</table>
\[ \sigma_X = \text{Standard deviation}; \ X = \text{mean}; \ V = \text{Variance} \]

The table above shows the results of the reliability analysis of the advantages and challenges of COQ. It clearly states that the Cronbach’s alpha value of the advantages is 0.950 with a total mean of 87.41 and a variance of 143.928. The challenges presented a cronbach’s alpha value of 0.926 with a mean of 73.28 and a variance of 118.328.

### 8.3.7. Normality Test

The Kolmogorov-Smirnov and Shapiro-Wilk tests helped to test normality on the advantages and challenges of the cost of quality. Table 8.16 below illustrates the normality test on the advantages and challenges.

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov(a)</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
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<td>Statistic</td>
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<td>Cost of Quality</td>
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<tr>
<td>Advantages</td>
<td>0.121</td>
<td>67</td>
</tr>
<tr>
<td>Cost of Quality</td>
<td>0.182</td>
<td>67</td>
</tr>
<tr>
<td>Challenges</td>
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</table>

The Kolmogorov-Smirnov test results on the advantages and challenges of Coq were as follows: advantages 0.121 and challenges 0.182. Each of the p-values presented is higher than 0.05.

The Shapiro-Wilk test results indicated the following: advantages 0.926 and challenges 0.901. All the values presented fell between 0 and 1.
CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1. Introduction

In this chapter, the conclusions and recommendations of the research study are presented and discussed in relation to the research objectives. A general research conclusion is also presented, based on the conclusions drawn from each of the research objectives.

9.2. Conclusion

The goal of the research was to assist decision makers in the South African construction sector on the issues linked to the cost of poor quality. In order to achieve this goal, the following objectives were developed:

1. To determine to what extent the concept of cost of quality has been approached from a holistic point of view in the construction sector.
2. To identify the factors associated with poor performance of South African construction sector.
3. To determine the issues that professionals in the construction industry face while applying a cost of quality program.
4. To identify the benefits linked to the implementation of the concept of cost of quality.

9.2.1 Conclusion for Research Objective 1

- To determine to what extent the concept of cost of quality has been approached from a holistic point of view in the construction sector.

In order to achieve this objective, this study conducted a thorough review of various studies that were conducted over the last two decades on the cost of poor quality in various industries was undertaken. It was revealed that most of the studies focused on large size companies and usually employed a qualitative methodology. Another point of attention is that although most of the studies focused on the construction sector, there is a considerable lack of publications based on studies done in South Africa on the Cost of Poor Quality, especially in the construction sector. Therefore this work was centred on the Cost of Poor Quality with a focus on South African’s Small and Medium Enterprises in the construction sector. Thus the first objective was achieved.

9.2.2 Conclusion for Research Objective 2

- To identify the factors associated with poor performance of South African construction sector

In order to achieve this objective, various factors were identified as having an influence on the performance of the construction sector of South Africa using the two-fold approach mentioned
previously. Those factors were then grouped into ten (10) categories namely Cost factors, Time factors, Quality factors, Productivity factors, Client satisfaction factors, Regulatory factors, Human resource factors, Health and safety factors, Innovation and learning factors and Environmental factors.

The results from the questionnaire survey have shown the most important factors impacting the performance of the industry of construction of South Africa. From each category were chosen the highest ranking factor as well as the lowest ranking factor. Those factors are the following:

**Cost factors:** “Profit rate of project” ranked the highest with a mean of 3.46 and standard deviation of 0.663 and “Cost of rework” ranked the lowest with a mean of 3.17 and a standard deviation of 0.827. The reason why the profit rate of a project was seen as the most important cost factor by experts is because of it is directly related to the income that could be generated from undertaking a project. It acts as a motivation for all the parties involved. The cost of rework ranked as the least important factor by experts because it is an aspect of the work they actively try to avoid as it brings up the overall cost of the project.

**Time factors:** With a mean of 3.48 and a standard deviation of 0.664, the availability of resources through project duration is the most important time factor because it guarantees a smoother process through the construction. Any shortage of resources would result in a delay in the time of the project, whereas planned time for project construction ranked the lowest with a mean of 3.18 and a standard deviation of 0.922 because as much as the client and the professionals involved would want the time frame respected, it usually changes over the course of the project.

**Quality factors:** The quality of equipment and raw materials in project is the most important quality factor (mean of 3.44 and SD of 0.726) as it is directly linked to the quality of the final result. Low quality material and equipment would result in a weak building structure in the long term. Quality auditing is the least important quality factor (mean of 3.28 and SD of 0.884) as it involves an extra cost to the organisation and the results of the auditing might disrupt the construction process.

**Productivity factors:** The relationship between management and labour ranked as the most crucial factor with a mean of 3.45 and a SD of 0.662 as it is crucial to the smooth process of the construction. A dispute between the management and the workforce would result in delays, strikes, extra costs and overall a low productivity, while the sequencing of work according to schedule ranked the least with a mean of 3.20 and SD of 0.962 because realistically the schedules are not always respected and they change frequently depending on the circumstances.
Client satisfaction factors: the most important factor in this category is number of reworks (mean of 3.50 and SD of 0.707) because every rework can be an extra cost to the client and a high number of reworks throughout the process doesn’t inspire confidence to the client, and the least important one is leadership skills for project management (mean of 3.25 and SD of 0.836)

Regulatory factors: In this category, the application for construction work permit ranked the highest with a mean of 3.51 and a standard deviation of 0.693 because without those permits, no construction can legally take place. They may take some time to acquire so they need to be dealt with first, and number of non-compliance to regulation ranked the lowest with a mean of 3.27 and standard deviation of 0.869 because on a practical level, experts are sometimes willing to overlook some of the non-compliances in order to advance the project faster.

Human resource factors: Working conditions is the most important human resource factor with a mean of 3.48 and a standard deviation of 0.704, because the wellbeing of the workforce through the project really impacts their attitude towards the project. Good working conditions result in employee satisfaction, higher productivity and an overall pleasant working environment, whereas frequently changing jobs is the least important factor with a mean of 3.25 and a standard deviation of 0.884 as it doesn’t always occur during the construction process. Employees know their jobs and they stick to it.

Health and safety factors: Risk assessment ranked the highest in this category with a mean of 3.50 and a standard deviation of 0.707 as it is directly linked to the wellbeing of the workers and the quality of the project while access to medical care and facilities ranked the lowest with a mean of 3.29 and a standard deviation of 0.861 because the choice of the construction site is not always at the discretion of the construction company, so they have no control over the existence of medical facilities around the site.

Innovation and learning factors: The most important factor in this category is learning from best practice and experience of others (mean of 3.57 and SD of 0.583) and the least important factor is learning from own experience and past history (mean of 3.40 and SD of 0.787)

Environmental factors: Human health is the most important environmental factor with a mean of 3.48 and a SD of 0.731 as it pertains to the respect of the human beings working on the project, their safety, health and wellbeing should come first, whereas the noise level on site is the least important factor with a mean of 3.28 and a SD of 0.901 because a construction site is bound to be noisy as the employees work and utilize machinery.
9.2.3 Conclusion for Research Objective 3

➢ To determine the issues that decision makers in the construction industry face while applying a cost of quality program

To achieve this objective, this study used a two-fold approach. Firstly, the study reviews the existing literatures on the common challenges faced by decision makers in the construction sector concerning the implementation of the concept of cost of quality. Secondly the study refined those challenges through quantitative interviews with various experts from different construction firms mostly located in Johannesburg, South Africa. The results clearly revealed that the implementation of the concept of cost of quality was not easy. The experts pointed out that there was a need for continuous reporting and documentation. Furthermore, respondents argued that they did not have enough knowledge concerning the concept of cost of quality; the implementation of cost of quality was seen to be expensive; the collection COQ data revealed itself to be difficult; there is a lack of information sharing; there is no commitment from the senior management; an organisation’s culture can be a barrier to the implementation of a cost of quality program; experts perceive the benefits of cost of quality to be insufficient and lastly; and there is no sense of accountability when it comes to COQ.

9.2.4 Conclusion for Research Objective 4

➢ To identify the benefits linked to the implementation of the concept of cost of quality

In order to achieve this objective, this study used the two-fold approach mentioned above. A set of benefits or advantages was selected using a review of literature and where compiled in the questionnaire survey. They were then evaluated by experts in the industry and that resulted in the identification of the top ten advantages of implementing cost of quality. The results showed that cost of quality is a tool for the identification of reasons that cause problems in a system; they further state that COQ helps in the easy achievement of quality goals by the employees; the cost of quality concept is also a motivation for employees towards quality goals; it is utilized for the identification of costly problem areas; the experts stated that problems occurring in a system are more easily highlighted through the use of cost of quality; cost of quality assists in the evaluation a quality system’s effectiveness; the implementation of COQ also provides the organisation with a competitive edge over competitors; COQ has showed itself to be an effective technique in cost saving; the cost of quality implementation helps in the respect of a project completion time and lastly; the monitoring of product quality is facilitated through the use of COQ.
9.3. Recommendations

As mentioned earlier on, the significance of the construction sector on the economy around the world has been proven by the fact that adds to the economy of a nation by providing the greater part of the nation's fixed capital resources and framework that help different ventures, providing jobs, and expanding national Gross Domestic Product. But it has been realised that this sector has not been performing well over the past decade for various reasons and these issues can be addressed by the implementation of the cost of poor quality.

Despite the fact that it might be expensive, the implementation of cost of quality has got various benefits such as the attainment of a higher quality in the organisation and its processes. With the impact and prominence that quality has in the current market, the proper implementation of the cost of quality concept can assist an organisation with the achievement of its quality goals, whether through the motivation of employees or in the design or redesign of work processes and jobs in the organisation.

Therefore a better understanding and the implementation of the cost of quality concept is essential to the future of the construction sector in general and small and medium enterprises in particular because they are a key to the economic growth of any country but they are generally neglected.
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Developing Countries: Challenges Facing the Construction Industry in Developing Countries (pp. 15-17).


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Zimwara, D., Mugwagwa, L., Maringa, D., Mnkandla, A., Mugwagwa, L. and Ngwarati, T.T., 2013. Cost of quality as a driver for continuous improvement-case study–company X.
Dear Sir/Madam

You are hereby invited to participate in a research that aims to analyse the issues related to the cost of poor quality in the South African construction sector. We would like to get your feedback on your personal experience and expectation as an individual operating in the construction industry.

Your feedback is important in helping us better understand the importance of a well-applied Cost of Quality strategy in an organisation.

It should take you between 10 to 15 minutes to complete the questionnaire. You may at any stage stop participating in the project. If you consent to participate in this research project, please complete the questionnaire below.

The information provided will remain confidential and will only be reported in summary format.

Thank you in anticipation for your participation in this survey.

Regards;

Dorcas Niati
Email: dorcas_nyati@yahoo.fr
Cell: +27 76 370 9189
APPENDIX 2: Questionnaire

SECTION A: BACKGROUND INFORMATION

This section of the questionnaire refers to background or biographical information. Although we are aware of the sensitivity of the questions in this section, the information will help us to compare groups of respondents. Once again, we assure you that your response will remain anonymous. Your co-operation is appreciated.

PLEASE ANSWER ALL THE FOLLOWING QUESTIONS BY TICKING THE RELEVANT BLOCK WITH A CROSS (X) OR WRITING DOWN YOUR ANSWER IN THE ALLOCATED SPACE

1. Gender

<table>
<thead>
<tr>
<th>Male</th>
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<tr>
<td>Female</td>
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2. Ethnicity

<table>
<thead>
<tr>
<th>Black</th>
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<tr>
<td>White</td>
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<tr>
<td>Coloured</td>
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<tr>
<td>Indian</td>
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<tr>
<td>Asian</td>
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3. Highest Education Qualification

<table>
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<th>No qualification</th>
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<tbody>
<tr>
<td>Grade 9 certificate</td>
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<tr>
<td>Matric Certificate (grade 12)</td>
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<tr>
<td>Diploma/Certificate</td>
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<tr>
<td>Bachelor Degree</td>
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<tr>
<td>Master’s Degree</td>
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<tr>
<td>Doctorate</td>
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</table>

4. State the type of organisation you currently work for

<table>
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<th>Private cooperation client</th>
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<tr>
<td>Private sector consultant</td>
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<tr>
<td>Private sector contractor</td>
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<tr>
<td>Public sector (government)</td>
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</table>

5. What is your job title?

<table>
<thead>
<tr>
<th>Architect</th>
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<tr>
<td>Quantity Surveyor</td>
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<tr>
<td>Structural Engineer</td>
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<td>Electrical Engineer</td>
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<tr>
<td>Mechanical Engineer</td>
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</table>
Civil engineer
Project manager
Construction manager
Other (Please specify):

6. Type of employment

<table>
<thead>
<tr>
<th>Permanent</th>
<th>Temporary</th>
<th>Contract</th>
<th>Other (Please specify):</th>
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</table>

7. Total length of service in the construction industry

<table>
<thead>
<tr>
<th>0-5 years</th>
<th>5-10 years</th>
<th>10-15 years</th>
<th>More than 15 years</th>
</tr>
</thead>
</table>

8. State the type of projects executed by organisation you are working for at the moment

<table>
<thead>
<tr>
<th>Building (residential, commercial)</th>
<th>Renovations</th>
<th>Road and transport (civil)</th>
<th>Water and sewage (civil)</th>
<th>Electrical engineering</th>
<th>Structural engineering</th>
<th>Mechanical engineering</th>
<th>Other (Please specify)</th>
</tr>
</thead>
</table>

9. Company size (number of employees)

<table>
<thead>
<tr>
<th>1-10</th>
<th>11-20</th>
<th>21-50</th>
<th>51-200</th>
<th>More than 200</th>
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</thead>
</table>

10. What is the company’s CIDB grading?

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<thead>
<tr>
<th>Grade 1</th>
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<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
<th>Grade 6</th>
<th>Grade 7</th>
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</table>
11. State the number of projects you are currently involved in _____________

12. State the number of projects you have executed in the last five years _____________
**SECTION B: FACTORS AFFECTING THE PERFORMANCE OF CONSTRUCTION PROJECTS**

Please indicate your answers using the following 5-point scale where:

1 = To no extent, 2 = To a small extent, 3 = To a moderate extent, 4 = To great extent and 5 = Do not know

To what extent do the following aspects affect the outcome of construction projects in South Africa?

<table>
<thead>
<tr>
<th>Groups/Factors</th>
<th>To no extent</th>
<th>To a small extent</th>
<th>Moderate extent</th>
<th>Great extent</th>
<th>Do not know</th>
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<tbody>
<tr>
<td><strong>Cost Factors</strong></td>
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<tr>
<td>1 Market share of organisation</td>
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<td>2 Liquidity of organisation</td>
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<td>3 Cash flow of project</td>
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<td>4 Profit rate of project</td>
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<td>5 Overhead percentage of project</td>
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<td>6 Project design cost</td>
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<td>7 Material and equipment cost</td>
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<td>8 Project labour cost</td>
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<td>9 Project overrun cost</td>
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<td>10 Cost of rework</td>
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<td>11 Cost of variation orders</td>
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<td>12 Waste rate of materials</td>
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<td>13 Regular project budget update</td>
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<td>14 Cost control system</td>
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<td>15 Escalation of material prices</td>
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<td>16 Exchange rate</td>
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<td><strong>Time Factors</strong></td>
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<td>17 Site preparation time</td>
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<td>18 Planned time for project construction</td>
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<td>19 Percentage of orders delivered late</td>
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<td>20 Time needed to implement variation orders</td>
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<td>21 Time needed to rectify defects</td>
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<td>22 Average delay in claim approval</td>
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<td>23 Average delay in payment from owner to contractor</td>
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<td>24 Availability of resources (labour, material &amp; equipment) as planned through project duration</td>
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<tr>
<td>25 Average delay because of closures and materials shortage</td>
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<td><strong>Groups/Factors</strong></td>
<td>To no extent</td>
<td>To a small extent</td>
<td>Moderate extent</td>
<td>Great extent</td>
<td>Do not know</td>
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<tr>
<td><strong>Quality Factors</strong></td>
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<td>26</td>
<td>Conformance to specification</td>
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<td>27</td>
<td>Availability of personnel with high experience and qualification</td>
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<tr>
<td>28</td>
<td>Quality of equipment and raw materials in project</td>
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<td>29</td>
<td>Participation of managerial levels with decision making</td>
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<td>30</td>
<td>Quality assessment system in organisation</td>
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<td>31</td>
<td>Quality training/meeting</td>
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<td>32</td>
<td>Quality auditing</td>
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<td><strong>Productivity Factors</strong></td>
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<td>33</td>
<td>Project complexity</td>
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<td>34</td>
<td>Number of new projects/year</td>
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<td>35</td>
<td>Management-labour relationship</td>
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<td>36</td>
<td>Absenteeism rate through project</td>
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<td>37</td>
<td>Sequencing of work according to schedule</td>
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<tr>
<td><strong>Client Satisfaction Factors</strong></td>
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<tr>
<td>38</td>
<td>Information coordination between owner and project parties</td>
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<td>39</td>
<td>Leadership skills for project management</td>
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<tr>
<td>40</td>
<td>Speed and reliability of service to client</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Number of disputes between owner and project parties</td>
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<tr>
<td>42</td>
<td>Number of reworks</td>
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<tr>
<td><strong>Regulatory Factors</strong></td>
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<td>43</td>
<td>Cost of compliance to regulators requirements</td>
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<td>44</td>
<td>Notification of construction work</td>
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</tr>
<tr>
<td>45</td>
<td>Amount of non-compliances to regulation</td>
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<td>46</td>
<td>Quality and availability of regulator documentation</td>
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<td>47</td>
<td>Neighbours’ and site conditions problems</td>
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<td>48</td>
<td>Provision of sub regulations</td>
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<td>Housekeeping of site</td>
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<td>Approval of inspection authority</td>
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<td>Offences and penalties</td>
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<td>52</td>
<td>Application for construction work permit</td>
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<td>53</td>
<td>Labour attitude towards project</td>
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<td>54</td>
<td>Professionals attitude towards project</td>
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<td>55</td>
<td>Dispute management (labour and supervisor)</td>
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<td>Dispute management (client and professionals)</td>
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<td>57</td>
<td>Employees (labourers) motivation</td>
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<td>Job security</td>
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<td>Frequently changing jobs</td>
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<td>Groups/Factors</td>
<td>To no extent</td>
<td>To a small extent</td>
<td>Moderate extent</td>
<td>Great extent</td>
<td>Do not know</td>
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<td>Training and education of managers</td>
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<td>Competitive salary packages</td>
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<td>Working conditions</td>
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<td>Health and Safety Factors</td>
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<td>Application of health and safety factors in organisation</td>
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<td>Health and safety specifications</td>
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<td>Easy access to site (location of project)</td>
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<td>Reportable accidents rate in project</td>
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<td>Access to medical care and facilities</td>
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<td>Risk assessment</td>
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<td>Innovation and Learning Factors</td>
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<td>Learning from own experience and past history</td>
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<td>Learning from best practice and experience of others</td>
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<td>Training human resources in the skills demanded by the project</td>
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<td>Review of failures and solve them</td>
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<td>Environmental Factors</td>
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<td>Air quality</td>
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<td>Noise level</td>
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<td>Wastes around the site</td>
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<td>Climate condition in the site</td>
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<td>Human health</td>
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<td>Integrated pest management</td>
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<td>Occupant comfort</td>
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<td>Occupant control</td>
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SECTION C: ADVANTAGES AND CHALLENGES OF COST OF QUALITY IMPLEMENTATION

Cost of Quality (COQ) includes the costs spent on the prevention of poor quality, the quality appraisal (e.g. inspections) and the costs resulting from product or service failure (e.g. rework and returns)

This section of the questionnaire explores your experiences, if any, with regard to the cost of quality (COQ) concept in the organisation you are currently working for.

If you are new to the project or organisation please refer to your previous project or organisation.

1. How familiar are you with the concept of cost of quality?
   - Very familiar
   - Familiar
   - Vaguely familiar
   - Not familiar

2. Does the company you are currently working for implement COQ?
   - Yes
   - No
   - Don’t know

3. Do the competitors of this company use COQ techniques effectively?
   - Yes
   - No
   - Don’t know

Please indicate your answers using the following 5-point scale where:
1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly agree

In your experience, to what extent do you agree or disagree with the following statements regarding the Cost of Quality concept in an organisation

<table>
<thead>
<tr>
<th>COST OF QUALITY RELATED STATEMENTS</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tbody>
<tr>
<td>1 COQ helps a great deal in cost reduction</td>
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<td>2 COQ implementation leads to a positive growth</td>
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<td>3 Implementing COQ helps create an edge over competitors</td>
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<td>4 COQ is useful for monitoring quality of the product.</td>
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<tr>
<td>COST OF QUALITY RELATED STATEMENTS</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>5 Organizations use COQ technique results as benchmark against other companies.</td>
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<td>6 The COQ technique is an effective cost saving technique.</td>
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<td>7 The whole organization [or every department of the organization] needs to understand COQ technique.</td>
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<td>8 The whole organization has a positive feeling towards COQ techniques.</td>
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<td>9 There are practical solutions that are found only due to COQ implementation.</td>
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<td>10 Usage of COQ leads to higher savings than the expenses needed to implement it</td>
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<td>11 COQ affects the Waste reduction positively</td>
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<td>12 COQ affects the Supplier cost control positively</td>
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<td>13 COQ affects the Productivity improvement positively</td>
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<td>14 COQ affects the Technological advancement positively</td>
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<td>15 COQ is used to identify high-cost problem areas.</td>
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<td>16 COQ helps in evaluating the effectiveness of a quality system.</td>
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<td>17 COQ helps to motivate employees towards quality goals.</td>
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<td>18 COQ helps employees achieve quality goals EASILY</td>
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<td>19 COQ reveals the reasons that cause problems in a system.</td>
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<td>20 COQ highlights the problems that occur in a system more easily</td>
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<td>21 COQ implementation leads to increase in project completion time</td>
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<tr>
<td>22 The implementation of COQ is not easy</td>
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<td>23 Lack of interest from employees is a reason behind the failure of COQ after implementation</td>
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<td>24 Low return on investment (ROI) is a reason behind the failure of COQ after implementation</td>
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<td>25 Un-necessary expenditure is a reason behind the failure of COQ after implementation</td>
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<td>26 Lack of information is a difficulty behind the implementation of COQ</td>
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<td>27 Employee attitudes is a difficulty behind the implementation of COQ</td>
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<td>28 Organization culture is a difficulty behind the implementation of COQ</td>
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<td>29 Lack of accountability is a difficulty behind the implementation of COQ</td>
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<td>30 Difficulty in collecting COQ data is a difficulty behind the implementation of COQ</td>
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<td>31 Incompatibility of existing accounting system is a difficulty behind the implementation of COQ</td>
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<td>COST OF QUALITY RELATED STATEMENTS</td>
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<td>32</td>
<td>Lack of senior management commitment is a difficulty behind the implementation of COQ</td>
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<td>Existence of other easier quality control methods is a difficulty behind the implementation of COQ</td>
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<td>Need for continuous reporting and documentation is a difficulty behind the implementation of COQ</td>
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<td>35</td>
<td>COQ is not implemented because of Lack of knowledge about COQ</td>
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<td>36</td>
<td>COQ is not implemented because of High costs</td>
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<td>37</td>
<td>COQ is not implemented because of Insufficient benefits</td>
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<td>38</td>
<td>Implementing COQ is a waste of time and money</td>
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<td>39</td>
<td>The costs due to COQ are considered as an important component while estimating the budget of the project</td>
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